

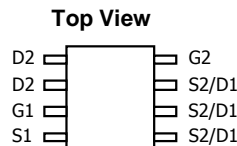
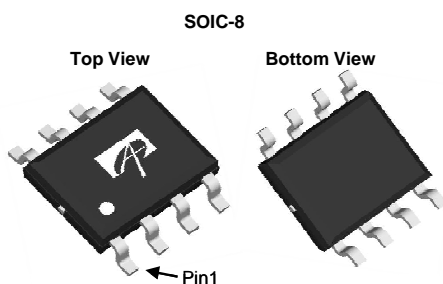
General Description

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.

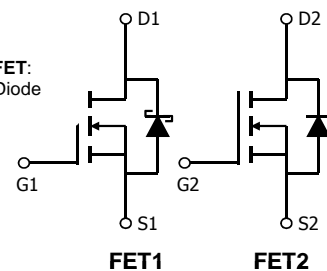
Product Summary

FET1	FET2
$V_{DS} (V) = 30V$	$V_{DS}(V) = 30V$
$I_D = 9.1A$	$I_D=7.8A$ ($V_{GS} = 10V$)
$R_{DS(ON)} < 15m\Omega$	$< 21m\Omega$ ($V_{GS} = 10V$)
$R_{DS(ON)} < 23m\Omega$	$< 32m\Omega$ ($V_{GS} = 4.5V$)

100% UIS Tested
 100% Rg Tested



SRFET™
 Soft Recovery MOSFET:
 Integrated Schottky Diode



Absolute Maximum Ratings $T_A=25^\circ C$ 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}	$T_A=25^\circ C$	9.1	7.6	7.8	6.5	A
	$T_A=70^\circ C$	7.3	6.1	6.3	5.2	
Pulsed Drain Current ^B	I_{DM}	100		64		A
Avalanche Current ^B	I_{AR}	17		9		A
Repetitive avalanche energy $L=0.3mH$ ^B	E_{AR}	43		12		mJ
Power Dissipation ^A	$T_A=25^\circ C$	2	1.4	2	1.4	W
	$T_A=70^\circ C$	1.3	0.9	1.3	0.9	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		-55 to 150		$^\circ C$

Thermal Characteristics FET1(Integrated Schottky Diode)

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

Thermal Characteristics FET2

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

FET1(Intergrated Schottky Diode) Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}$, $V_{GS}=0\text{V}$ $T_J=125^\circ\text{C}$			0.1 10	mA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			0.1	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	1.3	1.65	2.5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=10\text{V}$, $V_{DS}=5\text{V}$	100			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$, $I_D=9.1\text{A}$ $T_J=125^\circ\text{C}$		12.5	15	m Ω
		$V_{GS}=4.5\text{V}$, $I_D=7.3\text{A}$		18	22	
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}$, $I_D=9.1\text{A}$		26		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}$, $V_{GS}=0\text{V}$		0.43	0.5	V
I_S	Maximum Body-Diode + Schottky Continuous Current				3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=15\text{V}$, $f=1\text{MHz}$		903	1100	pF
C_{oss}	Output Capacitance			225		pF
C_{rss}	Reverse Transfer Capacitance			91		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		1.7	3.0	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $I_D=9.1\text{A}$		15.3	20	
$Q_g(4.5\text{V})$	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	$V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $R_L=1.65\Omega$, $R_{GEN}=3\Omega$		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	$I_F=9.1\text{A}$, $dI/dt=300\text{A}/\mu\text{s}$		17	20	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=9.1\text{A}$, $dI/dt=300\text{A}/\mu\text{s}$		30.0		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design.

B: Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}=150^\circ\text{C}$.

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

D: The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ 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 $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

F: The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

Rev2: Jun. 2011

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FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

