



AO4601

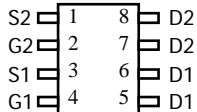
Complementary Enhancement Mode Field Effect Transistor

General Description

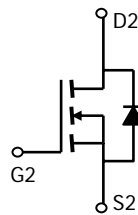
The AO4601 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. *Standard Product AO4601 is Pb-free (meets ROHS & Sony 259 specifications). AO4601L is a Green Product ordering option. AO4601 and AO4601L are*

Features

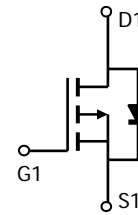
n-channel	p-channel
V_{DS} (V) = 30V	-30V
I_D = 4.7A ($V_{GS}=10V$)	-8A ($V_{GS} = -20V$)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 55m Ω ($V_{GS}=10V$)	< 18m Ω ($V_{GS} = -20V$)
< 70m Ω ($V_{GS}=4.5V$)	< 19m Ω ($V_{GS} = -10V$)
< 110m Ω ($V_{GS} = 2.5V$)	



SOIC-8



n-channel



p-channel

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	± 25	V	
Continuous Drain Current ^A	I_D	$T_A=25^\circ\text{C}$	4.7	-8	A
		$T_A=70^\circ\text{C}$	4	-6.9	
Pulsed Drain Current ^B	I_{DM}	30	-50		
Power Dissipation	P_D	$T_A=25^\circ\text{C}$	2	2	W
		$T_A=70^\circ\text{C}$	1.44	1.44	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ\text{C}$	

Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	n-ch	52	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		n-ch	78	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	n-ch	48	60	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	p-ch	50	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		p-ch	73	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	p-ch	31	40	$^\circ\text{C/W}$

n-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	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=24\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 12\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	0.6	1	1.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}, V_{DS}=5\text{V}$	10			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=4\text{A}$ $T_J=125^\circ\text{C}$		45 66	55 80	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=3\text{A}$		55	70	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}, I_D=2\text{A}$		83	110	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}, I_D=4\text{A}$		8		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.8	1	V
I_S	Maximum Body-Diode Continuous Current				2.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$		390		pF
C_{oss}	Output Capacitance			54.5		pF
C_{rss}	Reverse Transfer Capacitance			41		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		3		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=4.5\text{V}, V_{DS}=15\text{V}, I_D=4\text{A}$		0.6		nC
Q_{gs}	Gate Source Charge			1.38		nC
Q_{gd}	Gate Drain Charge			4.34		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=3.75\Omega,$ $R_{GEN}=6\Omega$		3.3		ns
t_r	Turn-On Rise Time			1		ns
$t_{D(off)}$	Turn-Off Delay Time			21.7		ns
t_f	Turn-Off Fall Time			2.1		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=4\text{A}, di/dt=100\text{A}/\mu\text{s}$		12		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=4\text{A}, di/dt=100\text{A}/\mu\text{s}$		6.3		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 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 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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N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

