

## General Description

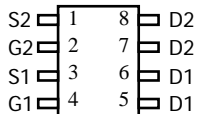
The AO4601 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. *Standard Product AO4601 is Pb-free (meets ROHS & Sony 259 specifications).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

## Features

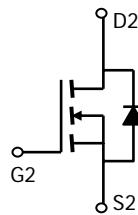
n-channel                      p-channel  
 $V_{DS}$  (V) = 30V                -30V  
 $I_D$  = 4.7A ( $V_{GS}=10V$ )   -8A ( $V_{GS} = -20V$ )



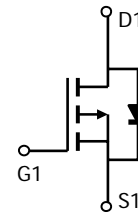
$R_{DS(ON)}$                        $R_{DS(ON)}$   
 < 55m $\Omega$  ( $V_{GS}=10V$ )      < 18m $\Omega$  ( $V_{GS} = -20V$ )  
 < 70m $\Omega$  ( $V_{GS}=4.5V$ )      < 19m $\Omega$  ( $V_{GS} = -10V$ )  
 < 110m $\Omega$  ( $V_{GS} = 2.5V$ )



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	$V_{GS}$	$\pm 12$	$\pm 25$	V	
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ\text{C}$	4.7	-8	A
		$T_A=70^\circ\text{C}$	4	-6.9	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	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 <sup>A</sup>	$R_{\theta JA}$	n-ch	52	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		n-ch	78	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	n-ch	48	60	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	p-ch	50	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		p-ch	73	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	p-ch	31	40	$^\circ\text{C/W}$

n-channel MOSFET Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.6	1	1.4	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	10			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =4A T <sub>J</sub> =125°C		45 66	55 80	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A		55	70	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =2A		83	110	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =4A		8		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.8	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				2.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		390		pF
C <sub>oss</sub>	Output Capacitance			54.5		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			41		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		3		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =15V, I <sub>D</sub> =4A		0.6		nC
Q <sub>gs</sub>	Gate Source Charge			1.38		nC
Q <sub>gd</sub>	Gate Drain Charge			4.34		nC
t <sub>D(on)</sub>	Turn-On Delay Time	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =3.75Ω, R <sub>GEN</sub> =6Ω		3.3		ns
t <sub>r</sub>	Turn-On Rise Time			1		ns
t <sub>D(off)</sub>	Turn-Off Delay Time			21.7		ns
t <sub>f</sub>	Turn-Off Fall Time			2.1		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =4A, di/dt=100A/μs		12		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =4A, di/dt=100A/μs		6.3		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t<sub>100</sub> ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> 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 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

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N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

