



**ALPHA & OMEGA**  
SEMICONDUCTOR



## AO4616

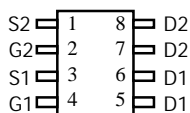
### Complementary Enhancement Mode Field Effect Transistor

#### General Description

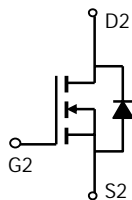
The AO4616 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used in inverter and other applications. *Standard Product AO4616 is Pb-free (meets ROHS & Sony 259 specifications). AO4616L is a Green Product ordering option. AO4616 and AO4616L are electrically identical.*

#### Features

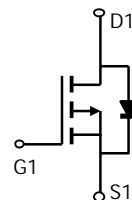
n-channel	p-channel
$V_{DS} (V) = 30V$	-30V
$I_D = 8.1A (V_{GS}=10V)$	-7.1A ( $V_{GS} = -10V$ )
$R_{DS(ON)}$	$R_{DS(ON)}$
$< 20m\Omega (V_{GS}=10V)$	$< 25m\Omega (V_{GS} = -10V)$
$< 28m\Omega (V_{GS}=4.5V)$	$< 40m\Omega (V_{GS} = -4.5V)$



SOIC-8



n-channel



p-channel

#### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ C$	8.1	-7.1	A
	$T_A=70^\circ C$	6.5	-5.6	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	-30	
Power Dissipation	$T_A=25^\circ C$	2	2	W
	$T_A=70^\circ C$	1.28	1.28	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

#### Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	n-ch	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		n-ch	74	110	$^\circ C/W$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	n-ch	35	60	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	p-ch	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		p-ch	74	110	$^\circ C/W$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	p-ch	35	40	$^\circ C/W$

N-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	1	1.8	3	V
ID(ON)	On state drain current	V <sub>GS</sub> =10V, V <sub>DS</sub> =5V	30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =8.1A T <sub>J</sub> =125°C		16.4 20	20 25	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A		23.4	28	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =8.1A		23		S
V <sub>SD</sub>	Body-Diode Forward Voltage	I <sub>S</sub> =1A		0.75	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				3	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		1040	1250	pF
C <sub>oss</sub>	Output Capacitance			180		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			110		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		0.7		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub> (10V)	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =8.1A		19.2		nC
Q <sub>g</sub> (4.5V)	Total Gate Charge			9.36		nC
Q <sub>gs</sub>	Gate Source Charge			2.6		nC
Q <sub>gd</sub>	Gate Drain Charge			4.2		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.8Ω, R <sub>GEN</sub> =3Ω		5.2		ns
t <sub>r</sub>	Turn-On Rise Time			4.4		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			17.3		ns
t <sub>f</sub>	Turn-Off Fall Time			3.3		ns
t <sub>rr</sub>	Body-Diode Reverse Recovery Time	I <sub>F</sub> =8.1A, dI/dt=100A/μs		16.7	21	ns
Q <sub>rr</sub>	Body-Diode Reverse Recovery Charge	I <sub>F</sub> =8.1A, dI/dt=100A/μs		6.7	10	nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=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<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: 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<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

Rev 0 : July 2005

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## N-CH TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