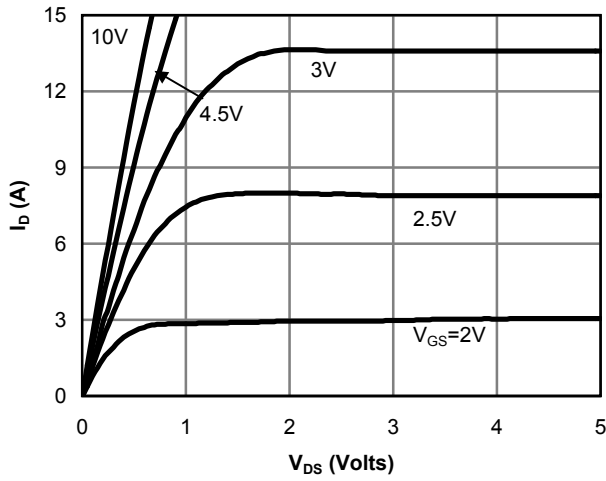


Fig 1: On-Region Characteristics

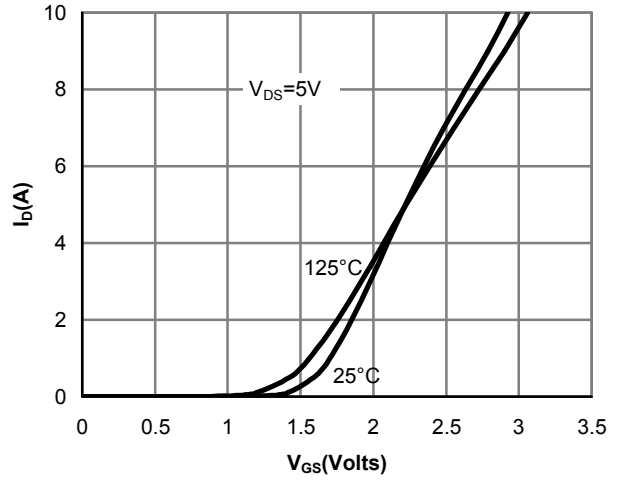


Figure 2: Transfer Characteristics

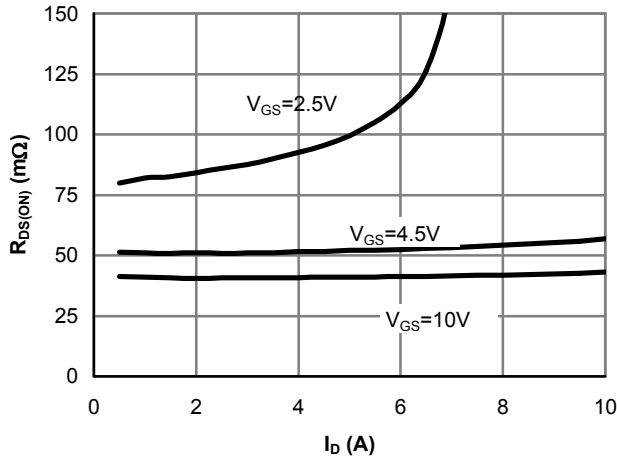


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

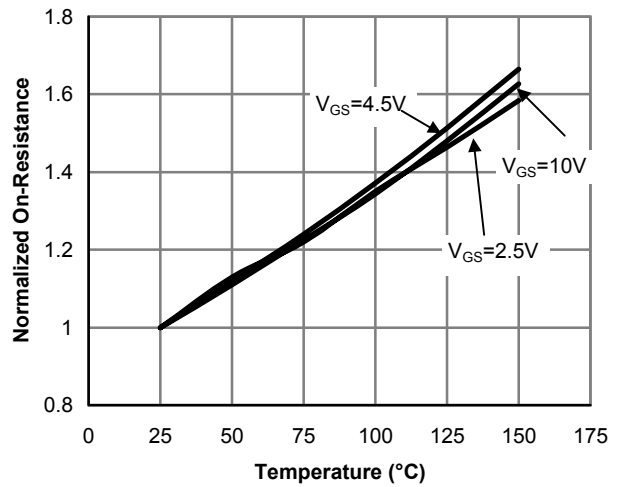


