ALPHA & OMEGA SEMICONDUCTOR

AO4940

Asymmetric Dual N-Channel Enhancement Mode Field Effect Transistor

SRFET™

General Description

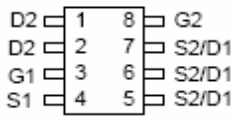
The AO4940 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A monolithically integrated Schottky diode in parallel with the synchronous MOSFET to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

Features

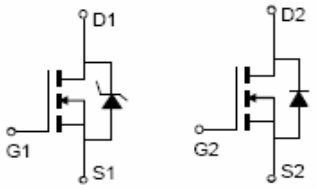
FET1	FET2	
V_{DS} (V) = 30V	V_{DS}(V) = 30V	
I_D = 9.1A	I_D=7.5A	(V_{GS} = 10V)
$R_{DS(ON)}$ < 15mΩ	< 23mΩ	(V_{GS} = 10V)
$R_{DS(ON)}$ < 23mΩ	< 36mΩ	(V_{GS} = 4.5V)

UIS TESTED!
Rg,Ciss,Coss,Crss Tested

SOIC-8



SRFET™
Soft **R**ecovery MOS**FET**:
Integrated Schottky Diode



Absolute Maximum Ratings T_A=25°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°C	I_{DSM}	9.1	7.6	7.5	6.2	A
	T_A=70°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=0.3mH [B]		E_{AR}	43		25		mJ
Power Dissipation[A]	T_A=25°C	P_{DSM}	2	1.4	2	1.4	W
	T_A=70°C		1.3	0.9	1.3	0.9	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		-55 to 150		°C

Thermal Characteristics FET1(Intergrated Schottky Diode)

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

Thermal Characteristics FET2

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

FET1(Intergrated 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			0.1	mA
		T_J=125°C			10	
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		12.5	15	mΩ
		T_J=125°C		18	22	
		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 $R_{\theta JA}$ 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.
B: Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C.
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 <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