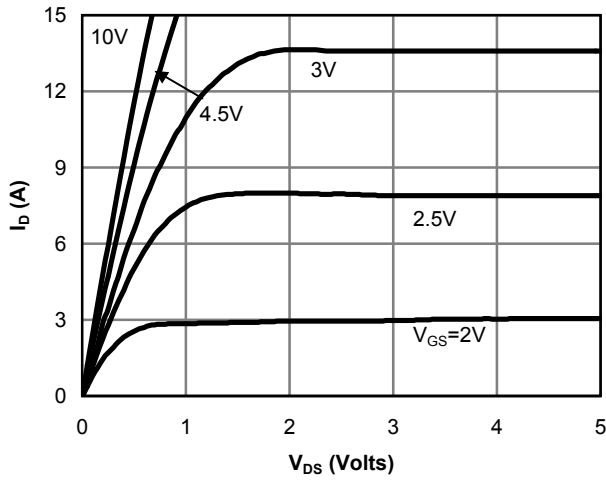


Fig 1: On-Region Characteristics

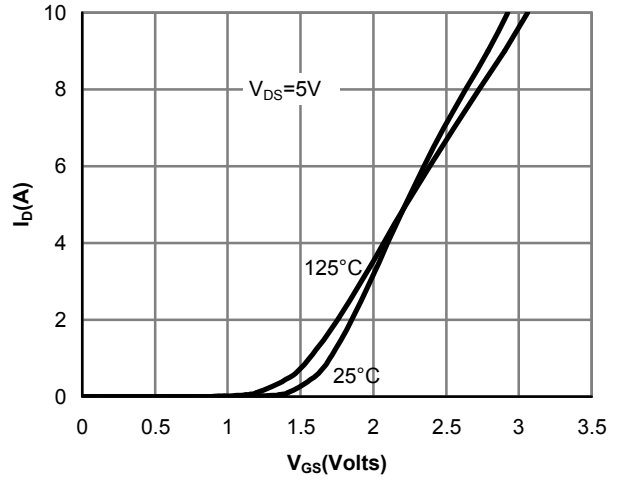


Figure 2: Transfer Characteristics

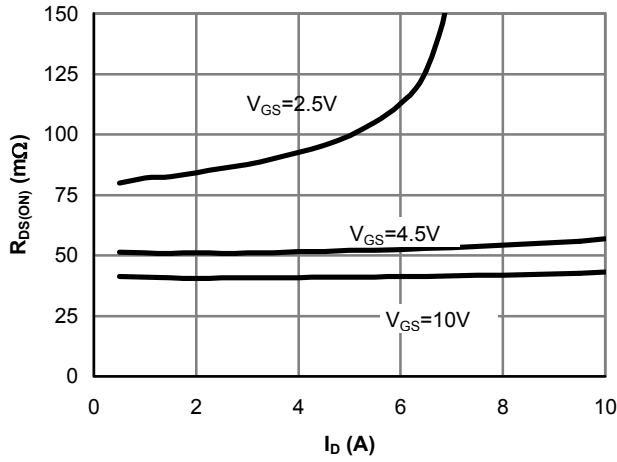


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

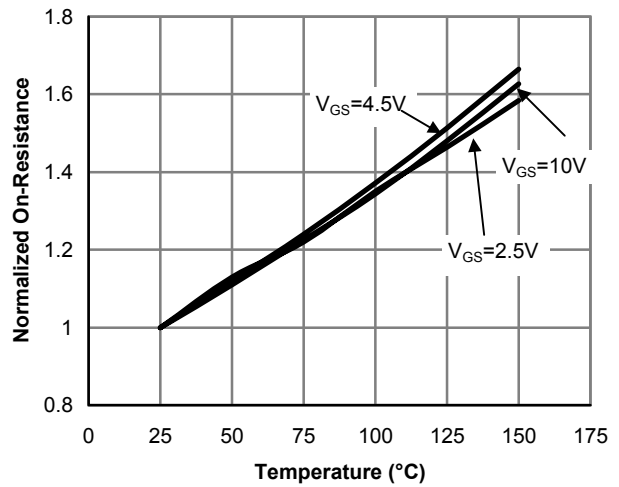


Figure 4: On-Resistance vs. Junction Temperature

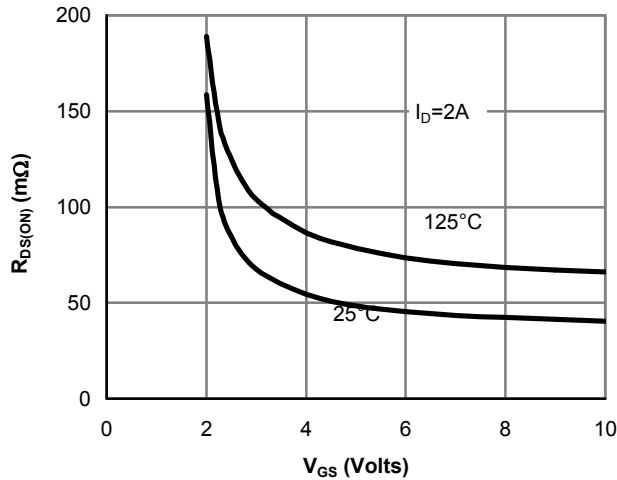


Figure 5: On-Resistance vs. Gate-Source Voltage

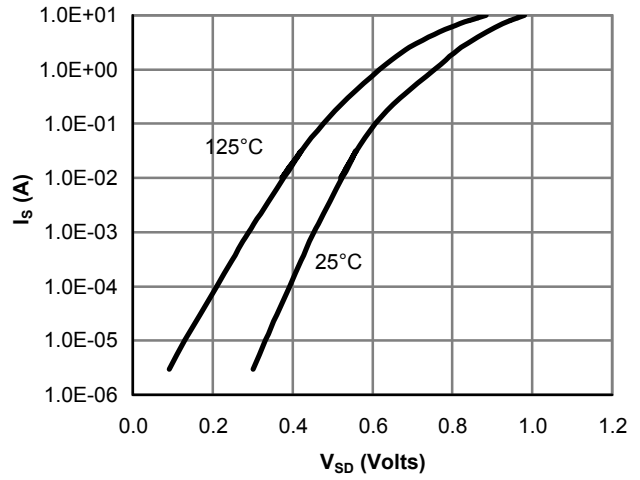