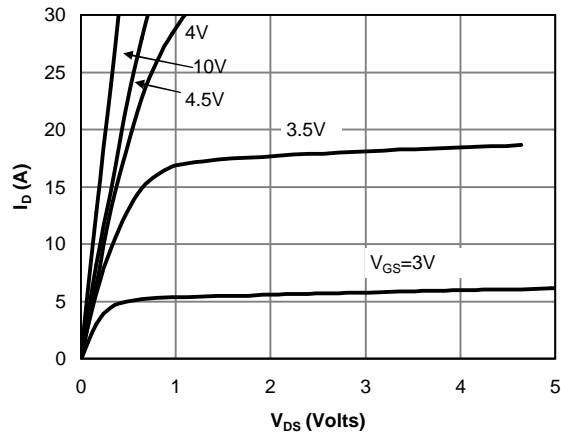


Fig 1: On-Region Characteristics

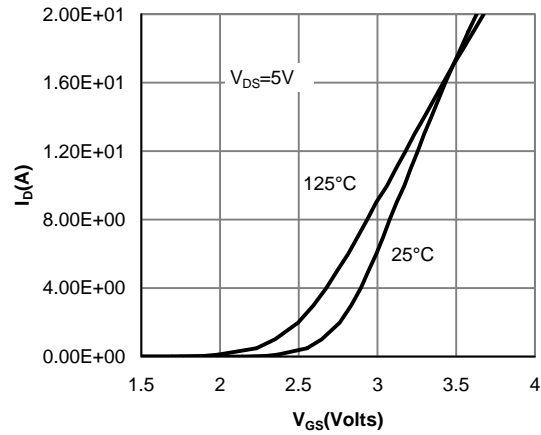


Figure 2: Transfer Characteristics

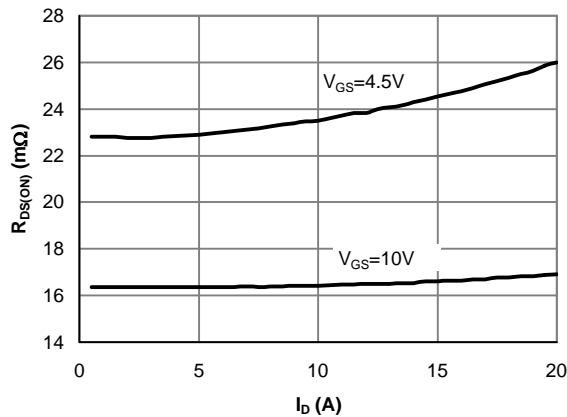


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

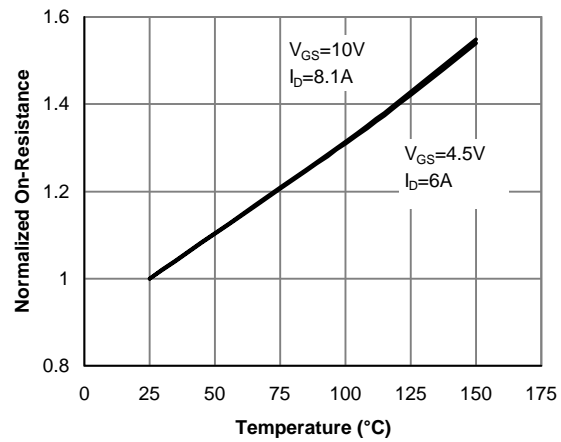


Figure 4: On-Resistance vs. Junction Temperature

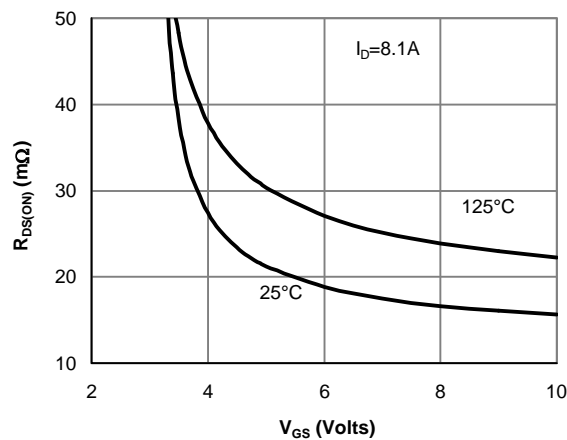


Figure 5: On-Resistance vs. Gate-Source Voltage

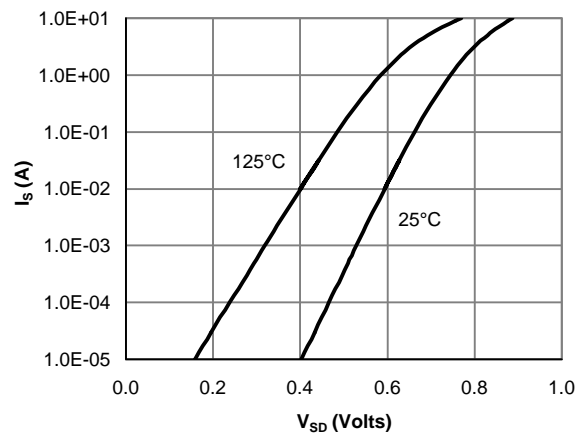


Figure 6: Body-Diode Characteristics

## N-CH TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

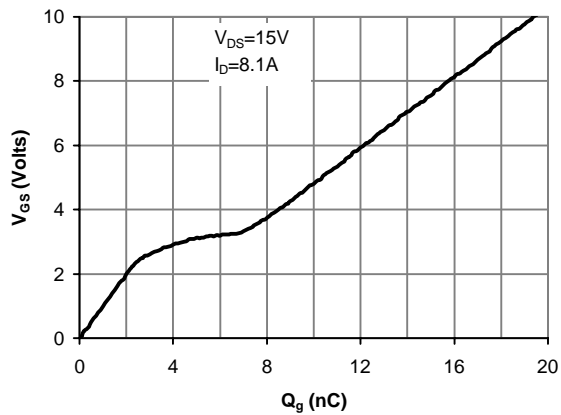


Figure 7: Gate-Charge Characteristics

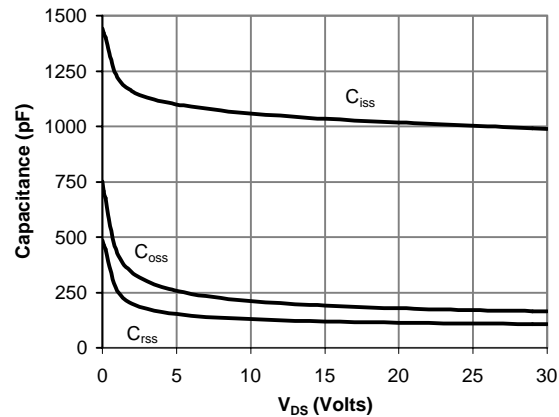


Figure 8: Capacitance Characteristics

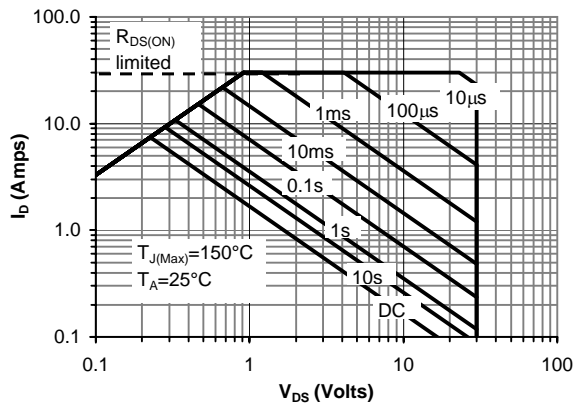


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

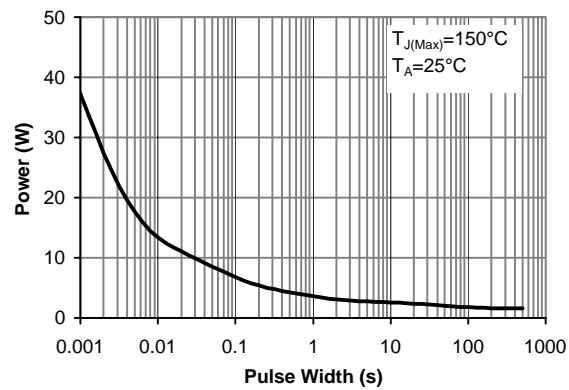


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