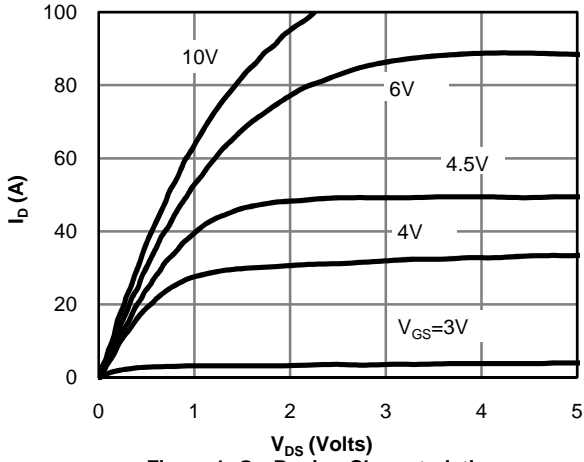


Figure 1: On-Region Characteristics

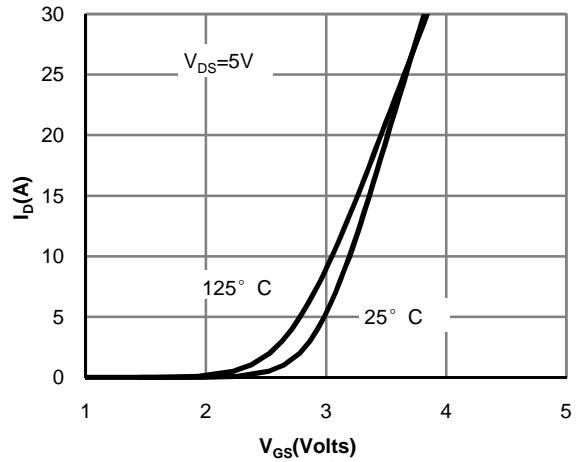


Figure 2: Transfer Characteristics

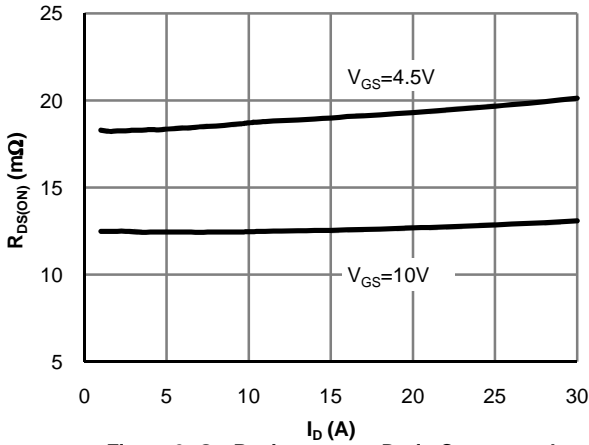


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

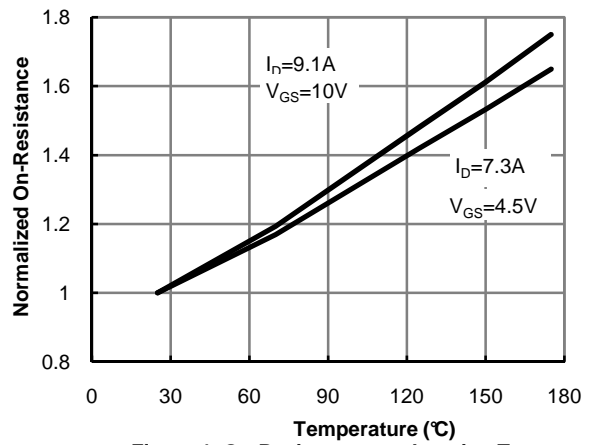


Figure 4: On-Resistance vs. Junction Temperature

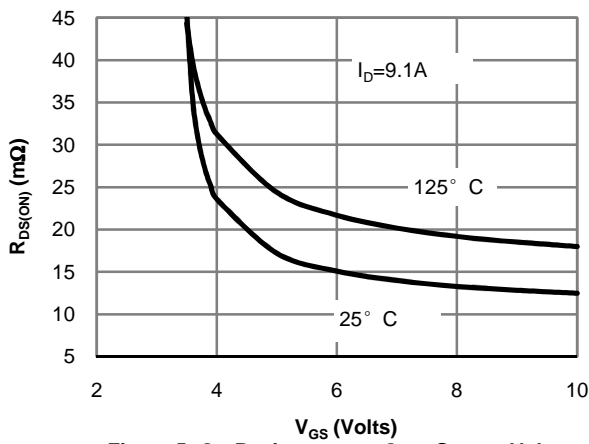


Figure 5: On-Resistance vs. Gate-Source Voltage

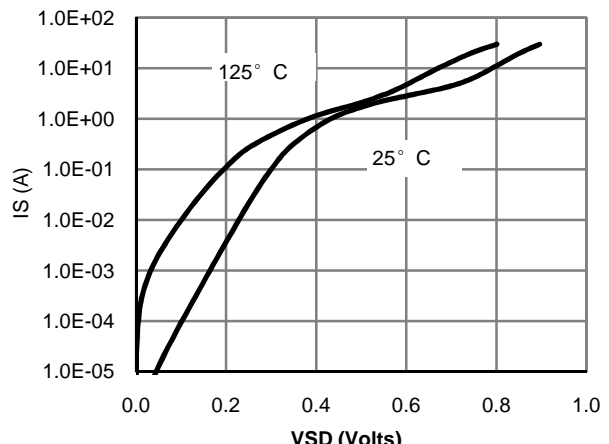


Figure 6: Body-Diode Characteristics

FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

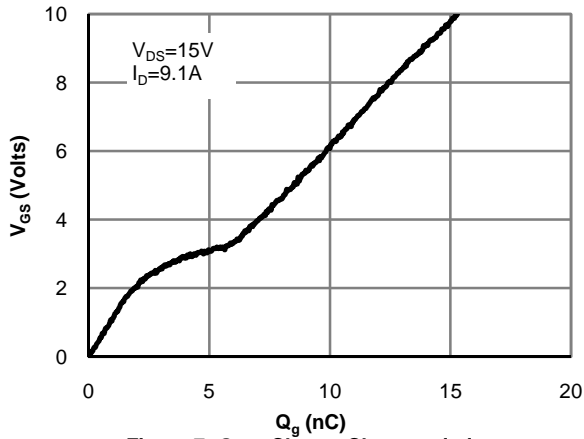


Figure 7: Gate-Charge Characteristics

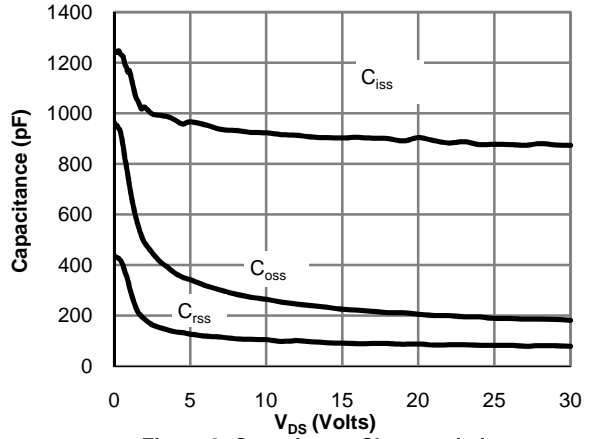


Figure 8: Capacitance Characteristics

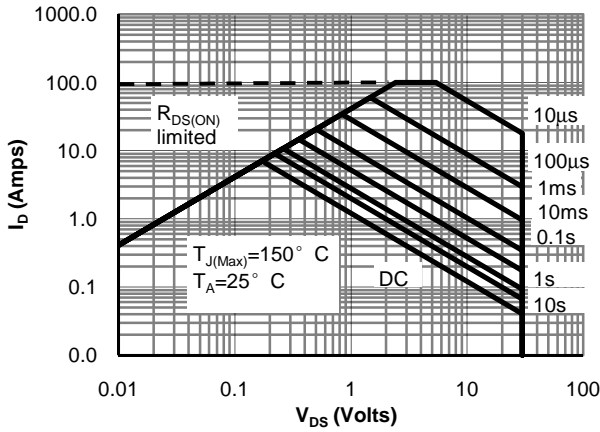


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

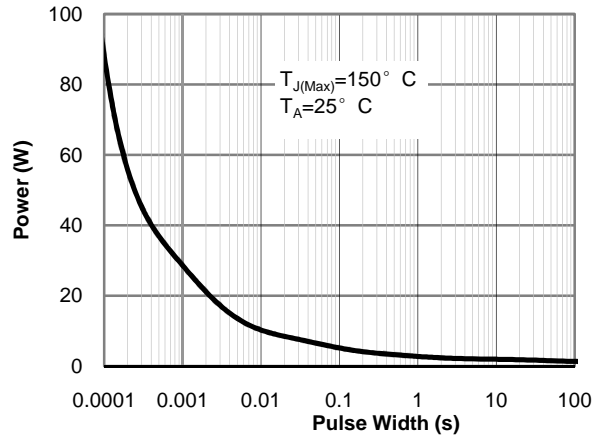


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

