ALPHA & OMEGA SEMICONDUCTOR

AO4603

Complementary Enhancement Mode Field Effect Transistor

General Description

The AO4603 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. *Standard product AO4603 is Pb-free (meets ROHS & Sony 259 specifications). AO4603L is a Green Product ordering option. AO4603 and AO4603L are electrically identical.*

Features

n-channel	p-channel
V_{DS} (V) = 30V	-30V
I_D = 4.7A (V_{GS}=10V)	-5.8A (V_{GS} = -10V)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 55mΩ (V_{GS}=10V)	< 35mΩ (V_{GS} = -10V)
< 70mΩ (V_{GS}=4.5V)	< 58mΩ (V_{GS} = -4.5V)
< 110mΩ (V_{GS} = 2.5V)	

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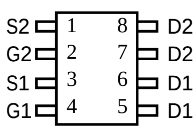

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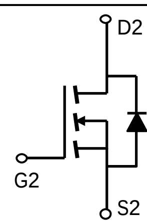
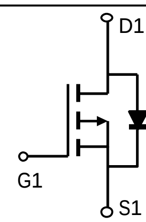


n-channel



p-channel

Absolute Maximum Ratings T_A=25°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}	±12	±20	V
Continuous Drain Current [A]	T_A=25°C	I_D	4.7	-5.8	A
	T_A=70°C		4	-4.9	
Pulsed Drain Current [B]		I_{DM}	30	-40	
Power Dissipation	T_A=25°C	P_D	2	2	W
	T_A=70°C		1.44	1.44	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics: n-channel and p-channel						
Parameter		**Symbol**	**Device**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	n-ch	52	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		n-ch	78	110	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	n-ch	48	50	°C/W
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	p-ch	50	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		p-ch	73	110	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	p-ch	31	35	°C/W

n-channel MOSFET 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}=24V, V_{GS}=0V				1	µA
			T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±12V				100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA		0.6	1	1.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=4.5V, V_{DS}=5V		10			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=4A			45	55	mΩ
			T_J=125°C				
		V_{GS}=4.5V, I_D=3A			55	70	mΩ
		V_{GS}=2.5V, I_D=2A			83	110	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=4A			8		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V			0.8	1	V
I_S	Maximum Body-Diode Continuous Current					2.5	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz			390		pF
C_{oss}	Output Capacitance				54.5		pF
C_{rss}	Reverse Transfer Capacitance				41		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz			3		Ω
SWITCHING PARAMETERS							
Q_g	Total Gate Charge	V_{GS}=4.5V, V_{DS}=15V, I_D=4A			0.6		nC
Q_{gs}	Gate Source Charge				1.38		nC
Q_{gd}	Gate Drain Charge				4.34		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=3.75Ω, R_{GEN}=6Ω			3.3		ns
t_r	Turn-On Rise Time				1		ns
$t_{D(off)}$	Turn-Off DelayTime				21.7		ns
t_f	Turn-Off Fall Time				2.1		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=4A, dI/dt=100A/µs			12		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=4A, dI/dt=100A/µs			6.3		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. The current rating is based on the t≤ 10s thermal resistance rating.
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 80µs 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.
Rev3: August 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS N-Channel

