



ALPHA & OMEGA
SEMICONDUCTOR



AO4940

Asymmetric Dual N-Channel Enhancement Mode Field Effect Transistor

SRFET™

General Description

The AO4940 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A monolithically integrated Schottky diode in parallel with the synchronous MOSFET to boost efficiency further. *Standard Product AO4940 is Pb-free (meets ROHS & Sony 259 specifications).*

Features

FET1

V_{DS} (V) = 30V
 I_D = 9.1A
 $R_{DS(ON)}$ < 15m Ω
 $R_{DS(ON)}$ < 23m Ω

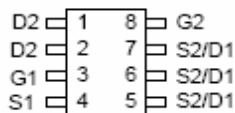
FET2

V_{DS} (V) = 30V
 I_D =7.5A (V_{GS} = 10V)
< 23m Ω (V_{GS} = 10V)
< 36m Ω (V_{GS} = 4.5V)

UIS TESTED!

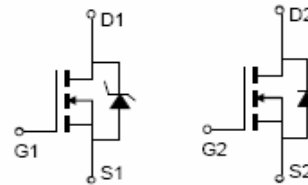
Rg,Ciss,Coss,Crss Tested

SOIC-8



SRFET™

Soft Recovery MOSFET:
Integrated Schottky Diode



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Max FET1		Max FET2		Units
		10 sec	Steady-State	10 sec	Steady-State	
Drain-Source Voltage	V_{DS}	30		30		V
Gate-Source Voltage	V_{GS}	± 20		± 20		V
Continuous Drain Current ^{AF}	$T_A=25^\circ\text{C}$	9.1	7.6	7.5	6.2	A
	$T_A=70^\circ\text{C}$	7.3	6.1	6.0	5.0	
Pulsed Drain Current ^B	I_{DM}	100		50		A
Avalanche Current ^B	I_{AR}	17		13		A
Repetitive avalanche energy $L=0.3\text{mH}$ ^B	E_{AR}	43		25		mJ
Power Dissipation ^A	$T_A=25^\circ\text{C}$	2	1.4	2	1.4	W
	$T_A=70^\circ\text{C}$	1.3	0.9	1.3	0.9	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		-55 to 150		$^\circ\text{C}$

Thermal Characteristics FET1(Integrated Schottky Diode)

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A $t \leq 10\text{s}$	$R_{\theta JA}$	48	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A Steady-State		74	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C Steady-State	$R_{\theta JL}$	32	40	$^\circ\text{C/W}$

Thermal Characteristics FET2

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A $t \leq 10\text{s}$	$R_{\theta JA}$	48	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A Steady-State		74	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C Steady-State	$R_{\theta JL}$	32	40	$^\circ\text{C/W}$

FET1(Integrated Schottky Diode) 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 T _J =125°C			0.1 10	mA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±20V			0.1	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	1.3	1.65	2.5	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	100			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =9.1A T _J =125°C		12.5 18	15 22	mΩ
		V _{GS} =4.5V, I _D =7.3A		18.5	23	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =9.1A		26		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.43	0.5	V
I _S	Maximum Body-Diode + Schottky Continuous Current				3	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		903	1100	pF
C _{oss}	Output Capacitance			225		pF
C _{rss}	Reverse Transfer Capacitance			91		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		1.7	3.0	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =9.1A		15.3	20	
Q _g (4.5V)	Total Gate Charge			7.8	10	nC
Q _{gs}	Gate Source Charge			2.0		nC
Q _{gd}	Gate Drain Charge			3.9		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.65Ω, R _{GEN} =3Ω		5.0		ns
t _r	Turn-On Rise Time			9.2		ns
t _{D(off)}	Turn-Off DelayTime			17.8		ns
t _f	Turn-Off Fall Time			4.4		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =9.1A, dI/dt=300A/μs		17	20	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =9.1A, dI/dt=300A/μs		30.0		nC

A: The value of R_{θJA} 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.

B: Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C.

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 <300 μs 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.

F: The current rating is based on the t≤ 10s thermal resistance rating.