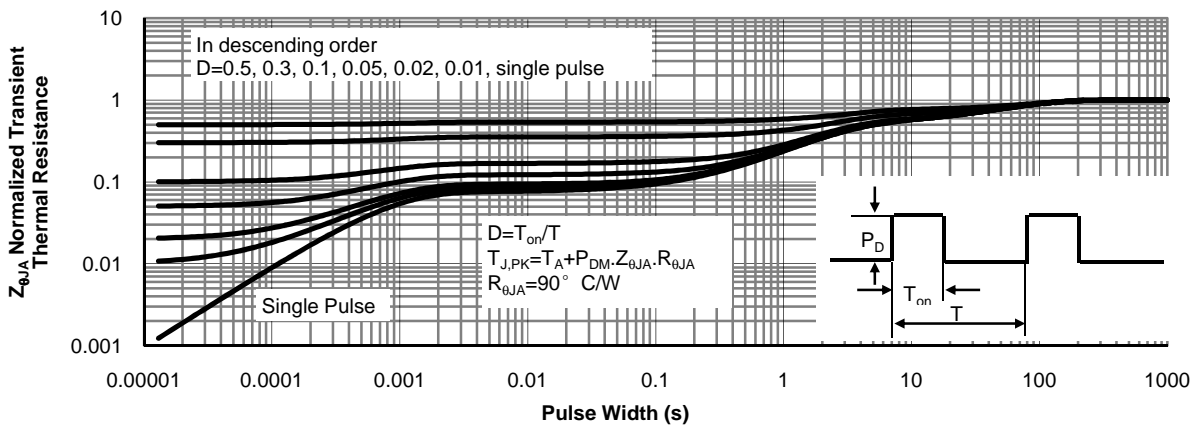


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

FET2 Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.5	2.1	2.6	V
$I_{D(ON)}$	On state drain current	$V_{GS}=10\text{V}, V_{DS}=5\text{V}$	64			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=7.8\text{A}$ $T_J=125^\circ\text{C}$		16.5	21	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=6\text{A}$		23.7	32	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}, I_D=7.8\text{A}$		20		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.75	1	V
I_S	Maximum Body-Diode Continuous Current				2.4	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$		373	448	pF
C_{oss}	Output Capacitance			67		pF
C_{rss}	Reverse Transfer Capacitance			41		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		1.8	2.8	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, I_D=7.8\text{A}$		7.2	11	nC