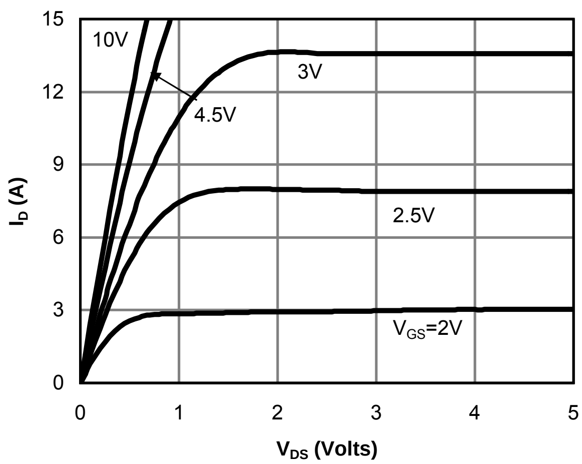

Fig 1: On-Region Characteristics

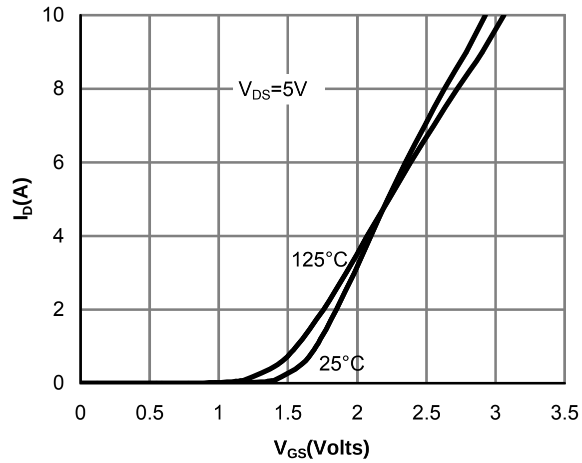

Figure 2: Transfer Characteristics

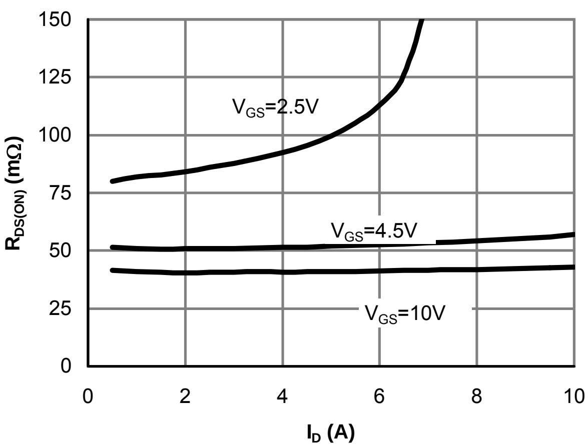

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

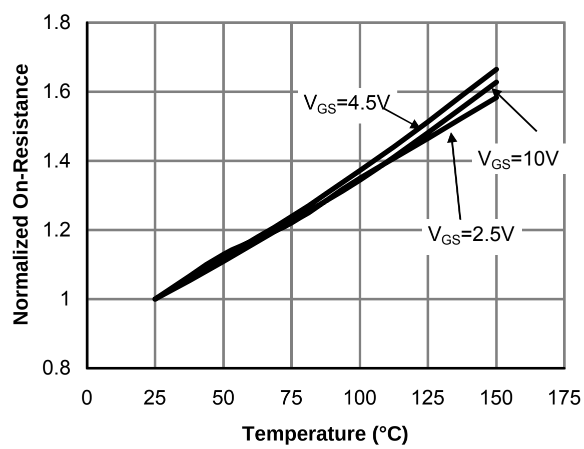

Figure 4: On-Resistance vs. Junction Temperature

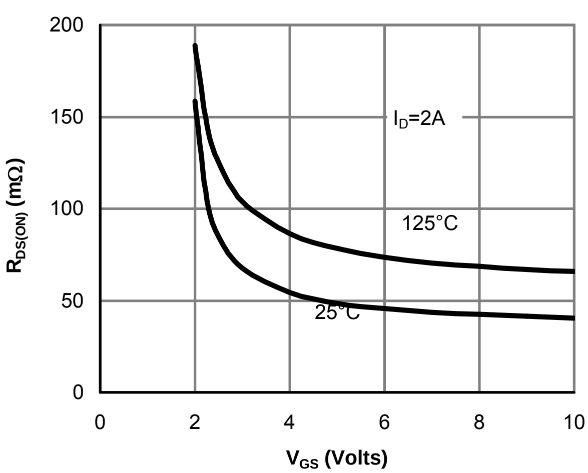

Figure 5: On-Resistance vs. Gate-Source Voltage

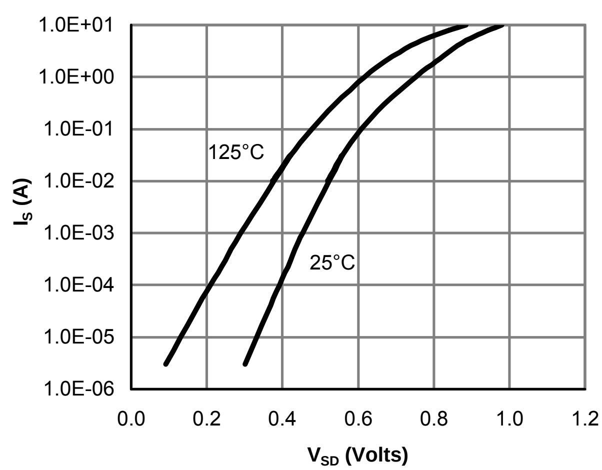

Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS N-Channel

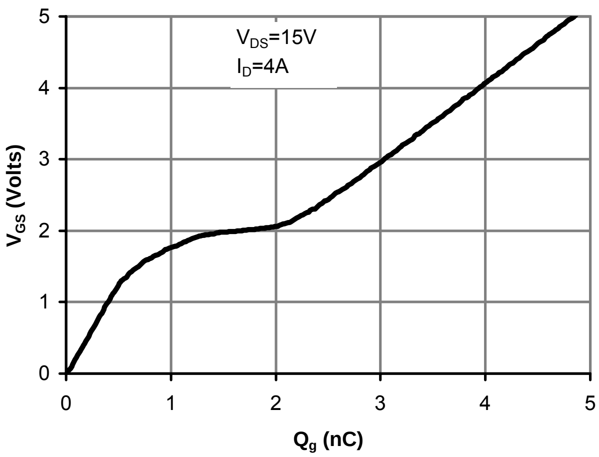

Figure 7: Gate-Charge Characteristics

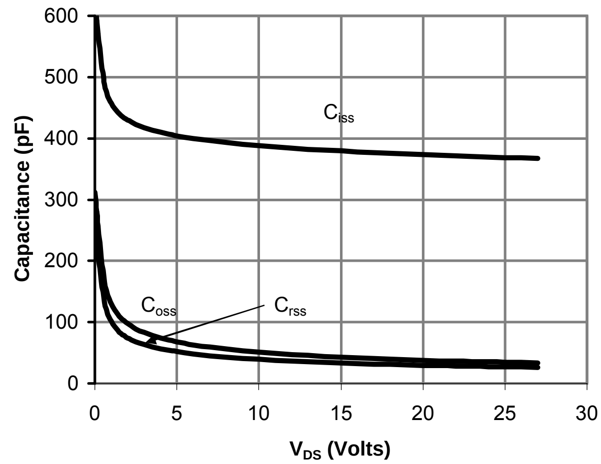

Figure 8: Capacitance Characteristics

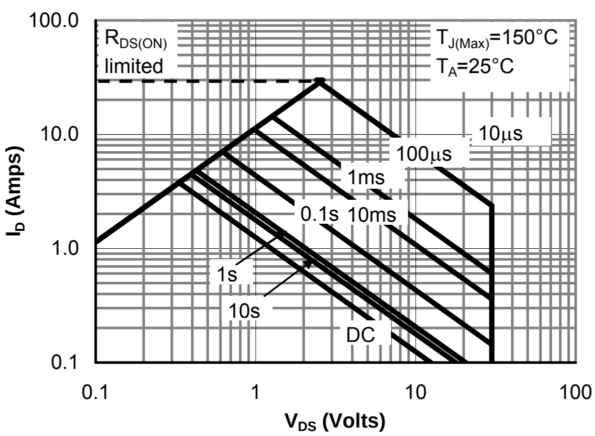

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

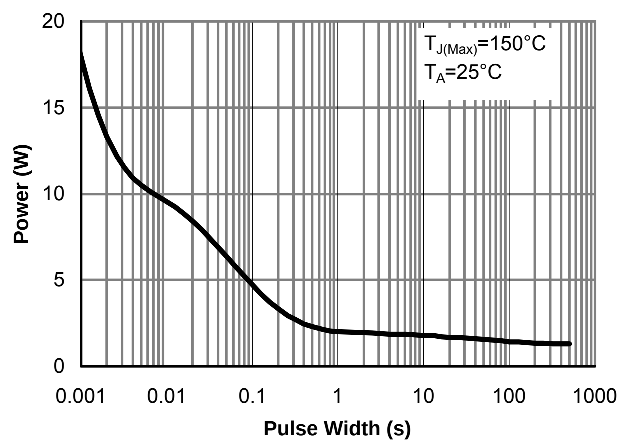