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FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

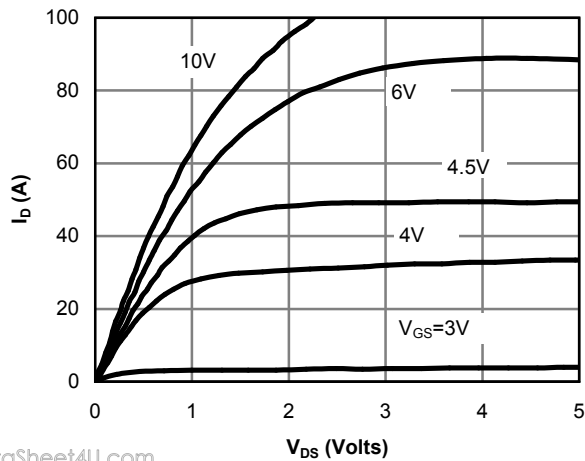


Figure 1: On-Region Characteristics

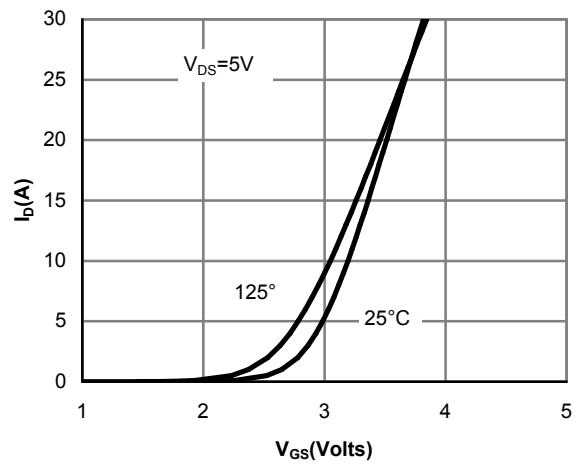


Figure 2: Transfer Characteristics

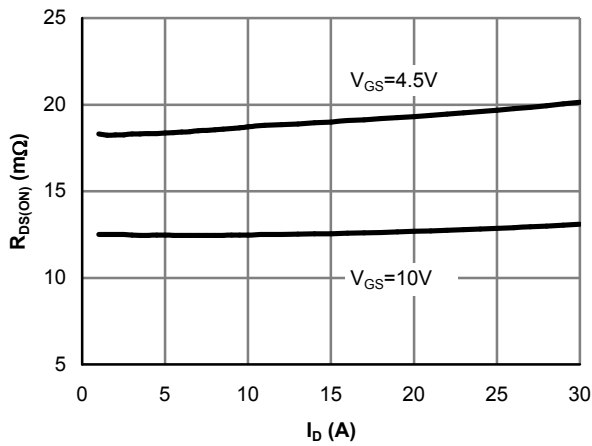