Figure 6: Body-Diode Characteristics

N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

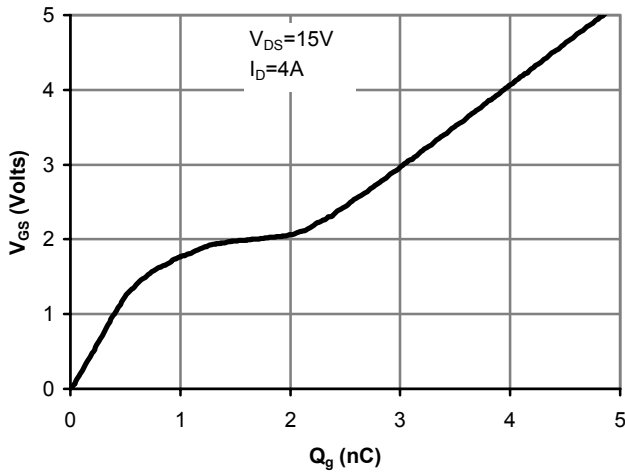


Figure 7: Gate-Charge Characteristics

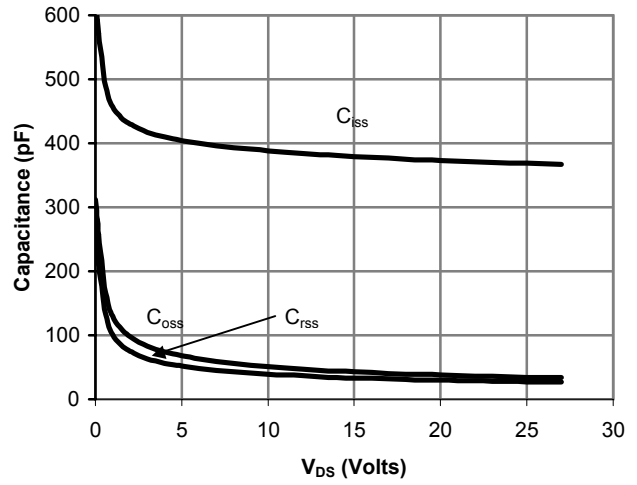


Figure 8: Capacitance Characteristics

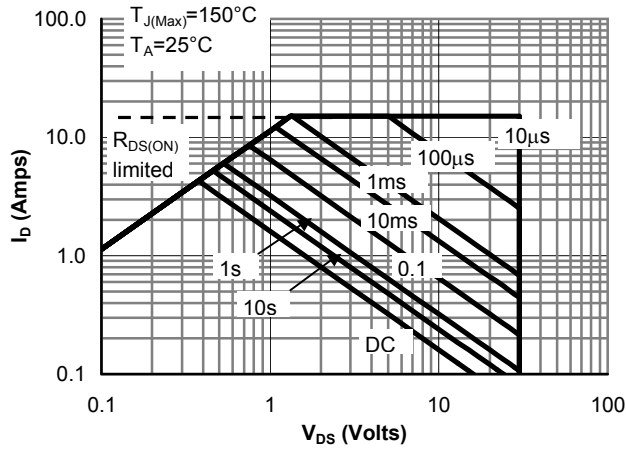


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

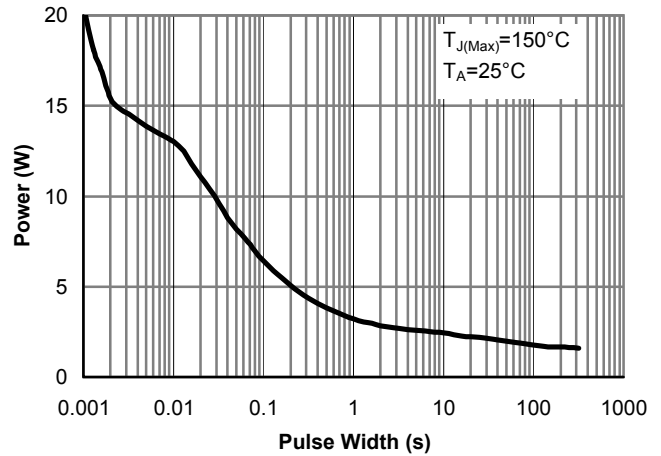


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

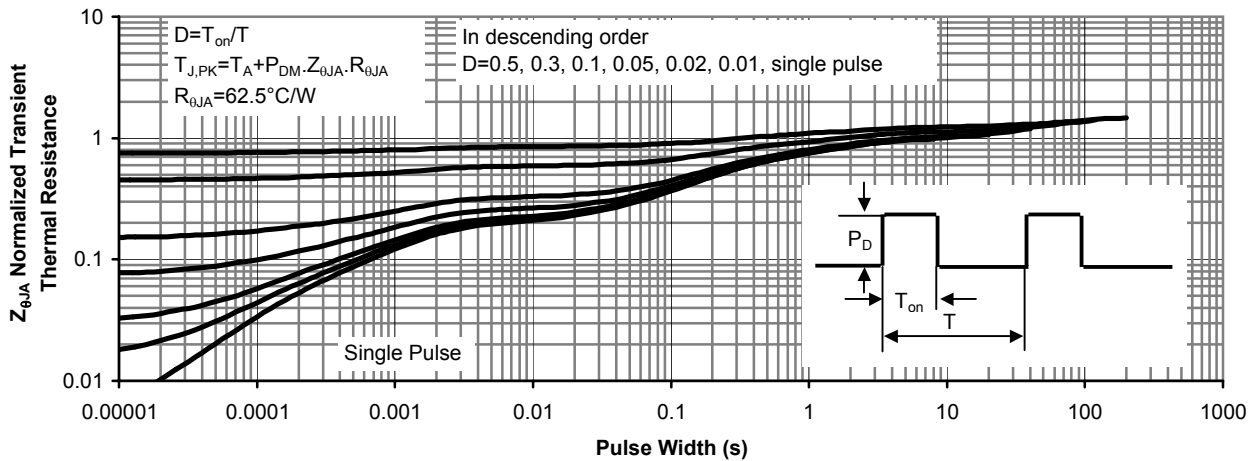