Figure 4: On-Resistance vs. Junction Temperature

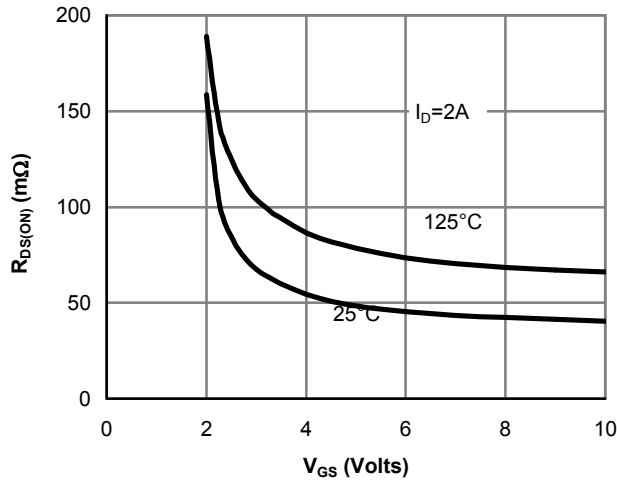


Figure 5: On-Resistance vs. Gate-Source Voltage

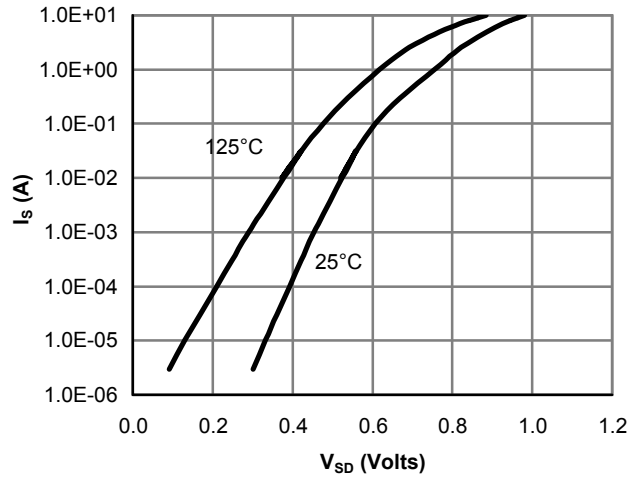


Figure 6: Body-Diode Characteristics

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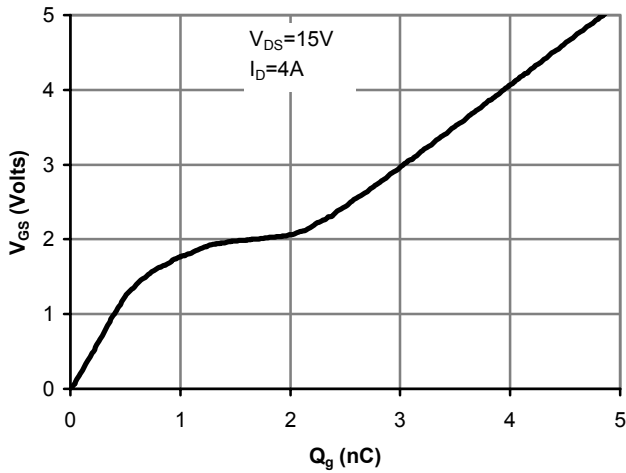


