



ALPHA & OMEGA
SEMICONDUCTOR, LTD.

Rev 2: Nov 2004

**AO6604, AO6604L (Green Product)
Complementary Enhancement Mode Field Effect Transistor**

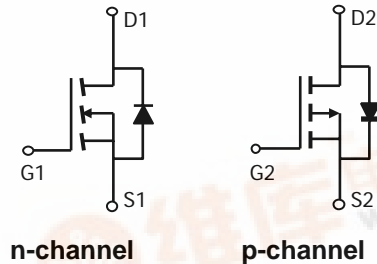
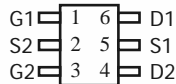
General Description

The AO6604 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs form a high-speed power inverter, suitable for a multitude of applications. AO6604L (Green Product) is offered in a lead-free package.

Features

n-channel	p-channel
$V_{DS} (V) = 20V$	-20V
$I_D = 3.4A$	-2.5A
$R_{DS(ON)}$	
< 60mΩ	< 110mΩ ($V_{GS} = 4.5V$)
< 75mΩ	< 140mΩ ($V_{GS} = 2.5V$)
< 100mΩ	< 200mΩ ($V_{GS} = 1.8V$)

TSOP6
Top View



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}	20	-20	V
Gate-Source Voltage	V_{GS}	± 8	± 8	V
Continuous Drain Current ^A	$T_A=25^\circ C$	3.4	-2.5	A
		$T_A=70^\circ C$	2.7	
Pulsed Drain Current ^B	I_{DM}	15	-15	
Power Dissipation	P_D	$T_A=25^\circ C$	1.15	W
		$T_A=70^\circ C$	0.73	
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	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	78	110	$^\circ C/W$
Maximum Junction-to-Ambient ^A		Steady-State	106	150
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	64	80	$^\circ C/W$



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	20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =16V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±8V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	0.4	0.6	1	V
I _{D(ON)}	On state drain current	V _{GS} =4.5V, V _{DS} =5V	15			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =4.5V, I _D =3.4A T _J =125°C		46 63	60 80	mΩ
		V _{GS} =2.5V, I _D =3A		57	75	mΩ
		V _{GS} =1.8V, I _D =2A		72	100	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =3.4A		10		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.76	1	V
I _S	Maximum Body-Diode Continuous Current				2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =10V, f=1MHz		436	570	pF
C _{oss}	Output Capacitance			66		pF
C _{rss}	Reverse Transfer Capacitance			44		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		3	4	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =4.5V, V _{DS} =10V, I _D =3.4A		6.2	8.1	nC
Q _{gs}	Gate Source Charge			1.6		nC
Q _{gd}	Gate Drain Charge			0.5		nC
t _{D(on)}	Turn-On Delay Time	V _{GS} =5V, V _{DS} =10V, R _L =3Ω, R _{GEN} =3Ω		5.5		ns
t _r	Turn-On Rise Time			6.3		ns
t _{D(off)}	Turn-Off Delay Time			40		ns
t _f	Turn-Off Fall Time			12.7		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =3.4A, di/dt=100A/μs		12.3	16	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =3.4A, di/dt=100A/μs		3.5		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 a given application depends on the user's specific board design. The current rating is based on the ≤ 10s thermal resistance rating.

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 80μs 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.

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N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

