



ALPHA & OMEGA
SEMICONDUCTOR



AOP611

Complementary Enhancement Mode Field Effect Transistor

General Description

The AOP611 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ 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.*

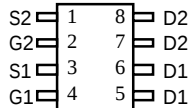
Features

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

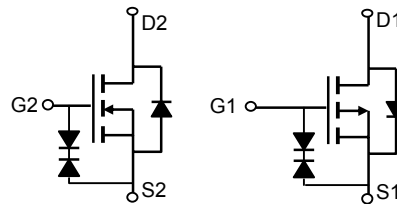
ESD rating: 3000V (HBM)

UIS TESTED!

R_g, C_{iss}, C_{oss}, C_{rss} Tested



PDIP-8



n-channel

p-channel

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	$T_A=25^\circ\text{C}$	6.5	-5.5	A
	$T_A=70^\circ\text{C}$	5.3	-4.4	
Pulsed Drain Current ^B	I_{DM}	30	-25	
Power Dissipation	$T_A=25^\circ\text{C}$	2.5	2.5	W
	$T_A=70^\circ\text{C}$	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	$^\circ\text{C}$

Thermal Characteristics: n-channel and p-channel

Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	n-ch	37	50	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		n-ch	74	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	n-ch	28	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	p-ch	35	50	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		p-ch	73	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	p-ch	32	40	$^\circ\text{C/W}$

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 T _J =55°C			1 5	μA
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 T _J =125°C		28.5 40	35 48	mΩ
		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_{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 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_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} 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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