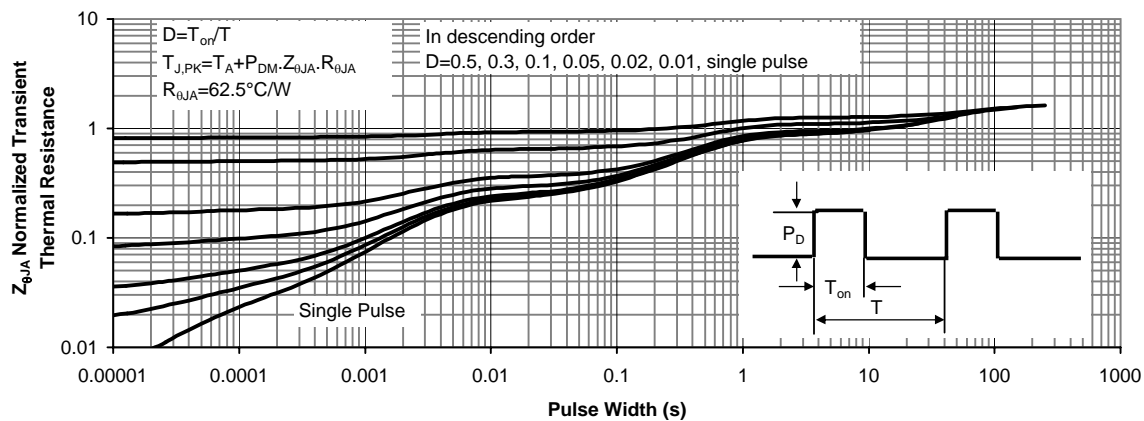


Figure 11: Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V	-30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.4	-2	-2.7	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V	30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-7.1A T <sub>J</sub> =125°C		20 27	25 33	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5.6A		29	40	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-7.1A		19.6		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		-0.7	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-4.2	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		1573		pF
C <sub>oss</sub>	Output Capacitance			319		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			211		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		6.7		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge (10V)	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-7.1A		30.9		nC