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

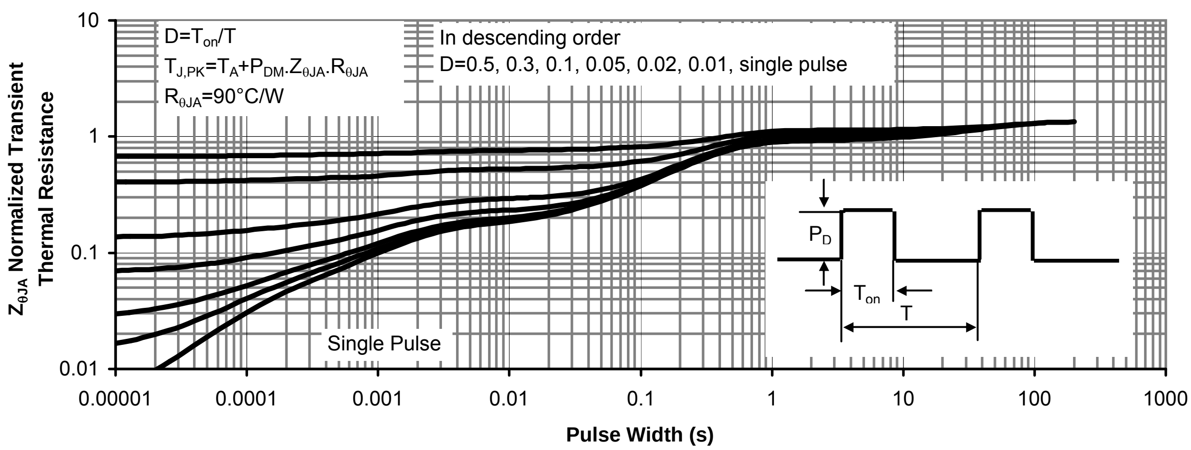

Figure 11: Normalized Maximum Transient Thermal Impedance

p-channel MOSFET 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}=-24V, 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		-1.2	-1.8	-2.2	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V		40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-5A			29	38	mΩ
			T_J=125°C		40		
		V_{GS}=-4.5V, I_D=-5A			39	63	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-10A					S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V			-0.75	-1	V
I_S	Maximum Body-Diode Continuous Current					-4.2	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz			920		pF
C_{oss}	Output Capacitance				190		pF
C_{rss}	Reverse Transfer Capacitance				122		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz			3.6		Ω
SWITCHING PARAMETERS							
Q_g	Total Gate Charge	V_{GS}=-10V, V_{DS}=-15V, I_D=-7.5A			2.4		nC
Q_{gs}	Gate Source Charge				4.5		nC
Q_{gd}	Gate Drain Charge				9.3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=2Ω, R_{GEN}=3Ω			7.6		ns
t_r	Turn-On Rise Time				5.2		ns
$t_{D(off)}$	Turn-Off DelayTime				21.6		ns
t_f	Turn-Off Fall Time				8		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-7.5A, dI/dt=100A/µs			20		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-7.5A, dI/dt=100A/µs			8.8		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 a 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 $R_{\theta JA}$ 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 6,12,14 are obtained using 80µs 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS P-Channel