Figure 7: Gate-Charge Characteristics

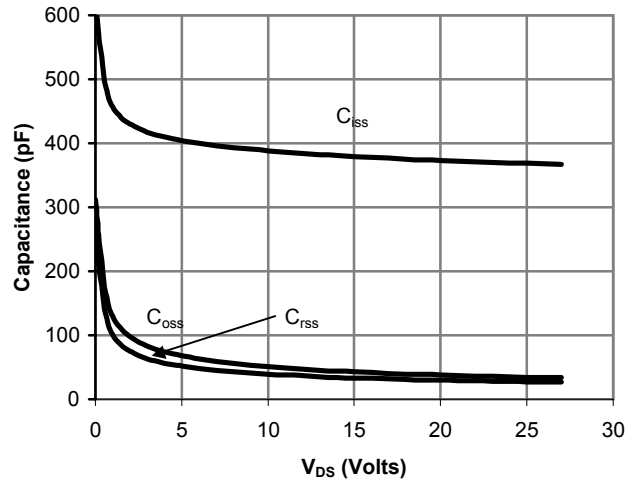


Figure 8: Capacitance Characteristics

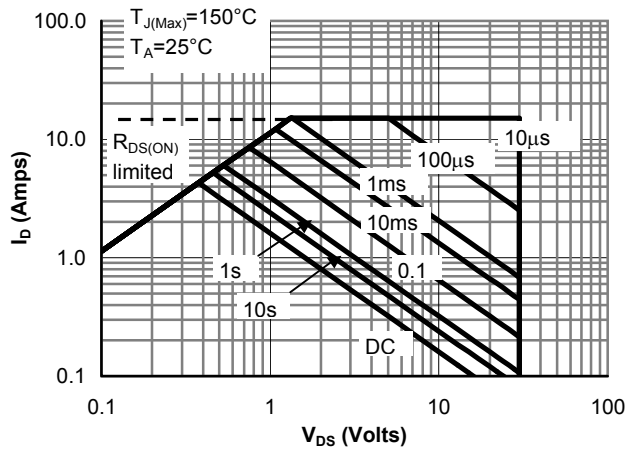


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

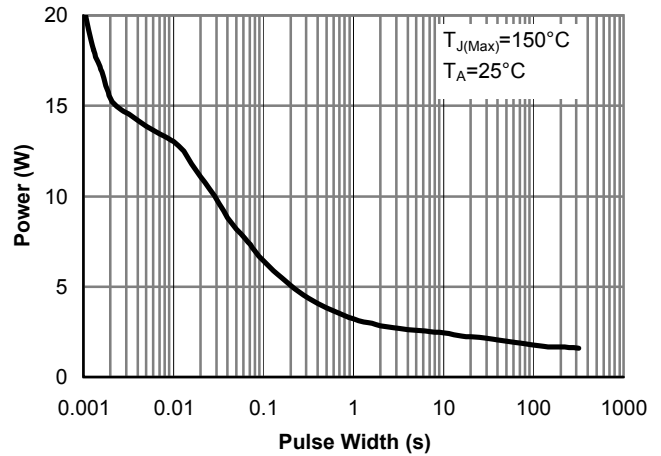


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

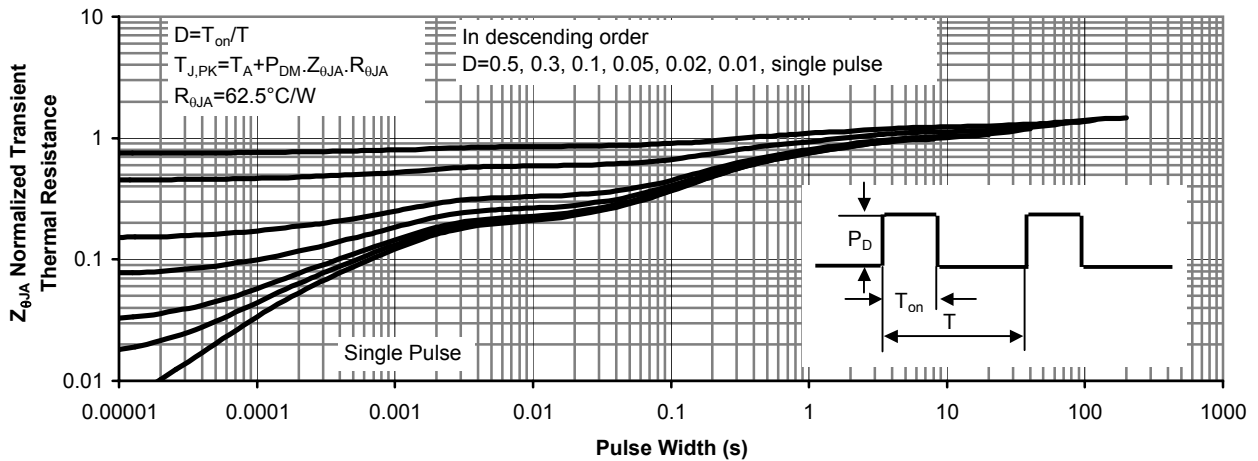


Figure 11: Normalized Maximum Transient Thermal Impedance

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	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 25\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.7	-2.5	-3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$, $I_D=-8\text{A}$ $T_J=125^\circ\text{C}$		16 20.5	19 25	$\text{m}\Omega$
		$V_{GS}=-20\text{V}$, $I_D=-8\text{A}$		15	18	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$, $I_D=-5\text{A}$		33		$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-8\text{A}$	16	21		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				-2.6	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$		2076		pF
C_{oss}	Output Capacitance			503		pF
C_{rss}	Reverse Transfer Capacitance			302		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		2		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-8\text{A}$		39		nC
Q_{gs}	Gate Source Charge			8		nC
Q_{gd}	Gate Drain Charge			11.4		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=1.8\Omega$, $R_{GEN}=3\Omega$		12.7		ns
t_r	Turn-On Rise Time			7		ns
$t_{D(off)}$	Turn-Off Delay Time			25.2		ns
t_f	Turn-Off Fall Time			12		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-8\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		32		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-8\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		26		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. 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 $80\mu\text{s}$ 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.