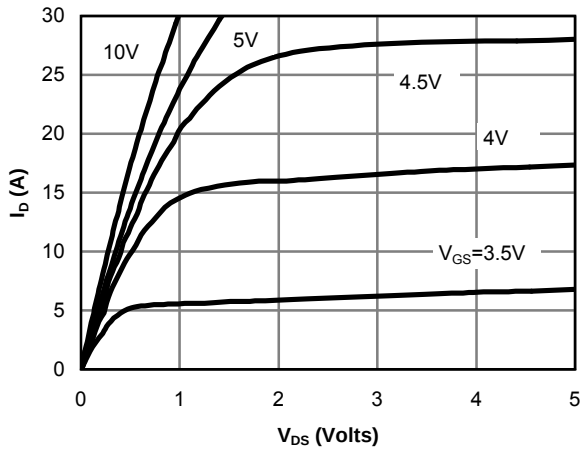


Figure 1: On-Region Characteristics

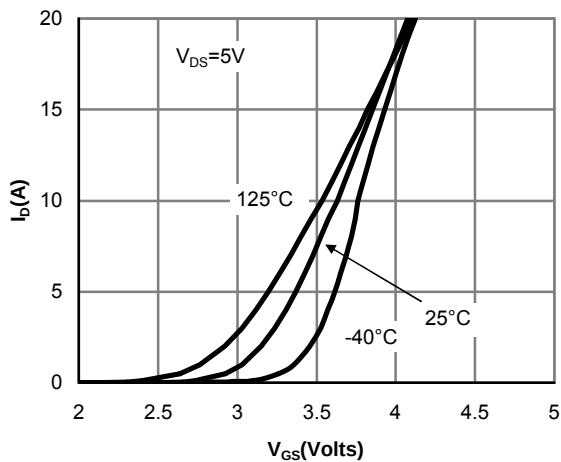


Figure 2: Transfer Characteristics

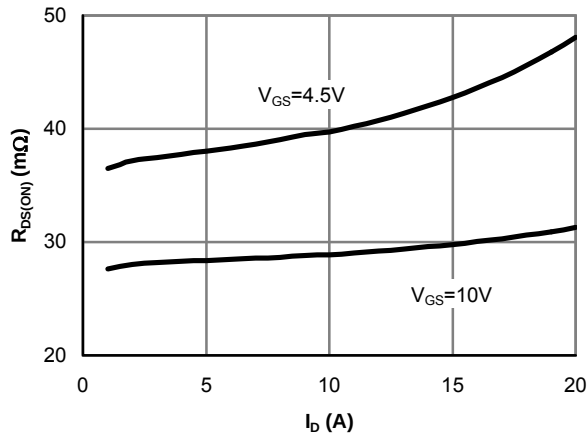


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

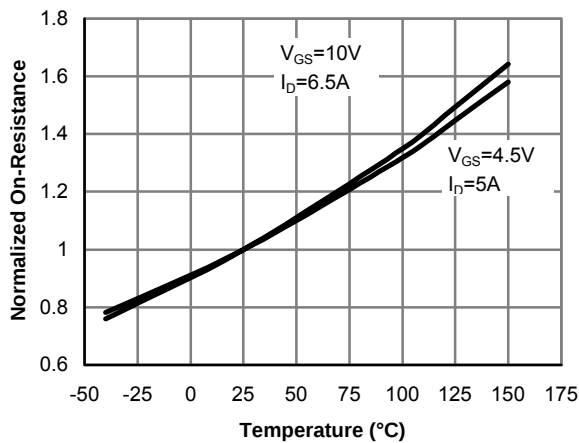


Figure 4: On-Resistance vs. Junction Temperature

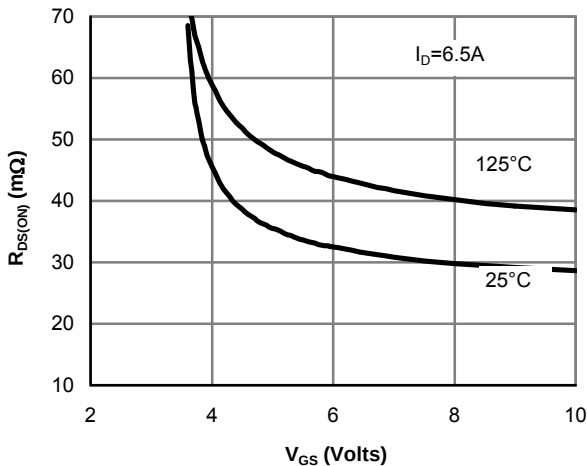


Figure 5: On-Resistance vs. Gate-Source Voltage

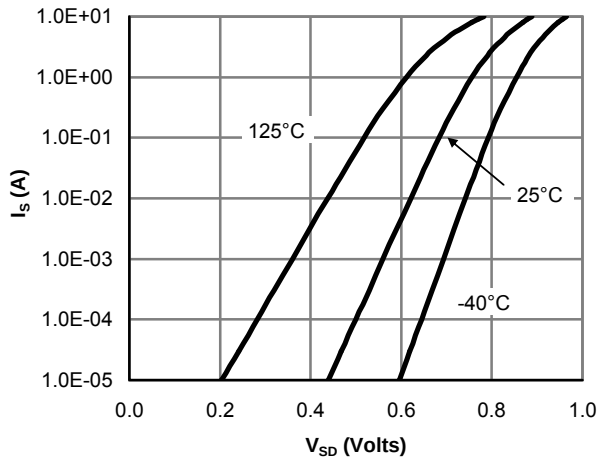


Figure 6: Body-Diode Characteristics

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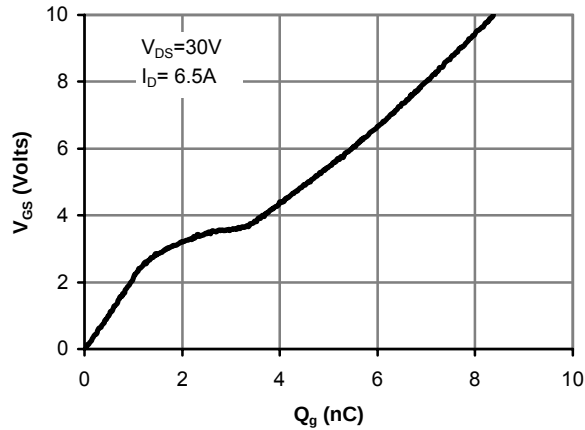