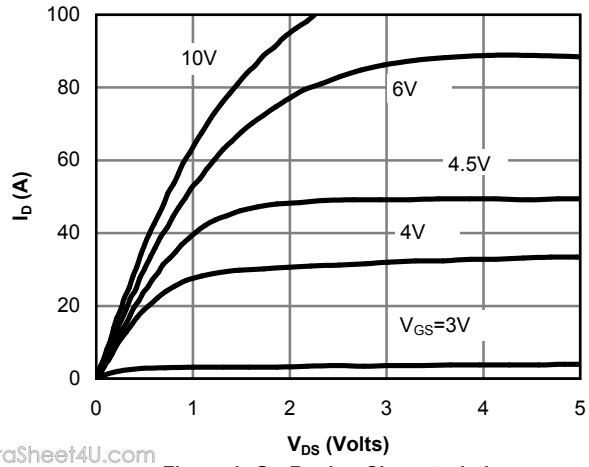

Figure 1: On-Region Characteristics

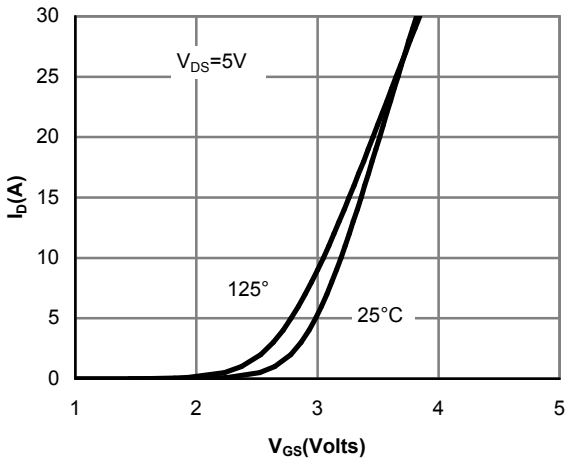

Figure 2: Transfer Characteristics

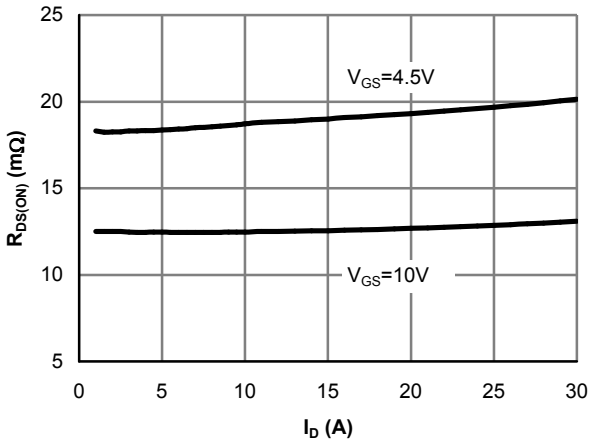

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

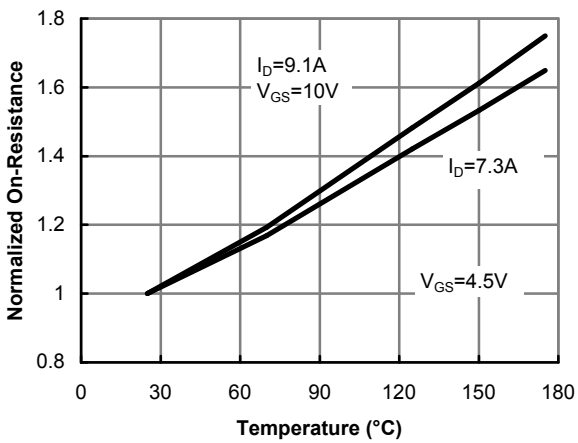

Figure 4: On-Resistance vs. Junction Temperature

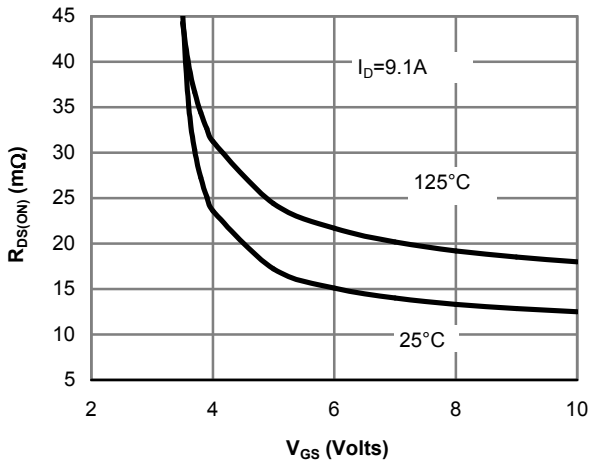

Figure 5: On-Resistance vs. Gate-Source Voltage

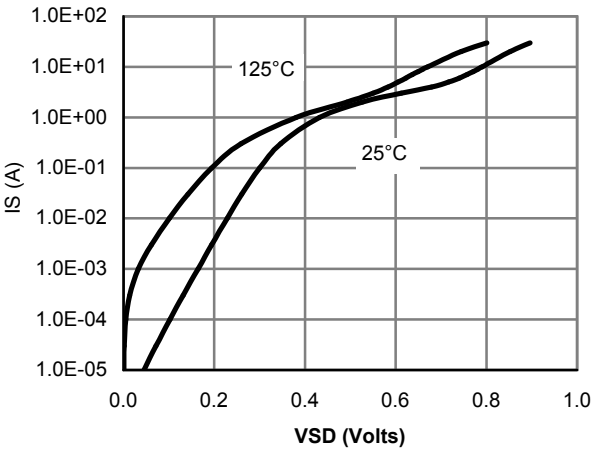

Figure 6: Body-Diode Characteristics

FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

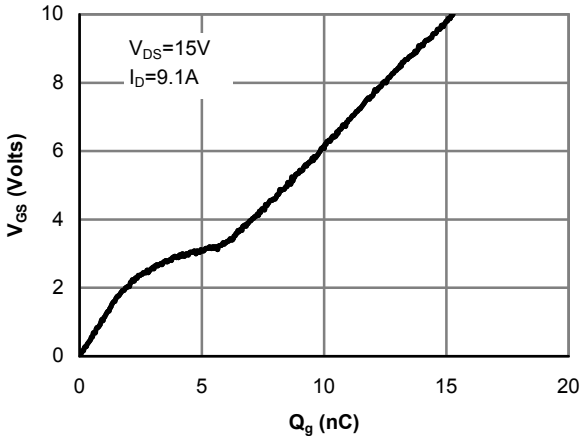

Figure 7: Gate-Charge Characteristics

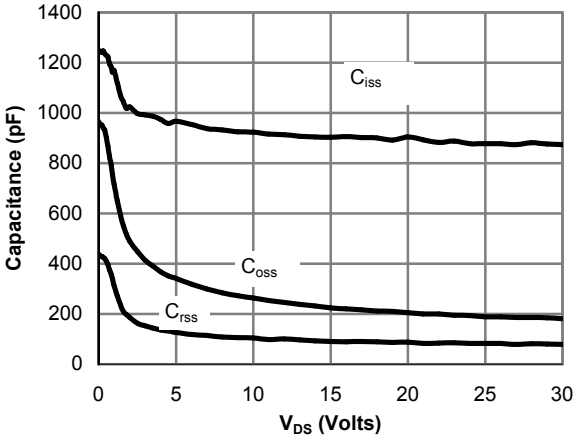

Figure 8: Capacitance Characteristics