Q <sub>g(4.5V)</sub>	Total Gate Charge (4.5V)			16.1		nC
Q <sub>gs</sub>	Gate Source Charge			8		nC
Q <sub>gd</sub>	Gate Drain Charge			4.4		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =2.2Ω, R <sub>GEN</sub> =3Ω		9.5		ns
t <sub>r</sub>	Turn-On Rise Time			8		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			44.2		ns
t <sub>f</sub>	Turn-Off Fall Time			22.2		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-7.1A, dI/dt=100A/μs		25.5		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-7.1A, dI/dt=100A/μs		14.7		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=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<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: 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<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

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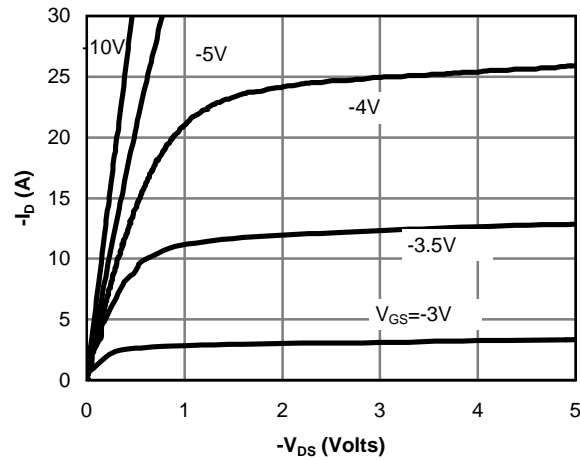