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

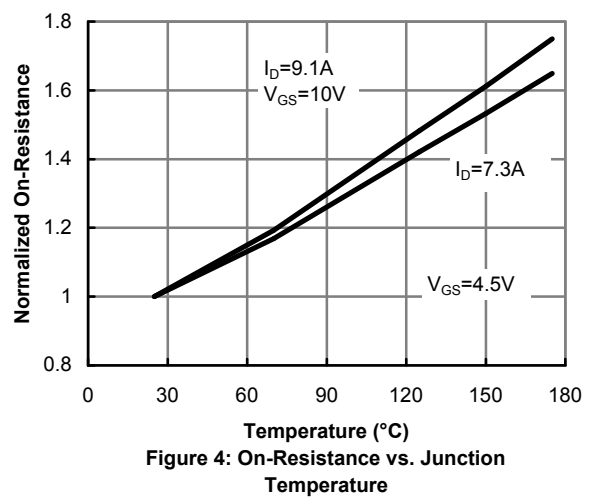


Figure 4: On-Resistance vs. Junction Temperature

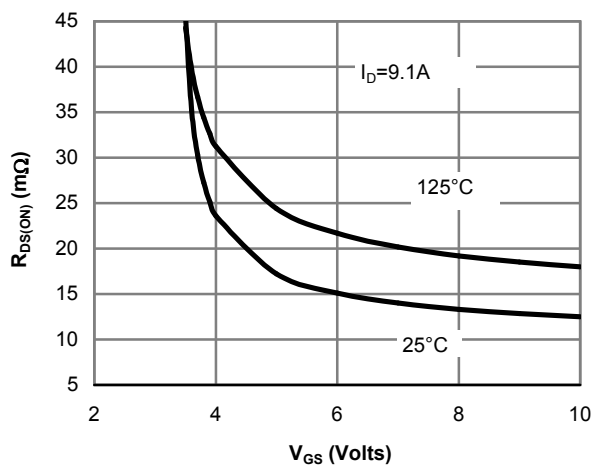


Figure 5: On-Resistance vs. Gate-Source Voltage

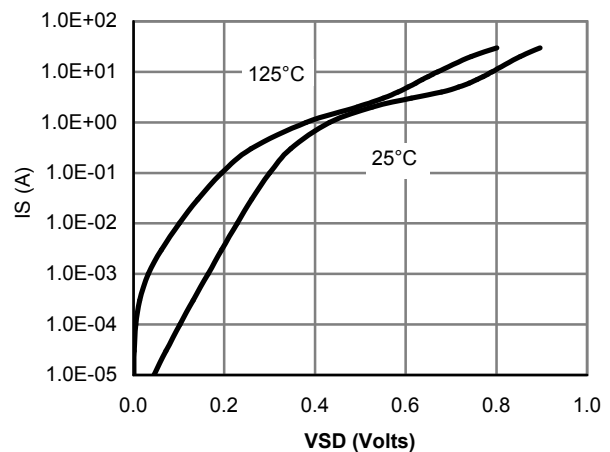
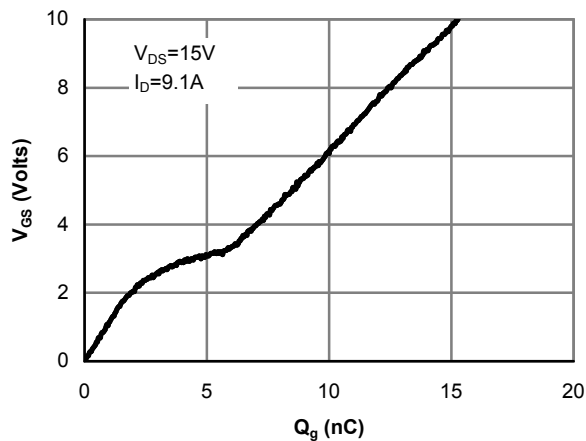