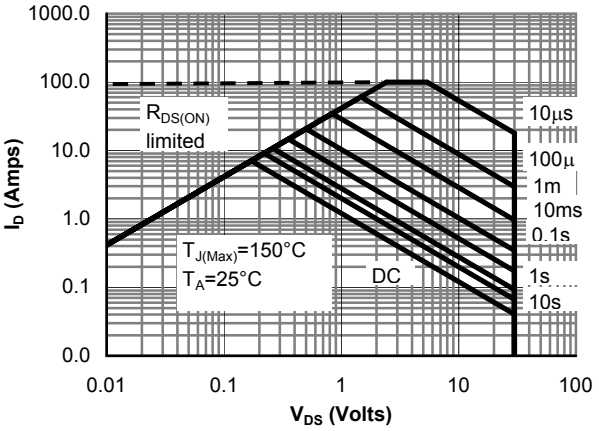

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

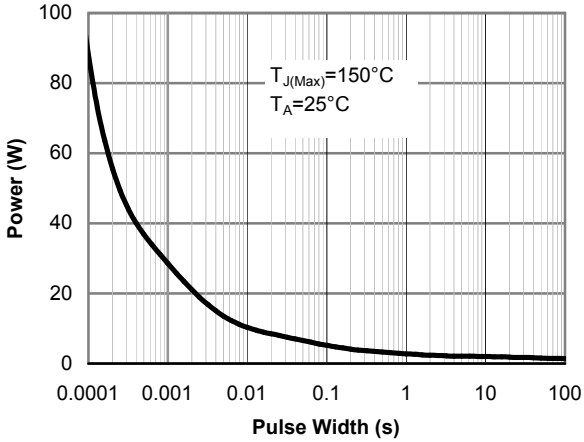

Figure10: Single Pulse Power Rating Junction-to-Ambient (Note E)

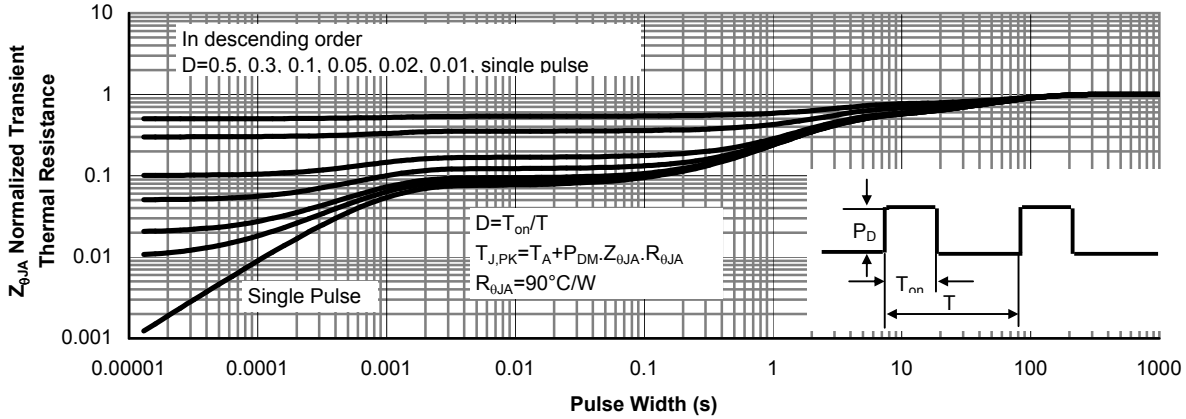

Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

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			1	µA
		T_J=55°C			5	
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		19	23	mΩ
		T_J=125°C		27	34	
		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 $R_{\theta JA}$ 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.
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 <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.
Rev 0: Mar. 2007