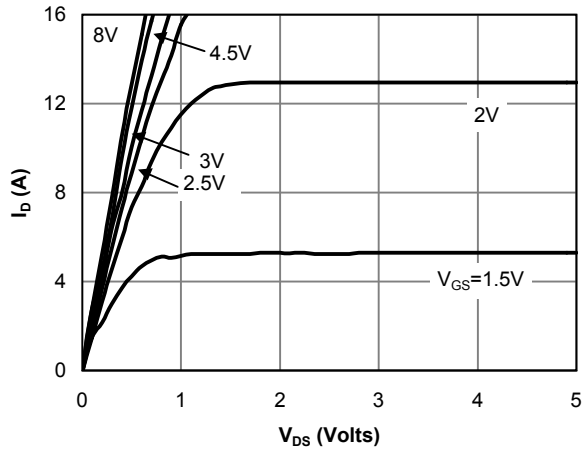


Fig 1: On-Region Characteristics

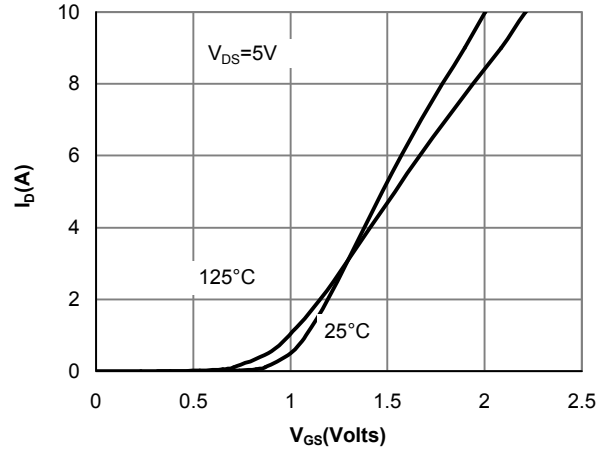


Figure 2: Transfer Characteristics

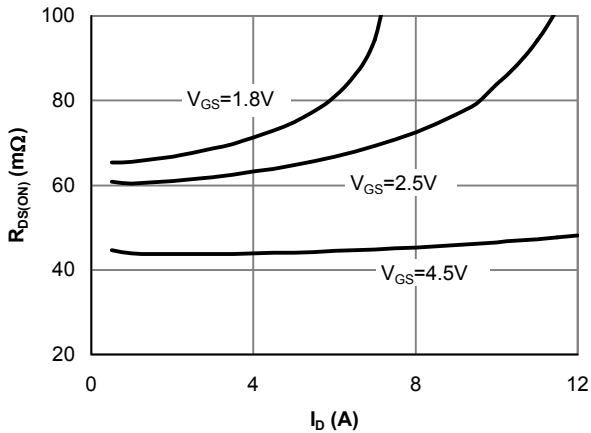


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

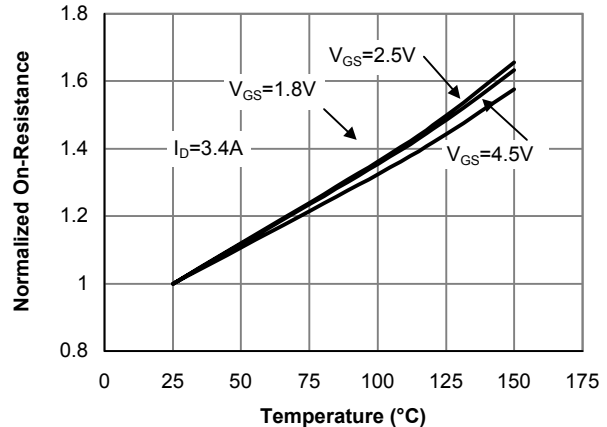


Figure 4: On-Resistance vs. Junction Temperature

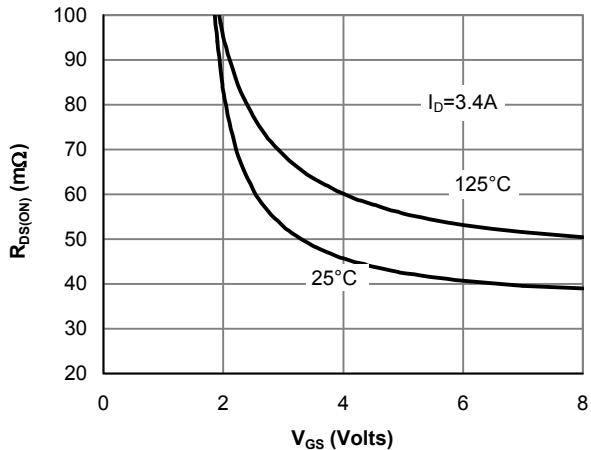


Figure 5: On-Resistance vs. Gate-Source Voltage

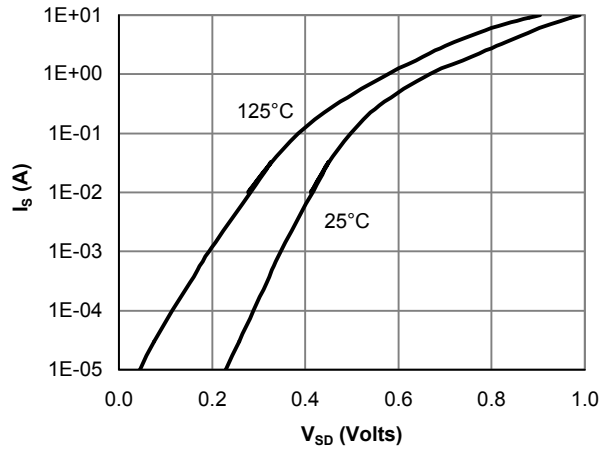


Figure 6: Body-Diode Characteristics

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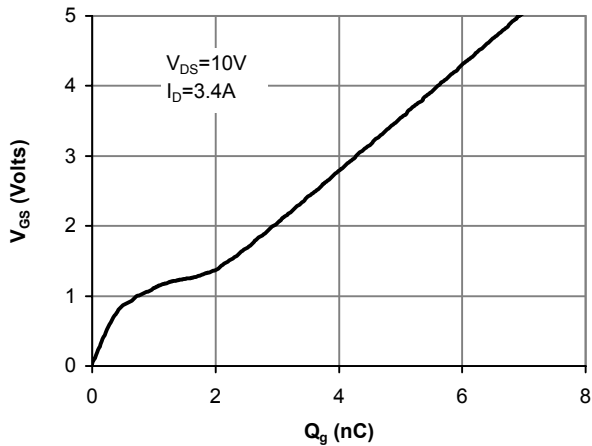