Figure 6: Body-Diode Characteristics

FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



www.DataSheet4U.com Figure 7: Gate-Charge Characteristics

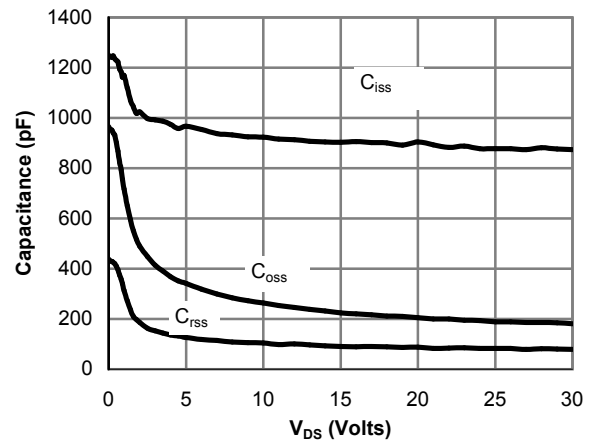


Figure 8: Capacitance Characteristics

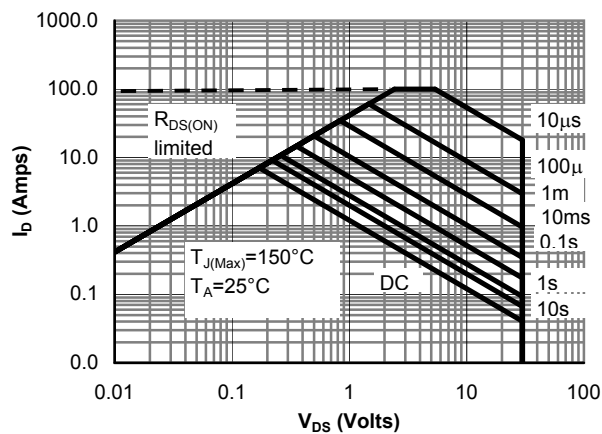


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

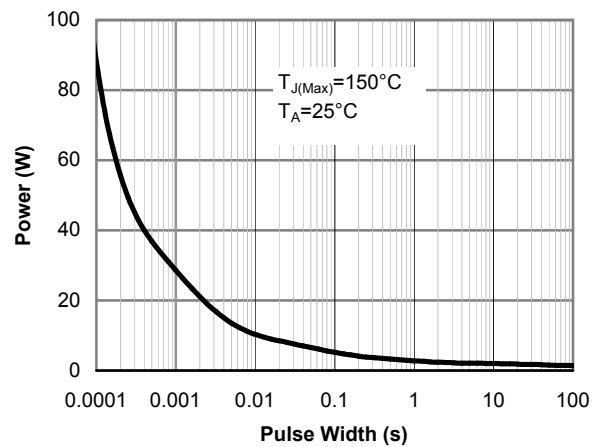


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

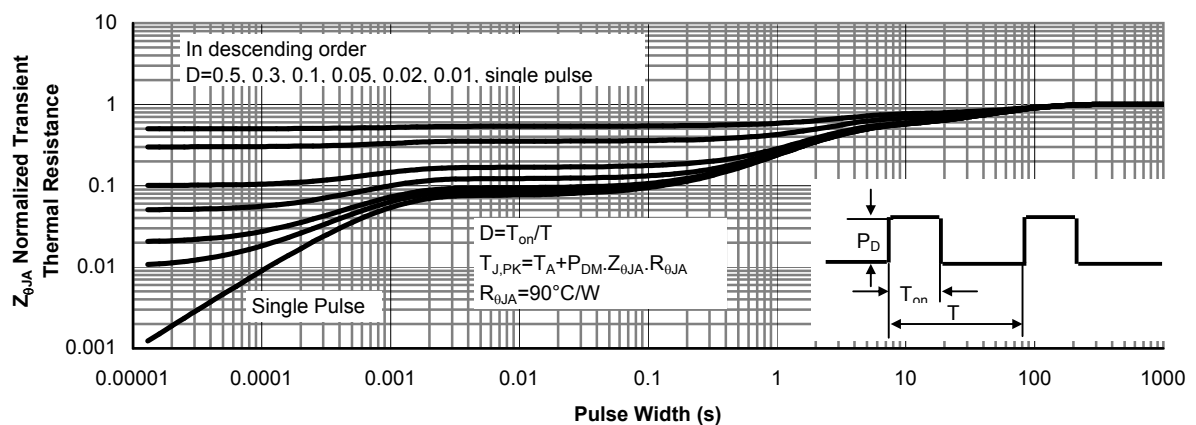


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

FET2 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 T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±20V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	1.3	1.6	2.5	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	50			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =7.5A T _J =125°C		19 27	23 34	mΩ
		V _{GS} =4.5V, I _D =6A		29	36	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =7.5A		22		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.75	1	V
I _S	Maximum Body-Diode Continuous Current				3	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		621	820	pF
C _{oss}	Output Capacitance			118		pF
C _{rss}	Reverse Transfer Capacitance			85		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		0.8	1.5	Ω
SWITCHING PARAMETERS						
Q _{g(10V)}	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =7.5A		11.3	17	nC
Q _{g(4.5V)}	Total Gate Charge			5.7	8.5	nC
Q _{gs}	Gate Source Charge			2.1		nC
Q _{gd}	Gate Drain Charge			3		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =2Ω, R _{GEN} =3Ω		4.5		ns
t _r	Turn-On Rise Time			3.1		ns
t _{D(off)}	Turn-Off DelayTime			15.1		ns
t _f	Turn-Off Fall Time			2.7		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =7.5A, dI/dt=100A/μs		15.5	21	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =7.5A, dI/dt=100A/μs		7.1		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.

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 <300 μs 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.

F: The current rating is based on the t≤ 10s thermal resistance rating.

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FET2: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