Figure 11: Normalized Maximum Transient Thermal Impedance

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	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	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 25\text{V}$			$\pm 100$	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
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	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		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	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<sup>2</sup> 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 1 in<sup>2</sup> 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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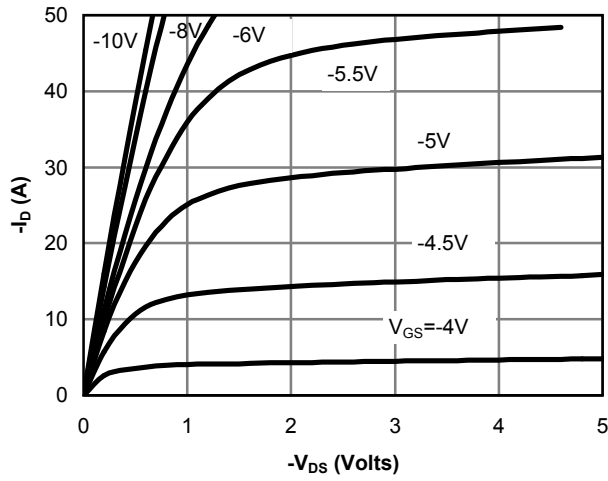


Fig 1: On-Region Characteristics

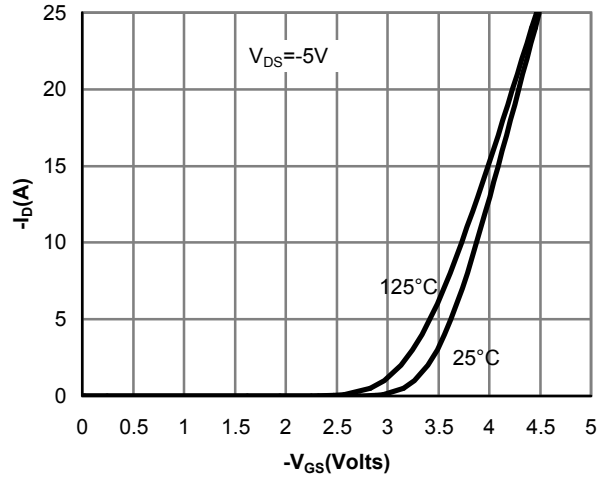


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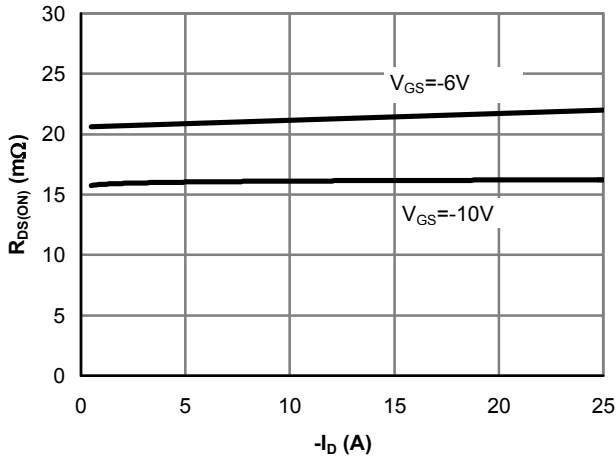


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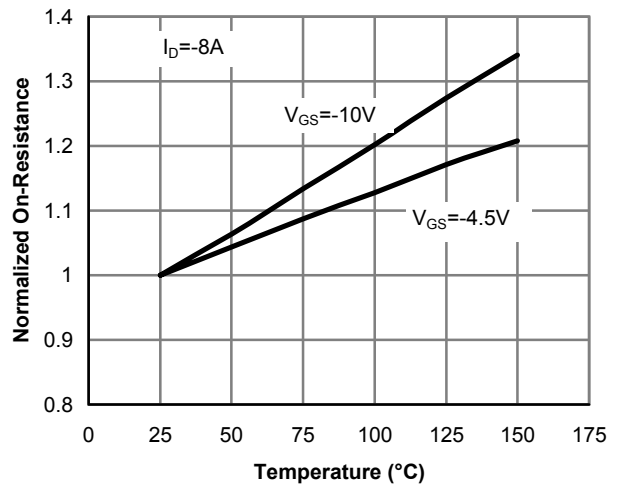