Figure 7: Gate-Charge Characteristics

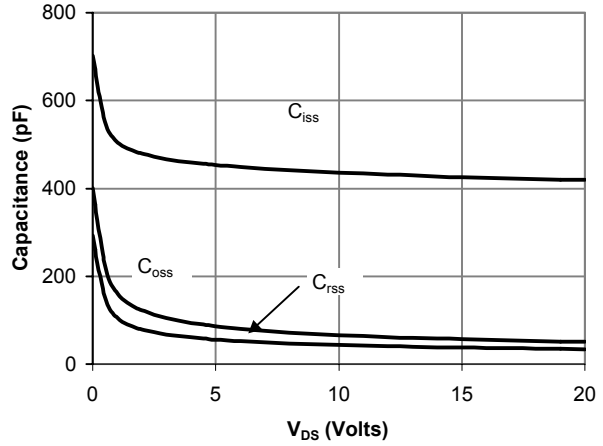


Figure 8: Capacitance Characteristics

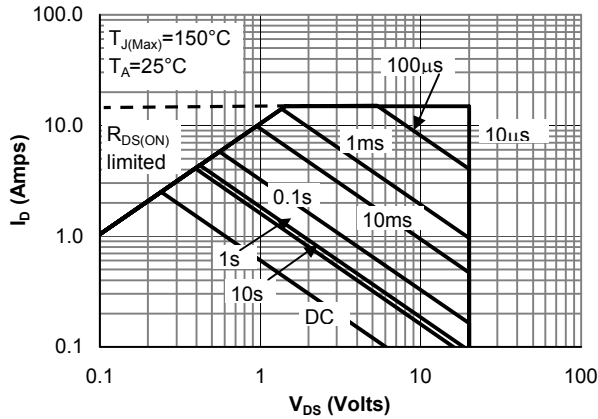


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

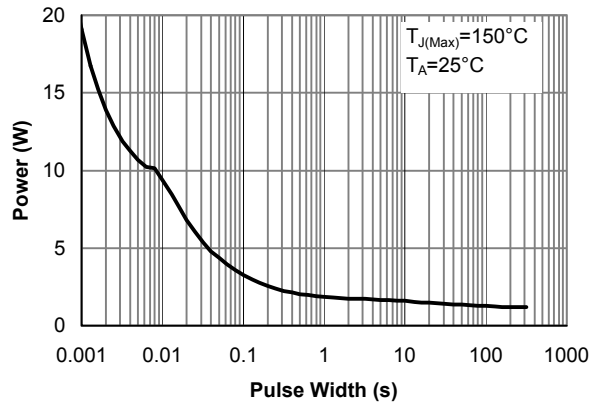


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

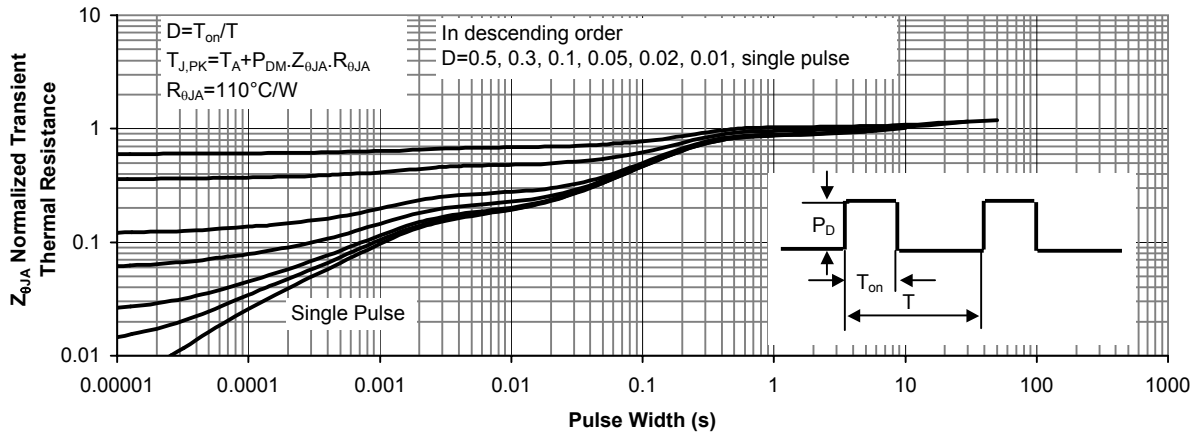


Figure 11: Normalized Maximum Transient Thermal Impedance

P-channel MOSFET Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-16\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1	μA
					-5	
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 8\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-0.3	-0.55	-1	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-4.5\text{V}$, $V_{DS}=-5\text{V}$	-15			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-4.5\text{V}$, $I_D=-2.5\text{A}$ $T_J=125^\circ\text{C}$		86	110	m Ω
				116	145	
		$V_{GS}=-2.5\text{V}$, $I_D=-2\text{A}$		113	140	m Ω
		$V_{GS}=-1.8\text{V}$, $I_D=-1\text{A}$		151	200	m Ω
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-3\text{A}$	4	6		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.78	-1	V
I_S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-10\text{V}$, $f=1\text{MHz}$		540	700	pF
C_{oss}	Output Capacitance			72		pF