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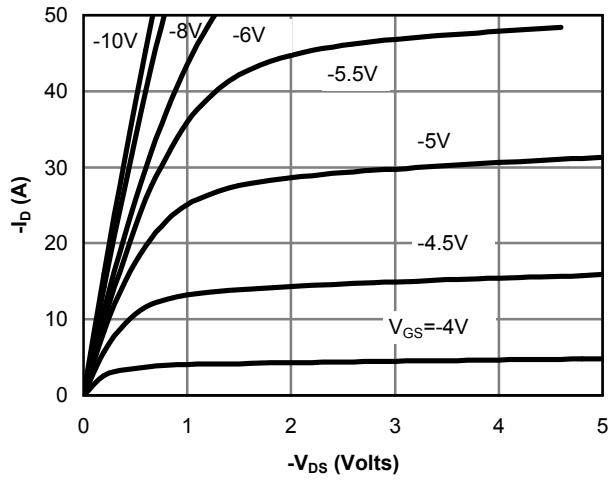


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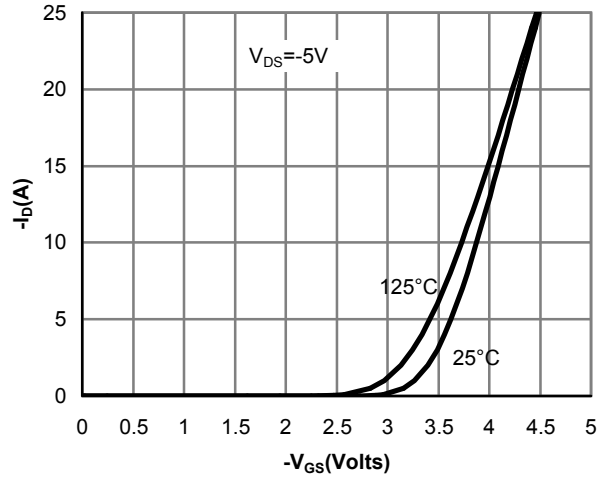


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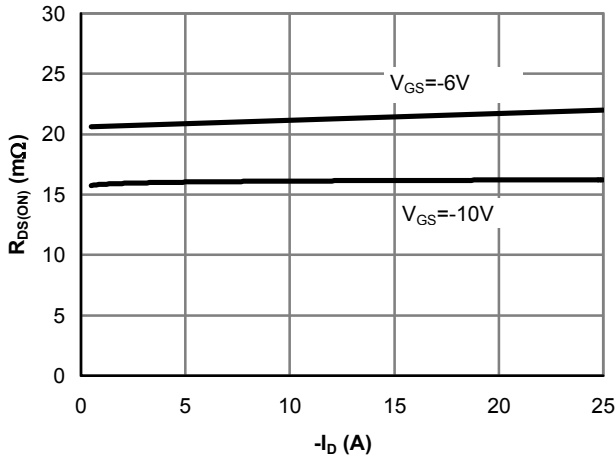


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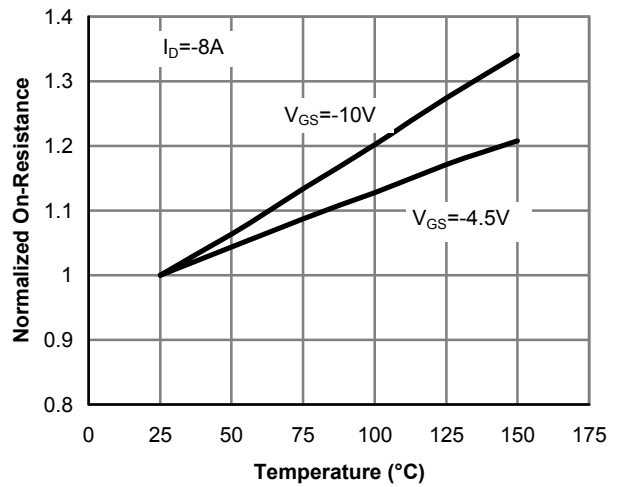