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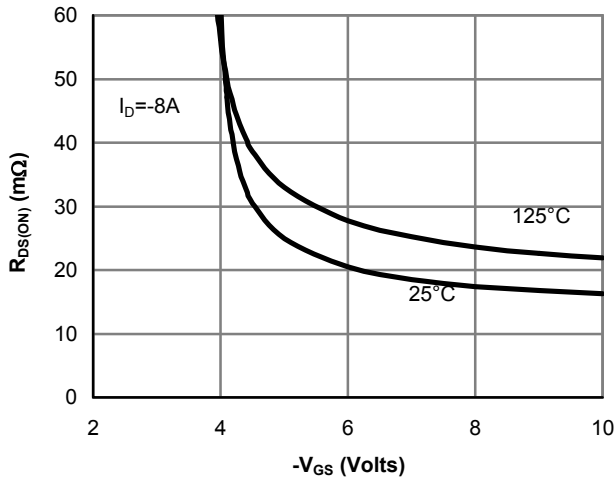


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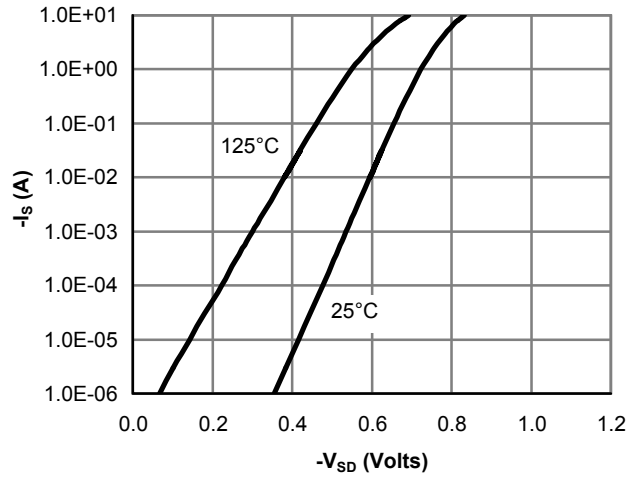


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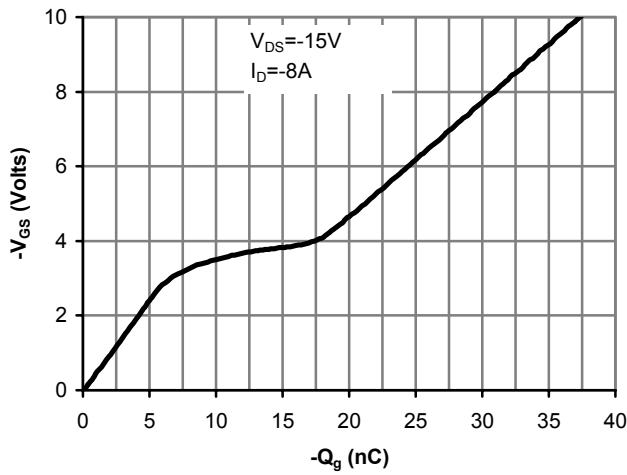


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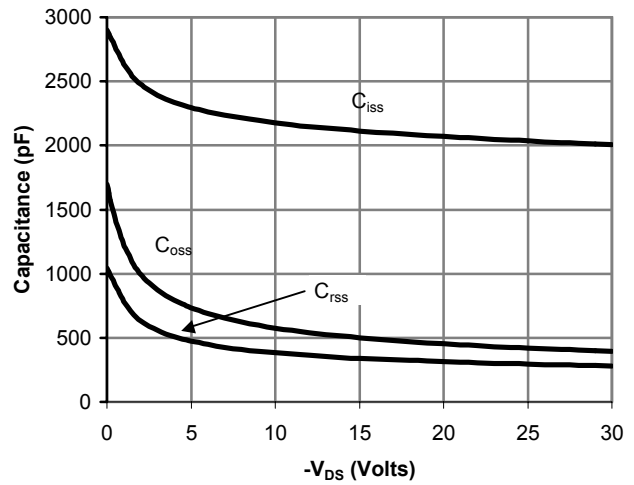