C_{riss}	Reverse Transfer Capacitance			49		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		12	15.6	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-4.5\text{V}$, $V_{DS}=-10\text{V}$, $I_D=-2.5\text{A}$		6.1	8	nC
Q_{gs}	Gate Source Charge			0.6		nC
Q_{gd}	Gate Drain Charge			1.6		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-4.5\text{V}$, $V_{DS}=-10\text{V}$, $R_L=3.9\Omega$, $R_{GEN}=3\Omega$		10		ns
t_r	Turn-On Rise Time			12		ns
$t_{D(off)}$	Turn-Off Delay Time			44		ns
t_f	Turn-Off Fall Time			22		ns
t_{rr}	Body Diode Reverse Recovery Time		$I_F=-2.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		21	28
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-2.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		7.5		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The value in any a given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

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 6,12,14 are obtained using 80 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 $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

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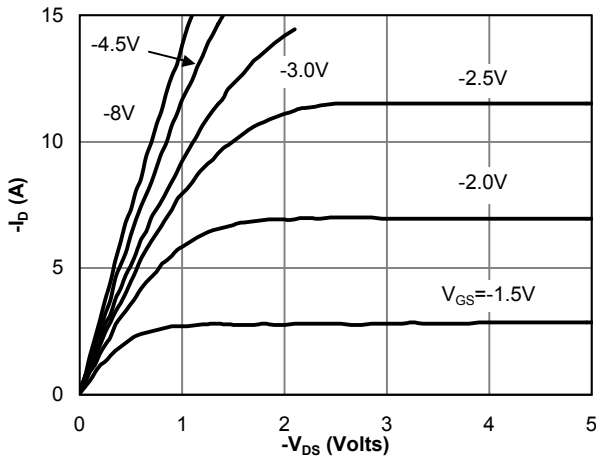


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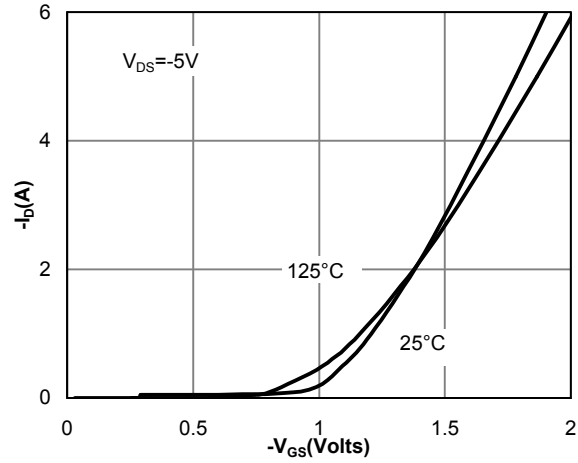