Figure 7: Gate-Charge Characteristics

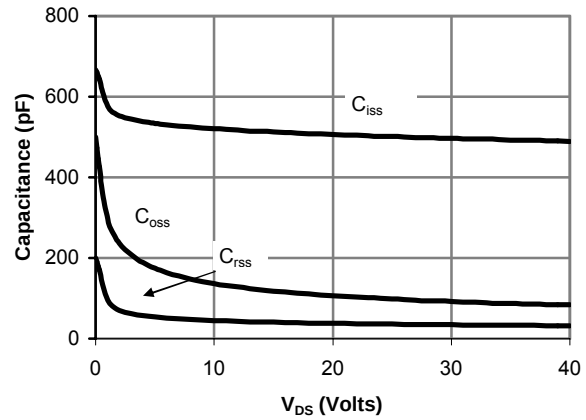


Figure 8: Capacitance Characteristics

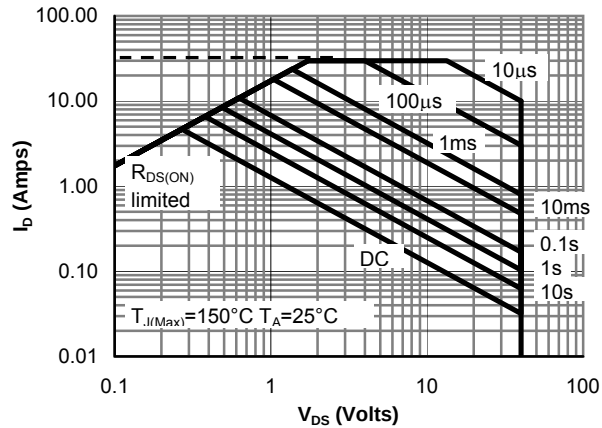


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

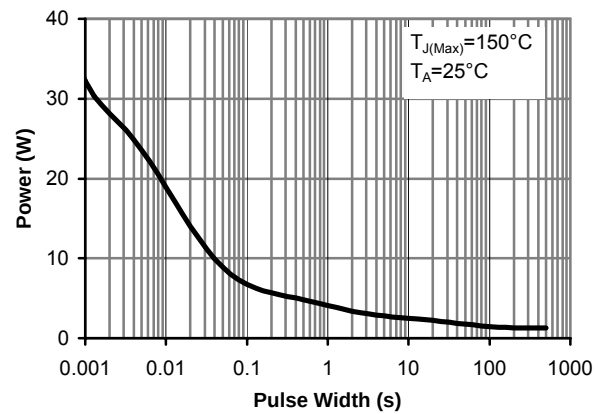


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

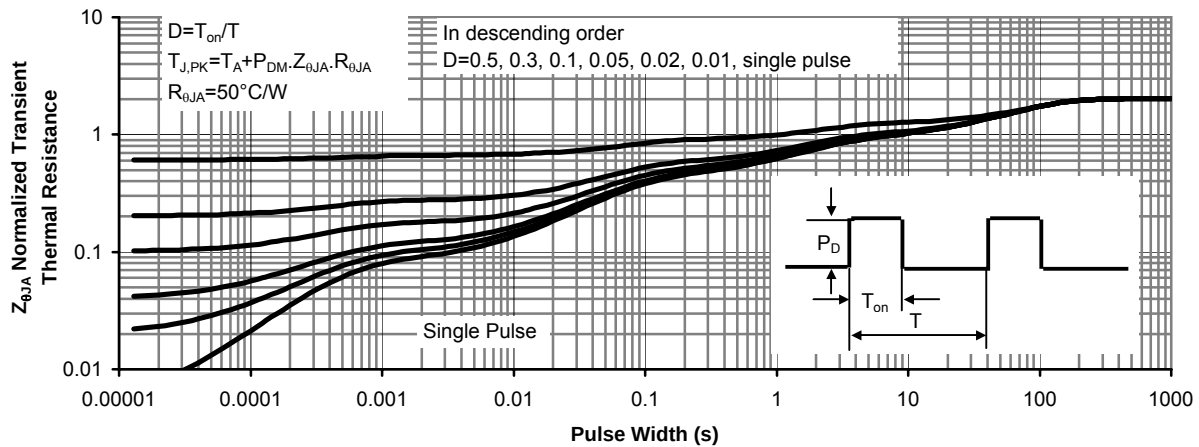


Figure 11: Normalized Maximum Transient Thermal Impedance

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 T _J =55°C			-1 -5	μA
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 T _J =125°C		43 60	52 72	mΩ
		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_{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 value in any given application depends on the user's specific board design. The current rating is based on the t_s 10s thermal resistance rating.

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

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} 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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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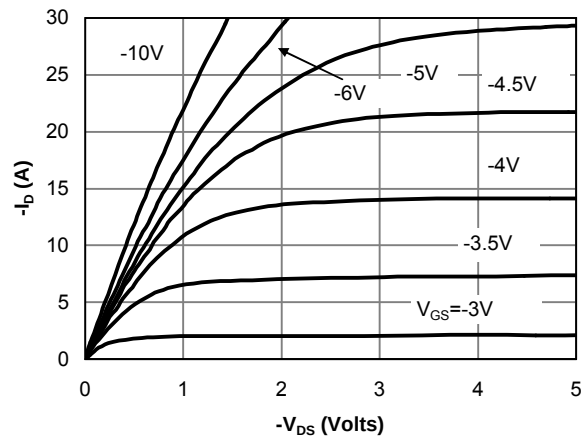