$Q_g(4.5\text{V})$	Total Gate Charge			3.5		nC
Q_{gs}	Gate Source Charge			1.3		nC
Q_{gd}	Gate Drain Charge			1.7		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=1.9\Omega,$ $R_{GEN}=3\Omega$		4.5		ns
t_r	Turn-On Rise Time			2.7		ns
$t_{D(off)}$	Turn-Off DelayTime			14.9		ns
t_f	Turn-Off Fall Time			2.9		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=7.8\text{A}, di/dt=100\text{A}/\mu\text{s}$		10.5	12.6	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=7.8\text{A}, di/dt=100\text{A}/\mu\text{s}$		4.5		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 $T_A=25^\circ\text{C}$. 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 impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

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

F: The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

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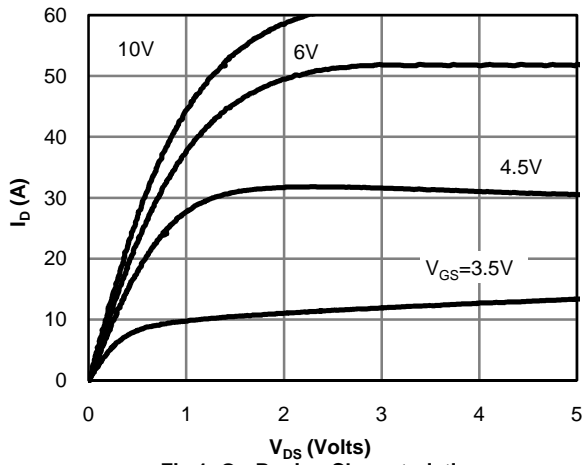