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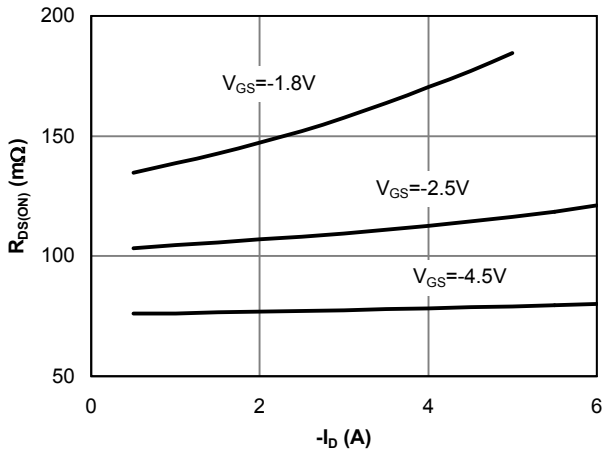


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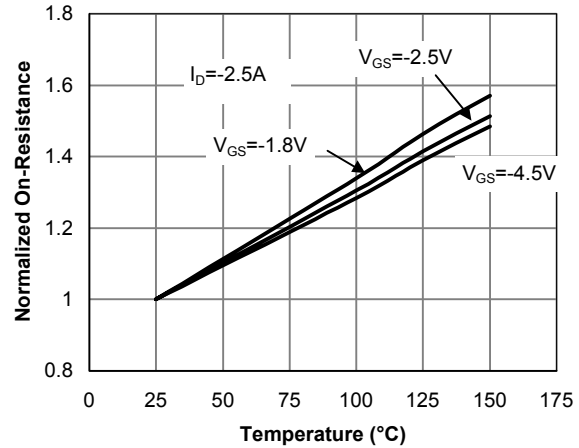


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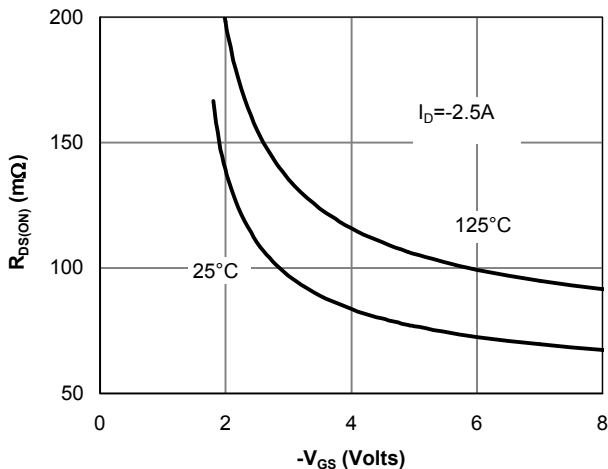


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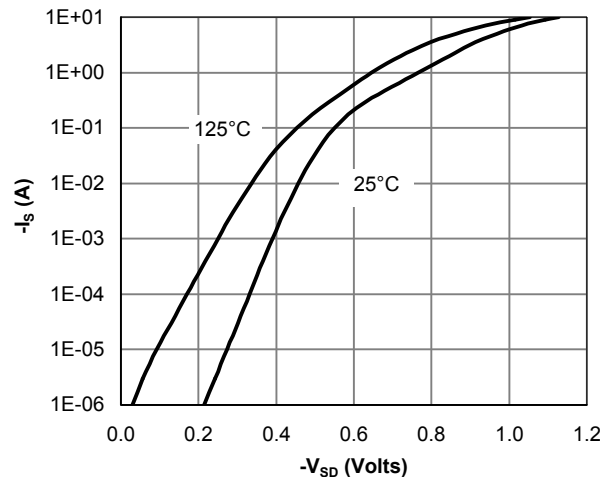


Figure 6: Body-Diode Characteristics

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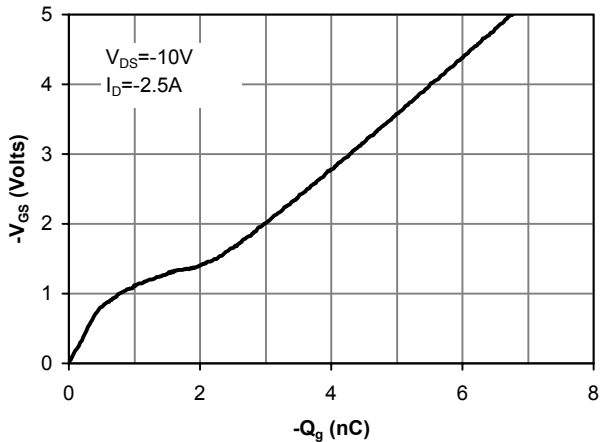