Fig 1: On-Region Characteristics

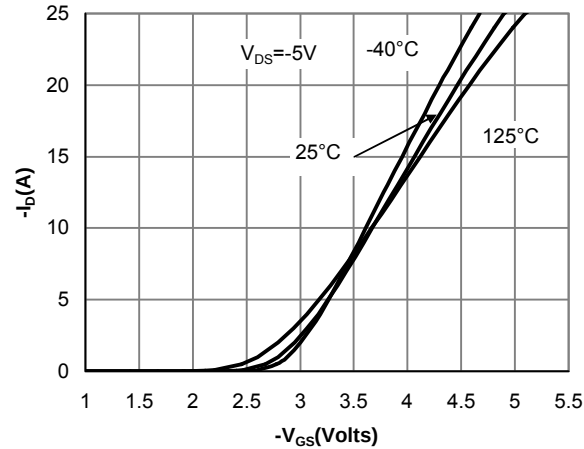


Figure 2: Transfer Characteristics

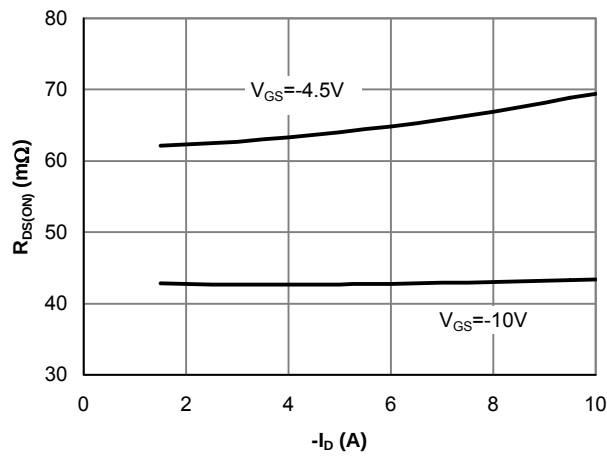


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

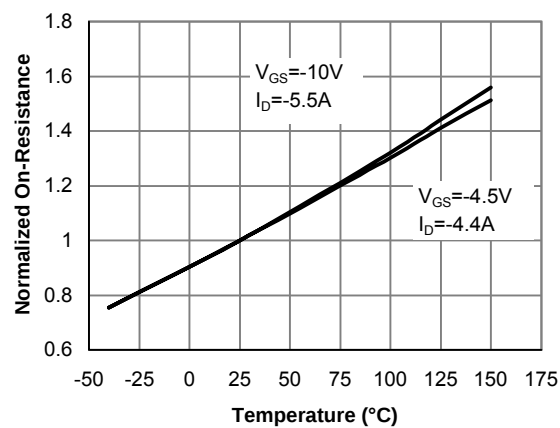


Figure 4: On-Resistance vs. Junction Temperature

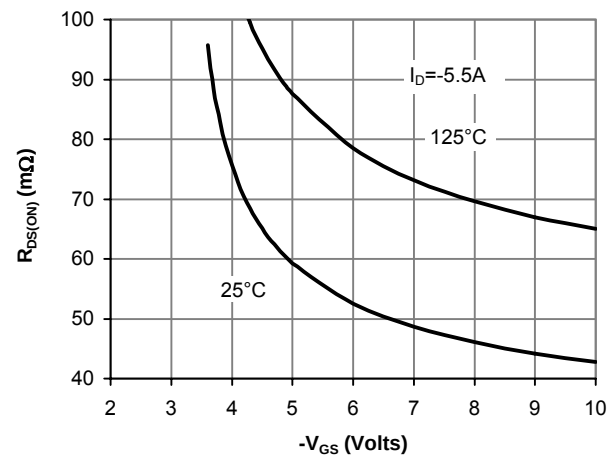


Figure 5: On-Resistance vs. Gate-Source Voltage

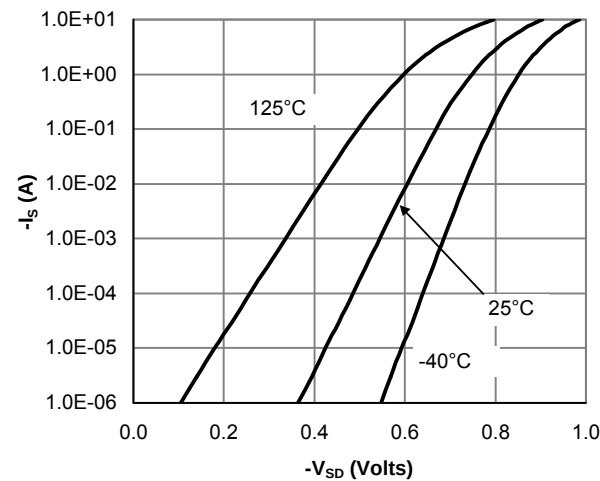


Figure 6: Body-Diode Characteristics

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