Fig 1: On-Region Characteristics

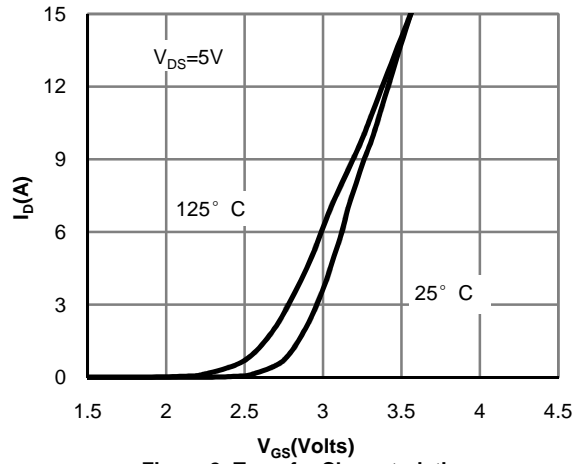


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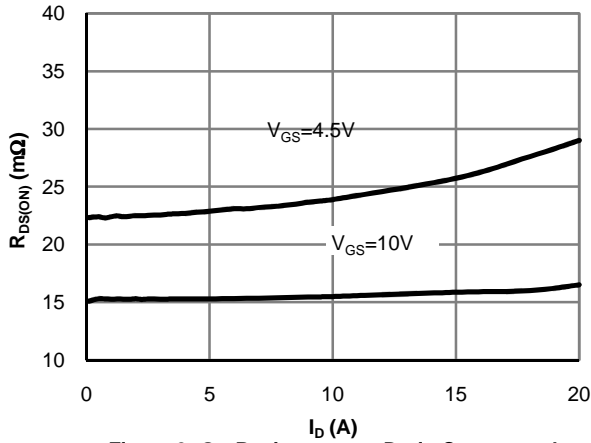


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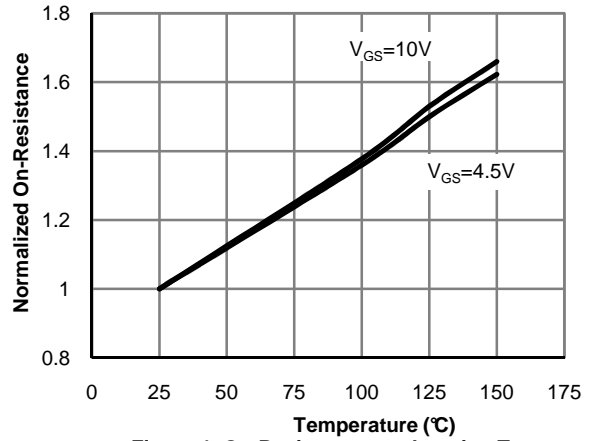


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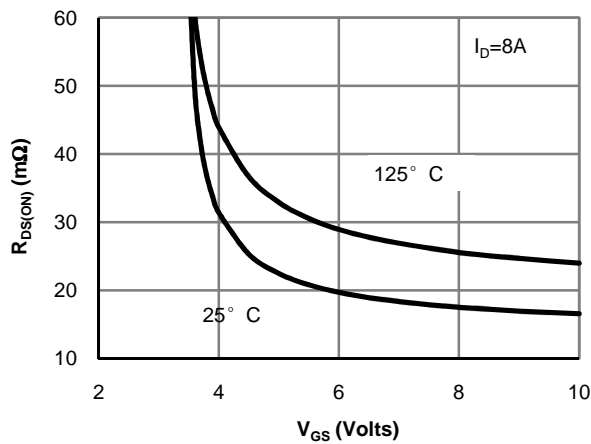


Figure 5: On-Resistance vs. Gate-Source Voltage

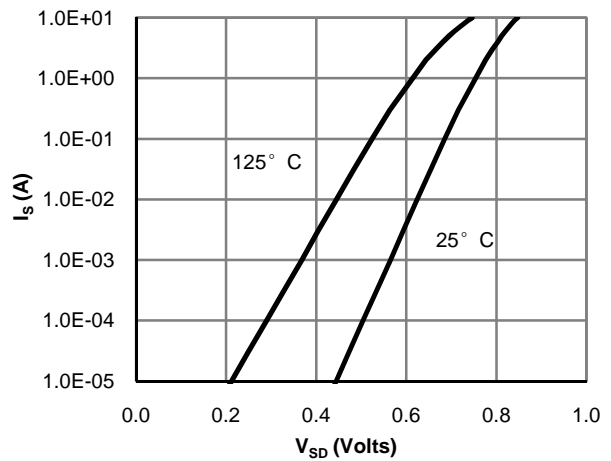


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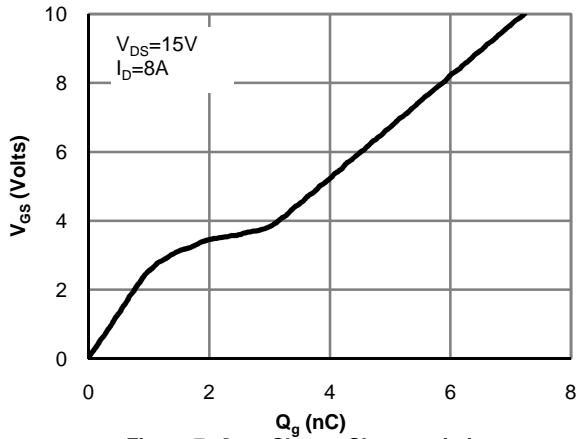