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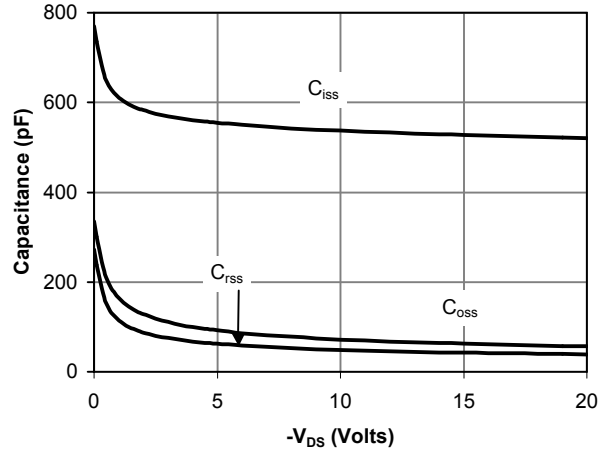


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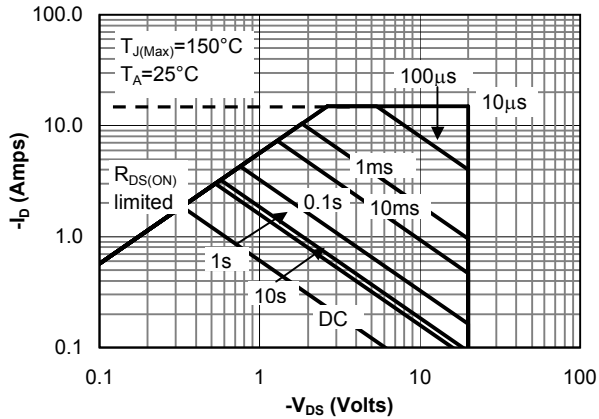


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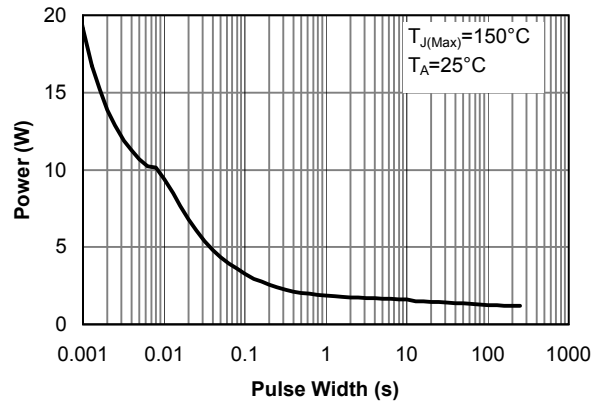


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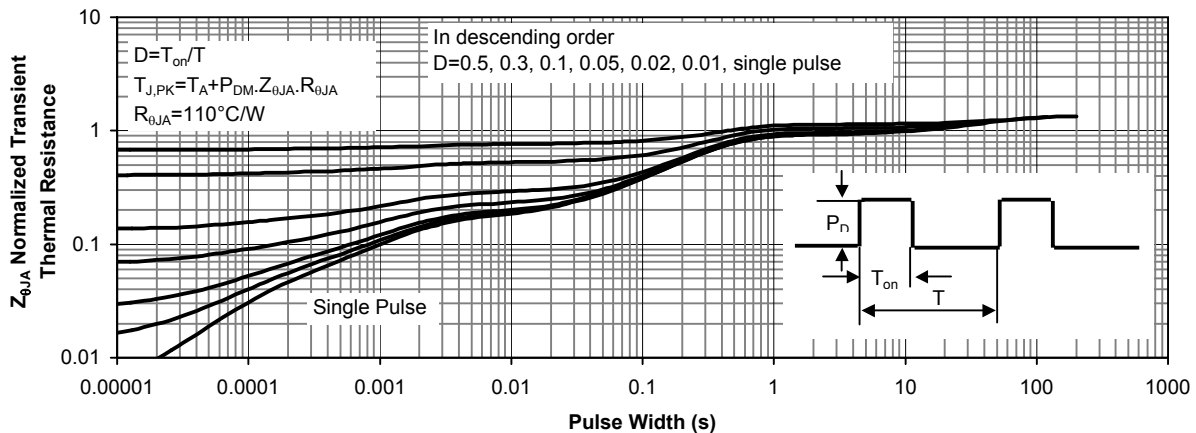


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