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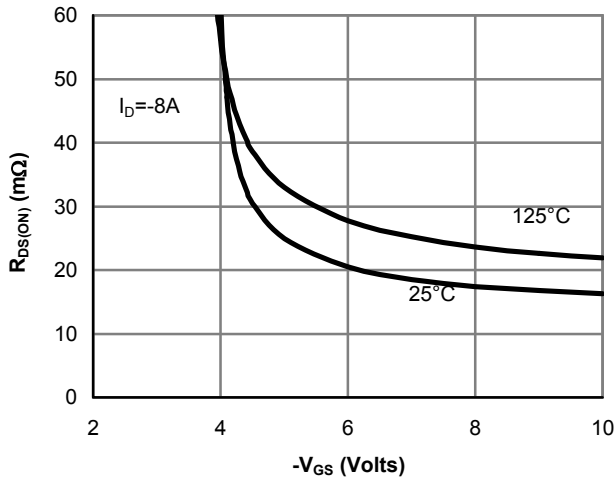


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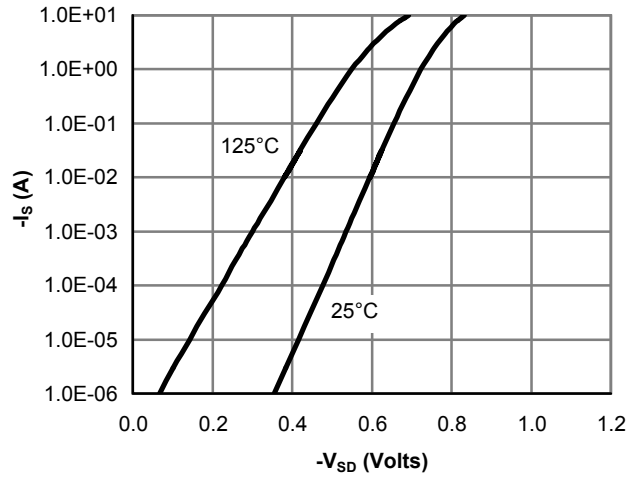


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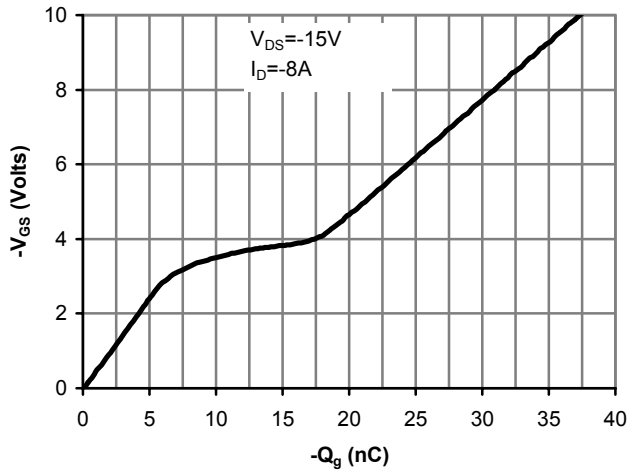


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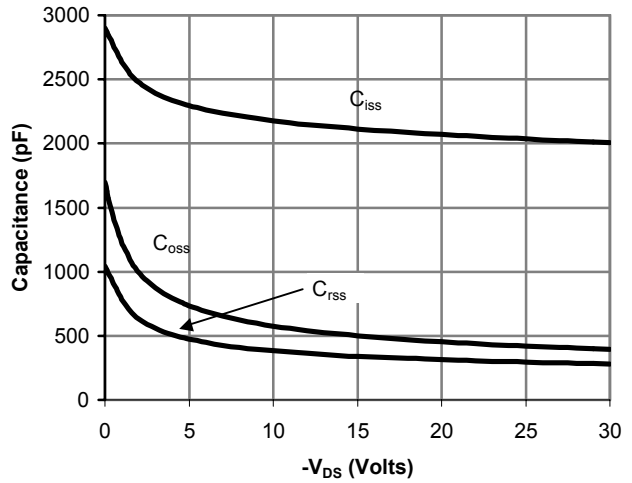