Fig 16: On-Region Characteristics

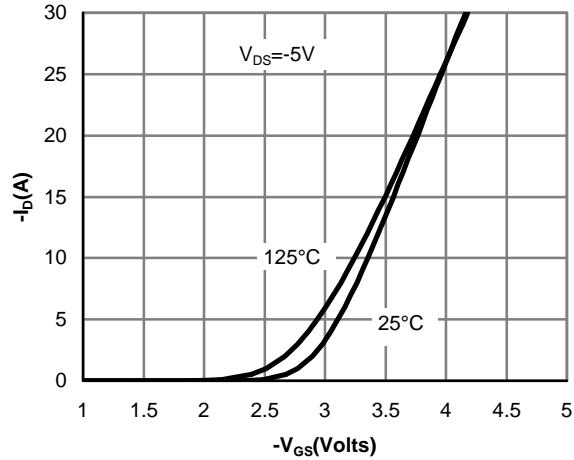


Figure 17: Transfer Characteristics

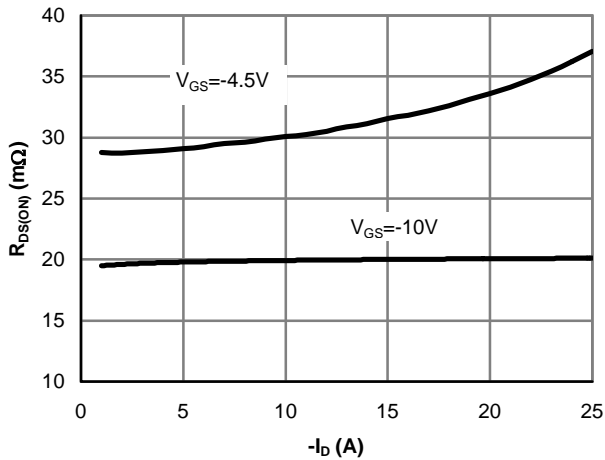


Figure 18: On-Resistance vs. Drain Current and Gate Voltage

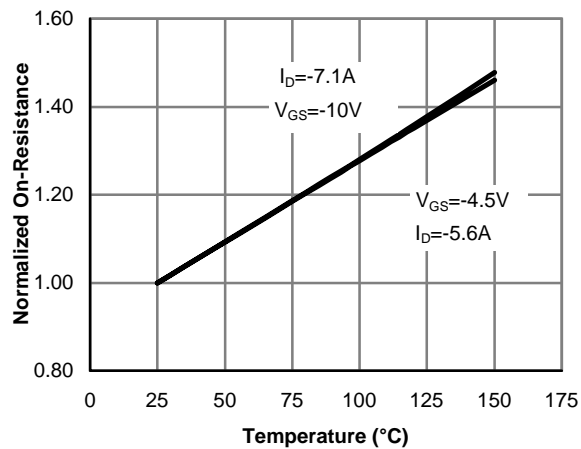


Figure 19: On-Resistance vs. Junction Temperature

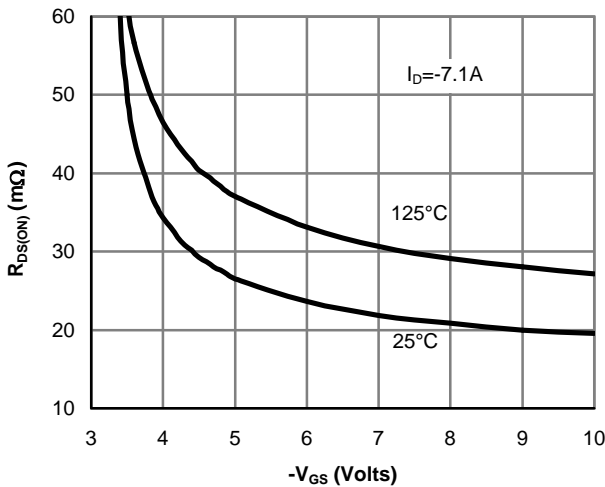


Figure 20: On-Resistance vs. Gate-Source Voltage

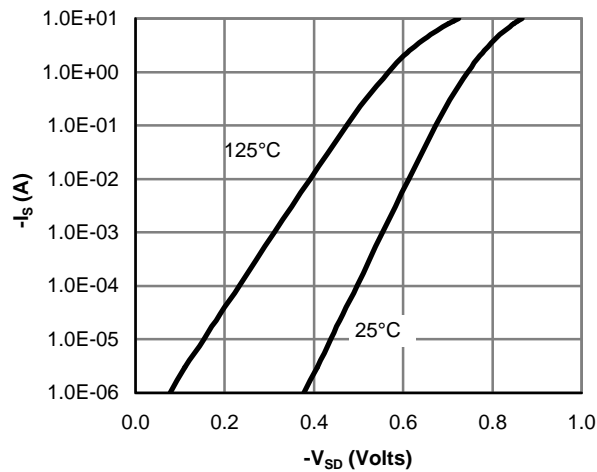


Figure 21: Body-Diode Characteristics

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