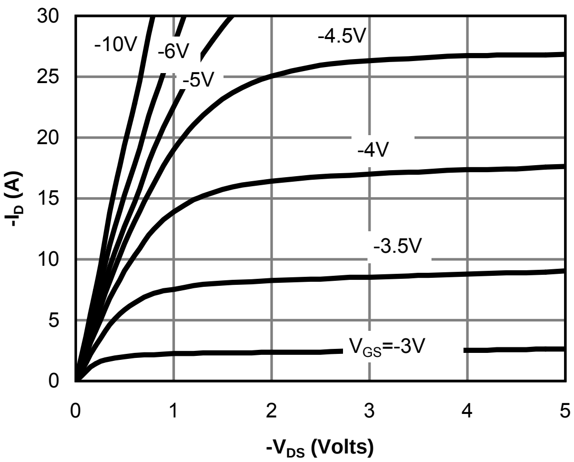

Fig 1: On-Region Characteristics

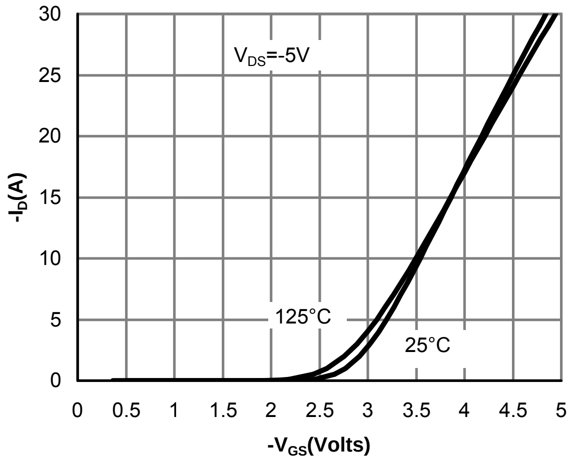

Figure 2: Transfer Characteristics

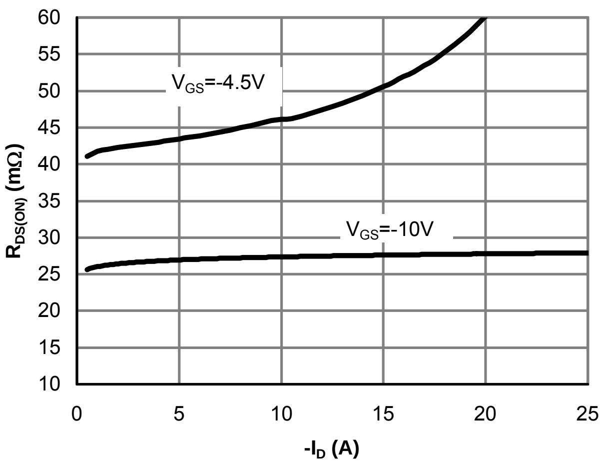

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

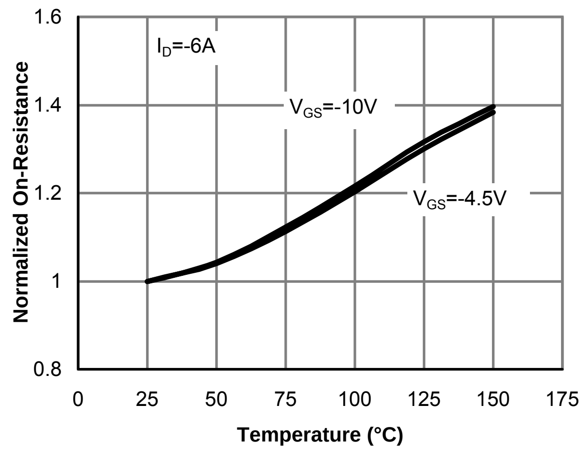

Figure 4: On-Resistance vs. Junction Temperature