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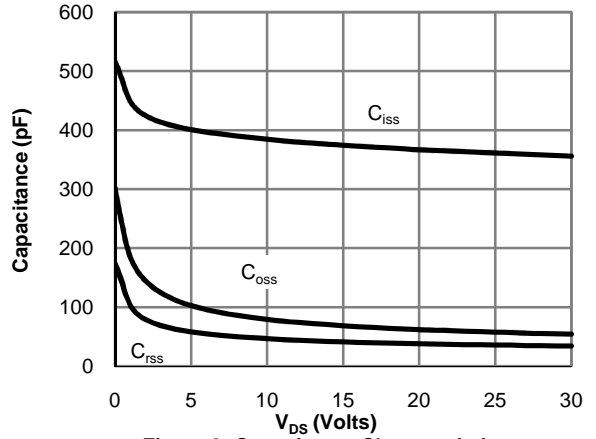


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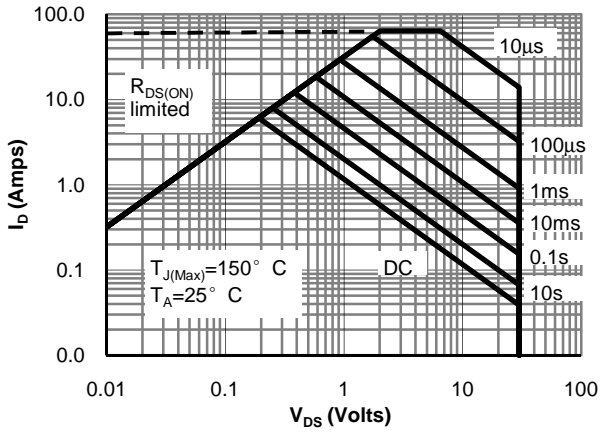


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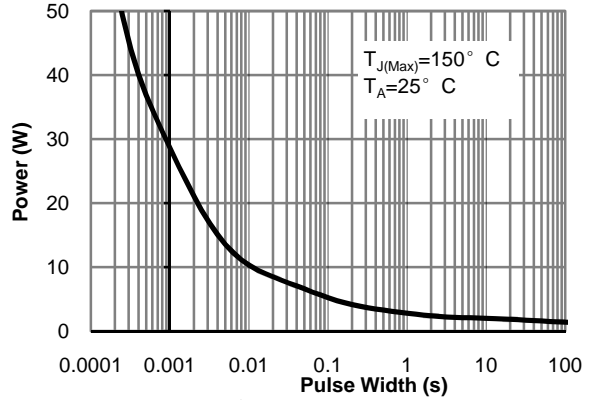


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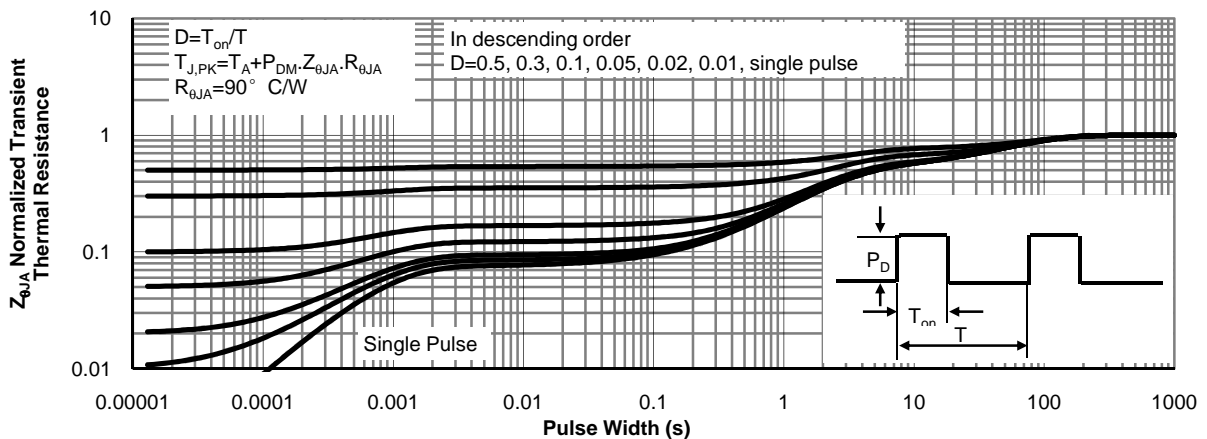


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