FET2: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

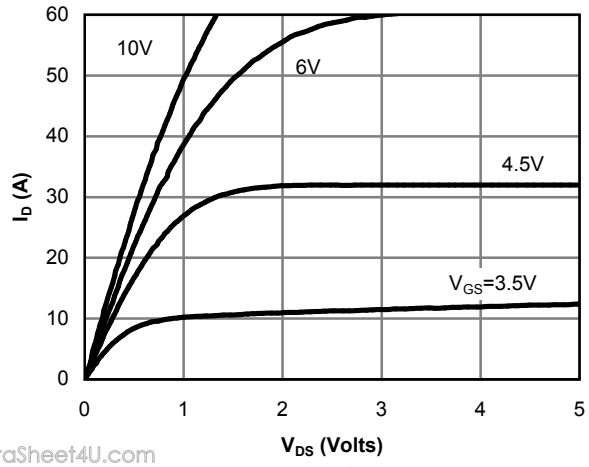

Fig 1: On-Region Characteristics

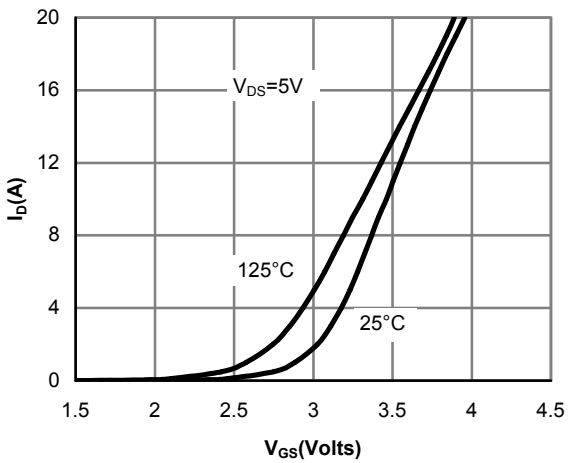

Figure 2: Transfer Characteristics

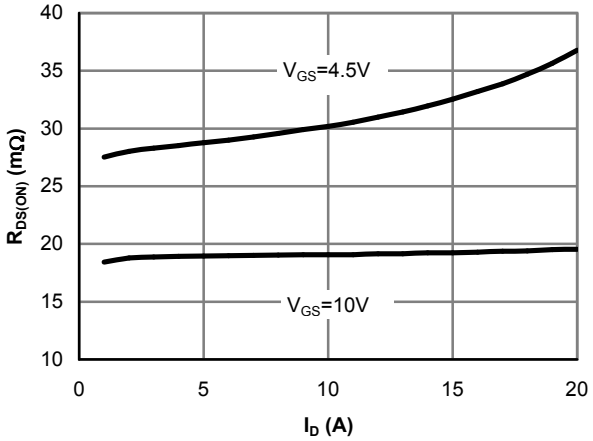

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

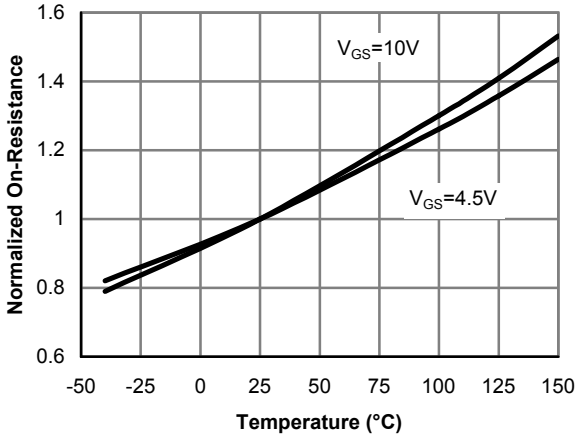

Figure 4: On-Resistance vs. Junction Temperature

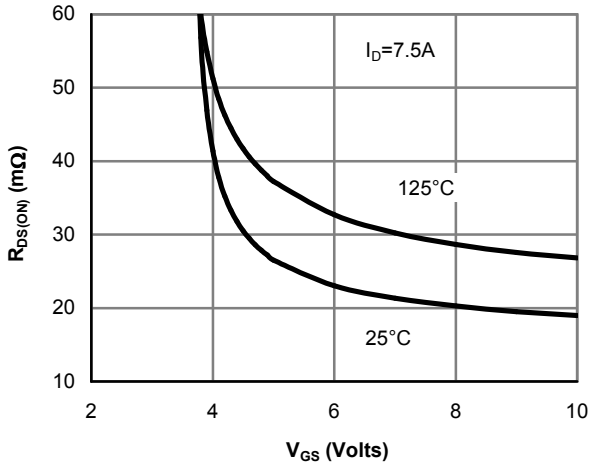

Figure 5: On-Resistance vs. Gate-Source Voltage

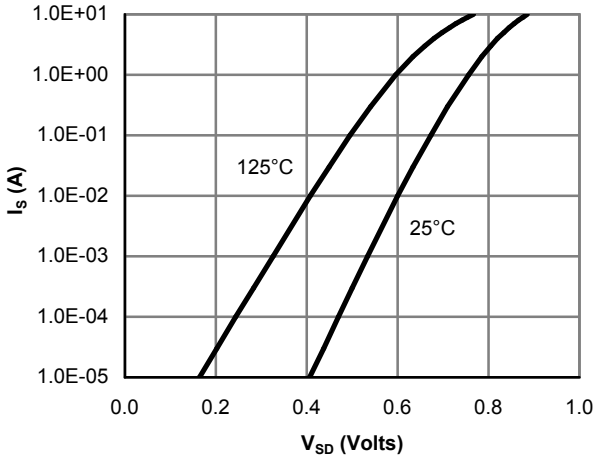

Figure 6: Body-Diode Characteristics