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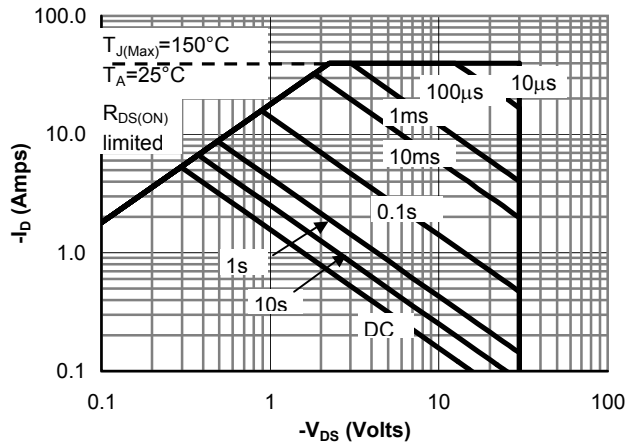


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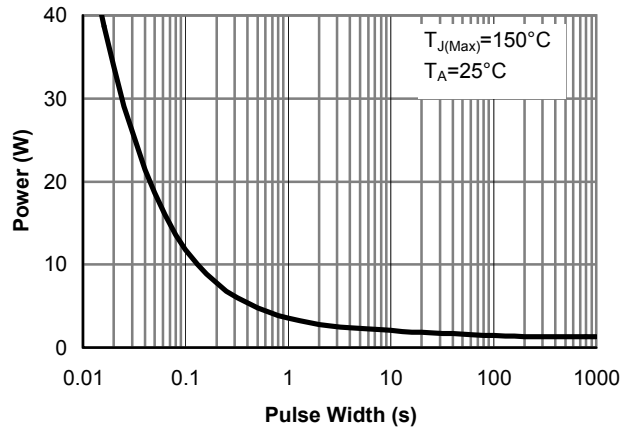


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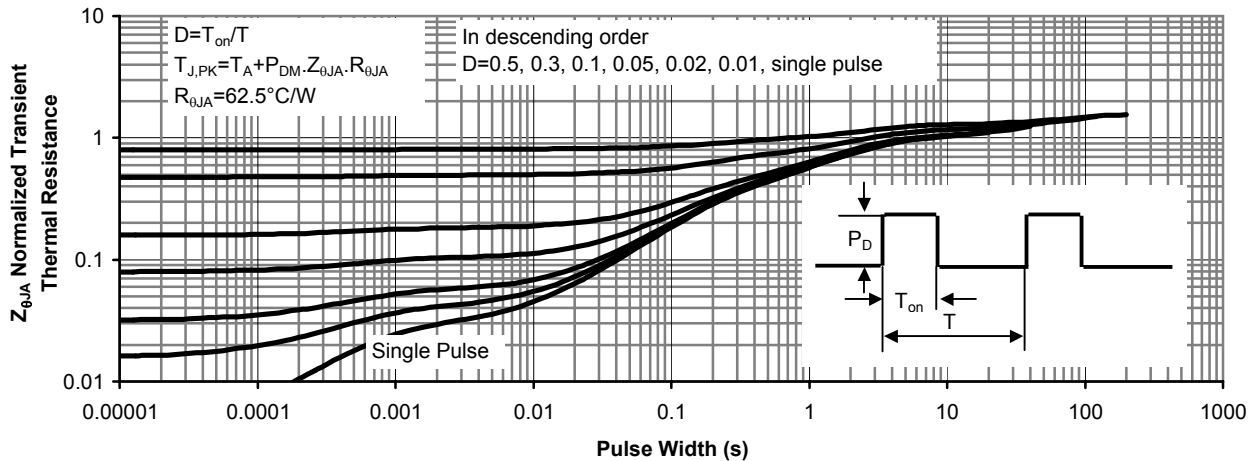


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