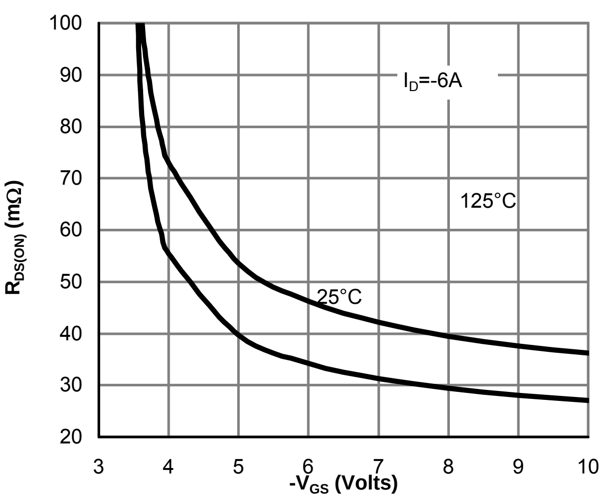

Figure 5: On-Resistance vs. Gate-Source Voltage

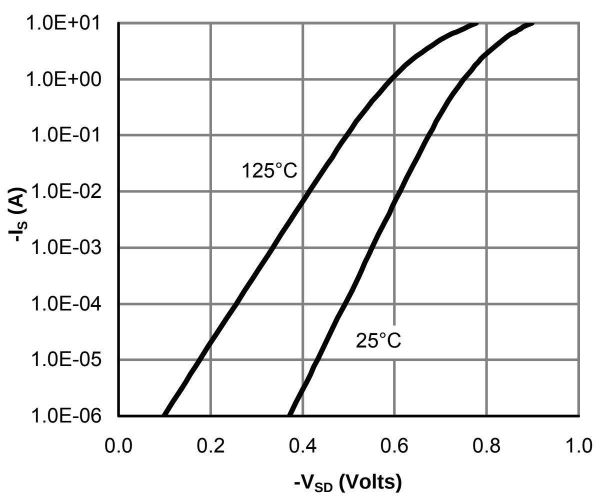

Figure 6: Body-Diode Characteristics

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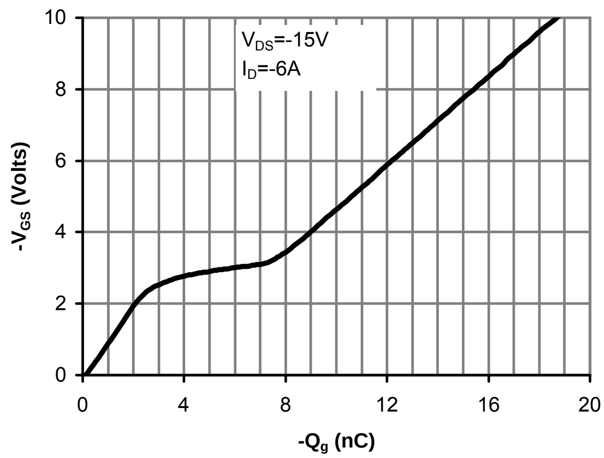
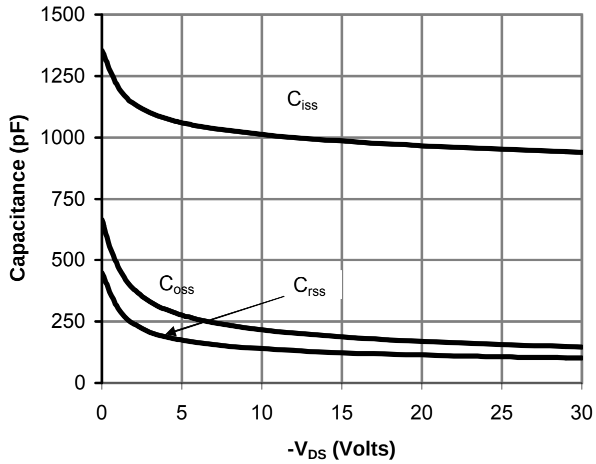