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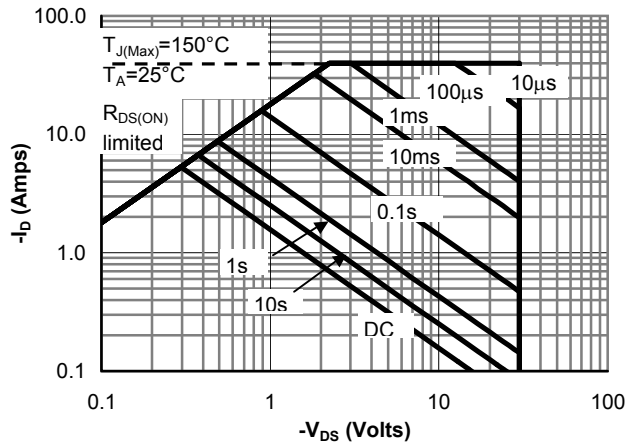


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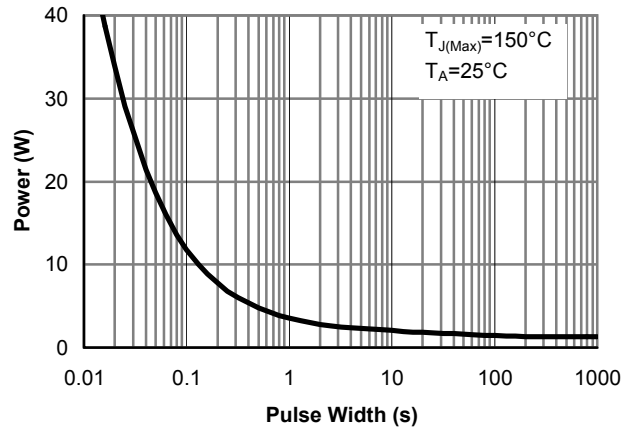


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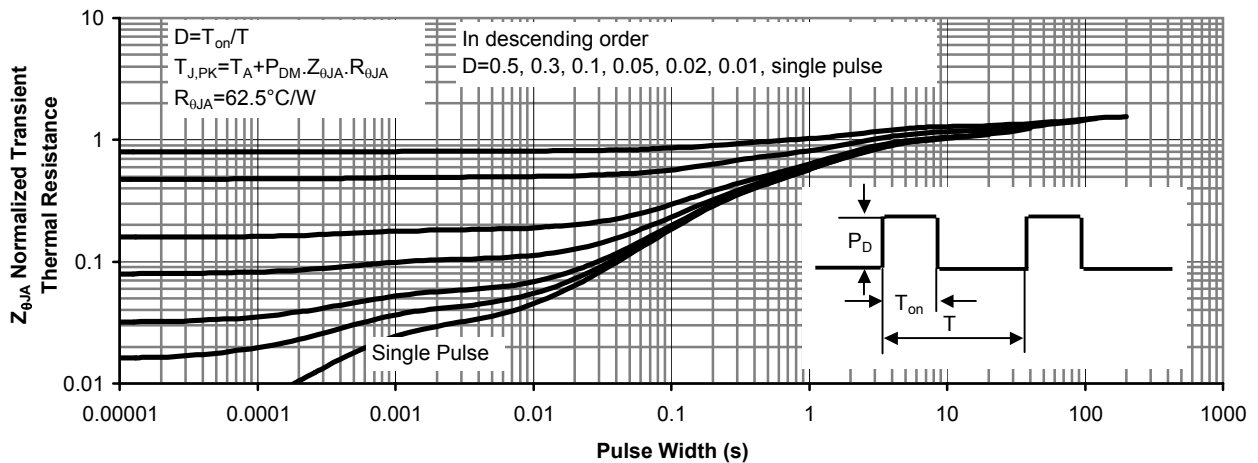


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