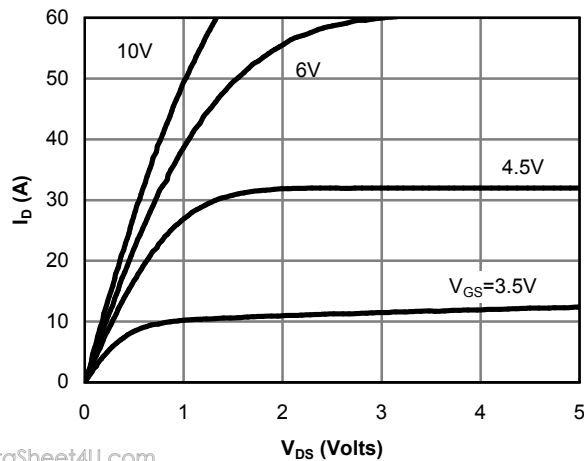


Fig 1: On-Region Characteristics

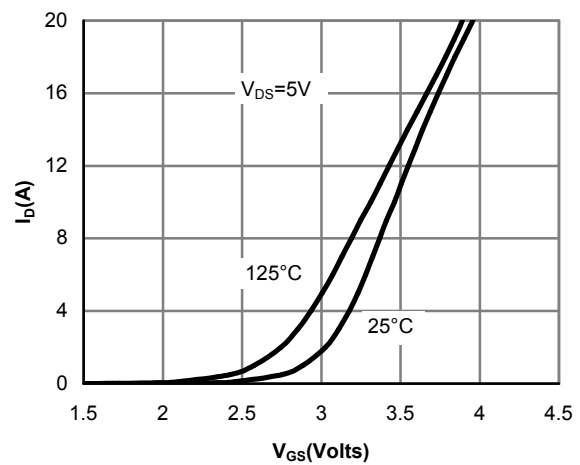


Figure 2: Transfer Characteristics

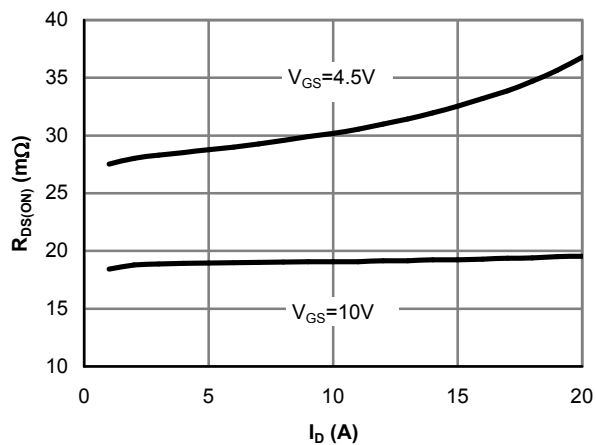


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

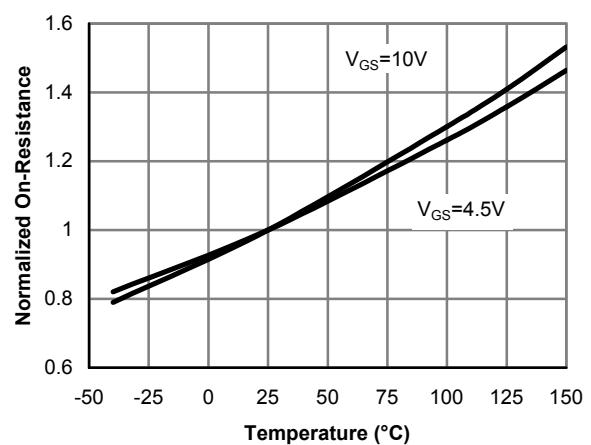


Figure 4: On-Resistance vs. Junction Temperature

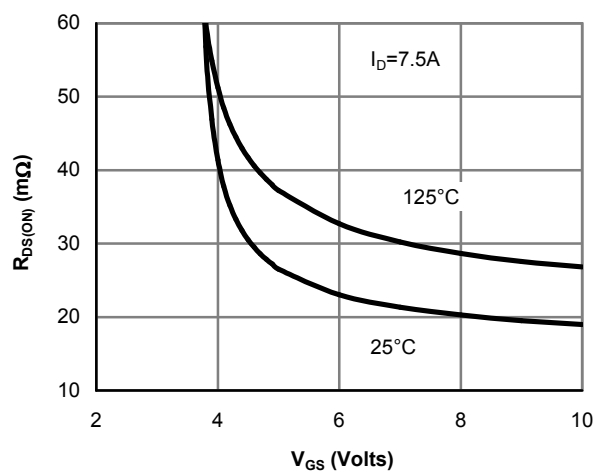


Figure 5: On-Resistance vs. Gate-Source Voltage

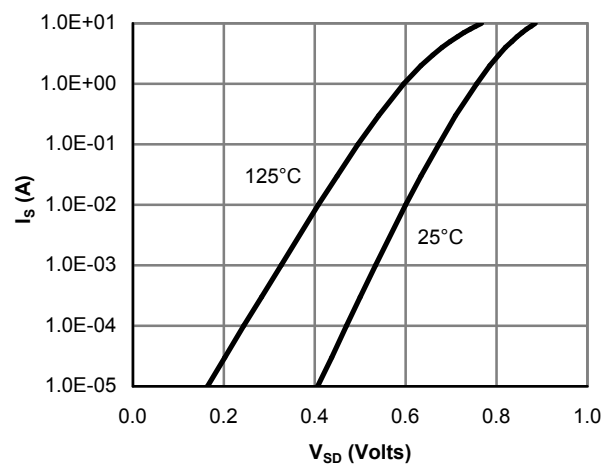


Figure 6: Body-Diode Characteristics