Figure 7: Gate-Charge Characteristics



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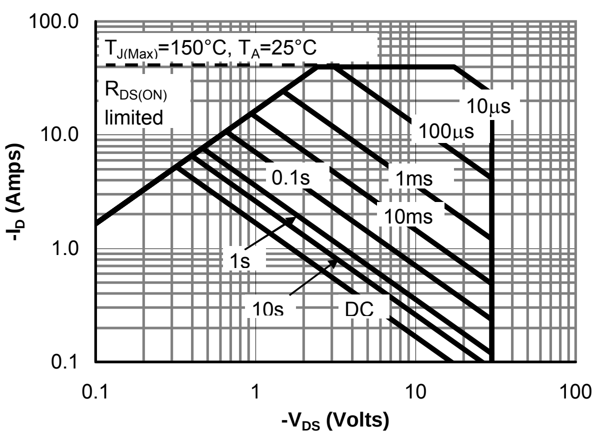

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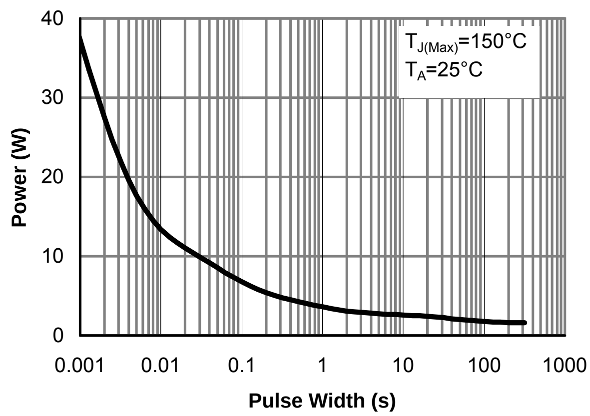

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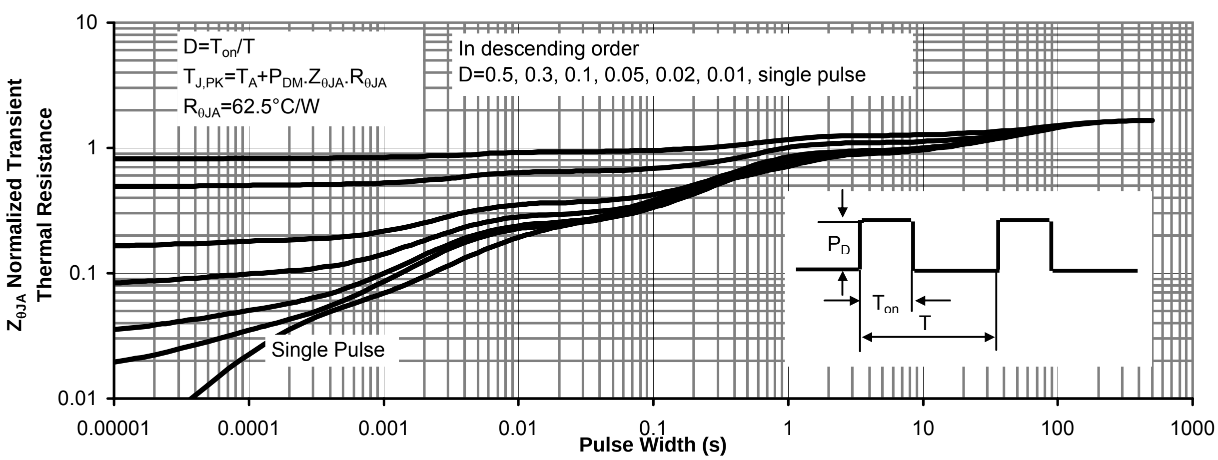

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