



**ALPHA & OMEGA**  
SEMICONDUCTOR



**AO6601**

**Complementary Enhancement Mode Field Effect Transistor**

### General Description

The AO6601/L 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.

*AO6601 and AO6601L are electrically identical.*

-RoHS Compliant

-AO6601L is Halogen Free

### Features

n-channel p-channel

$V_{DS}$  (V) = 30V

-30V

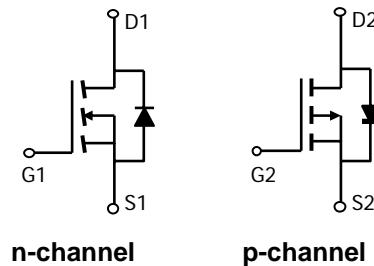
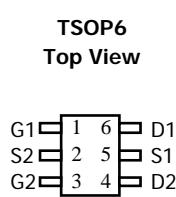
$I_D$  = 3.4A ( $V_{GS}$  = 10V) -2.3A ( $V_{GS}$  = -10V)

$R_{DS(ON)}$

< 60mΩ ( $V_{GS}$  = 10V) < 135mΩ ( $V_{GS}$  = -10V)

< 75mΩ ( $V_{GS}$  = 4.5V) < 185mΩ ( $V_{GS}$  = -4.5V)

< 115mΩ ( $V_{GS}$  = 2.5V) < 265mΩ ( $V_{GS}$  = -2.5V)



### 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	$V_{GS}$	$\pm 12$	$\pm 12$	V
Continuous Drain Current <sup>A</sup>	$I_D$	3.4	-2.3	A
$T_A=70^\circ\text{C}$		2.7	-1.8	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	-30	
Power Dissipation	$P_D$	1.15	1.15	W
$T_A=70^\circ\text{C}$		0.73	0.73	
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	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	78	110	°C/W
Maximum Junction-to-Ambient <sup>A</sup>		106	150	°C/W
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	64	80	°C/W

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	30			V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS}=24\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{\text{GSS}}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 12\text{V}$			100	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	0.6	1	1.4	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=4.5\text{V}, V_{DS}=5\text{V}$	10			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=3\text{A}$ $T_J=125^\circ\text{C}$		50 75	60	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=3\text{A}$		60	75	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}, I_D=2\text{A}$		88	115	$\text{m}\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{DS}=5\text{V}, I_D=3\text{A}$		7.8		S
$V_{\text{SD}}$	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.8	1	V
$I_S$	Maximum Body-Diode Continuous Current				1.5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$		390		pF
$C_{\text{oss}}$	Output Capacitance			54.5		pF
$C_{\text{rss}}$	Reverse Transfer Capacitance			41		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		3		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=4.5\text{V}, V_{DS}=15\text{V}, I_D=3\text{A}$		4.34		nC
$Q_{\text{gs}}$	Gate Source Charge			1.38		nC
$Q_{\text{gd}}$	Gate Drain Charge			0.6		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=5\Omega, R_{\text{GEN}}=6\Omega$		4		ns
$t_r$	Turn-On Rise Time			2		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			22		ns
$t_f$	Turn-Off Fall Time			3		ns
$t_{\text{rr}}$	Body Diode Reverse Recovery Time	$I_F=3\text{A}, dI/dt=100\text{A}/\mu\text{s}$		11		ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge	$I_F=3\text{A}, dI/dt=100\text{A}/\mu\text{s}$		5.5		nC

A: The value of  $R_{\text{QJA}}$  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  $R_{\text{QJA}}$  is the sum of the thermal impedance from junction to lead  $R_{\text{QJL}}$  and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300μs 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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## AO6601 n-channel typical characteristics

### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

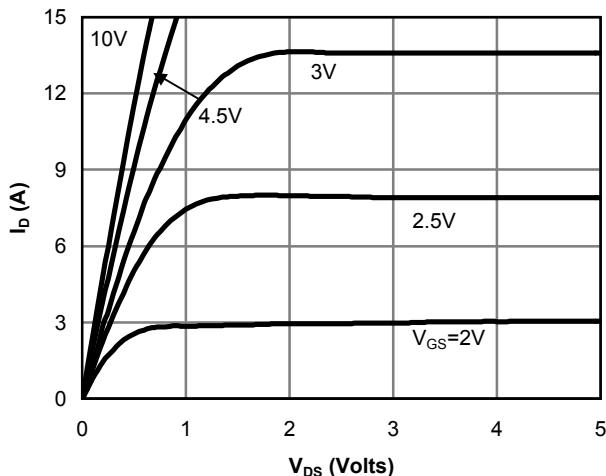


Fig 1: On-Region Characteristics

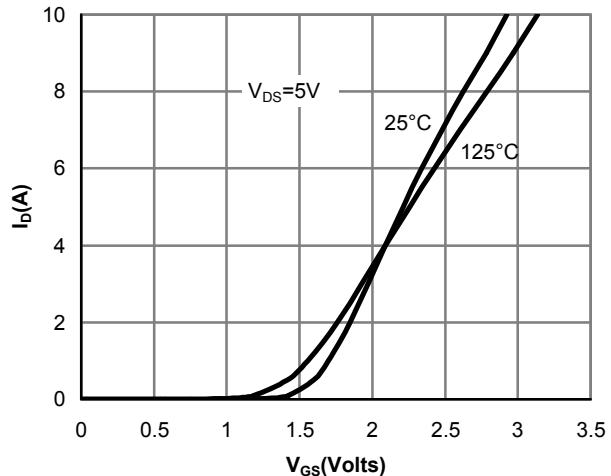


Figure 2: Transfer Characteristics

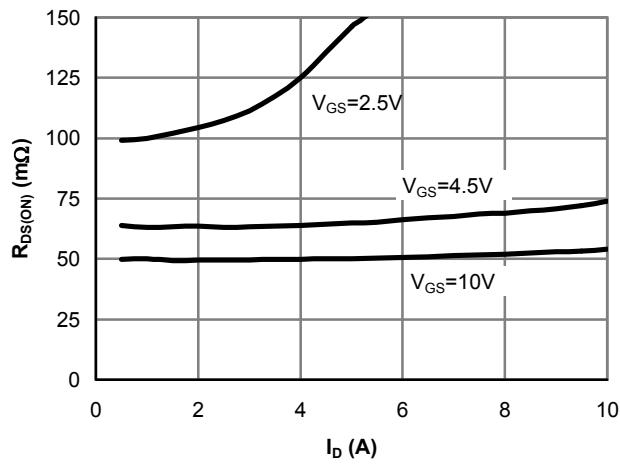


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

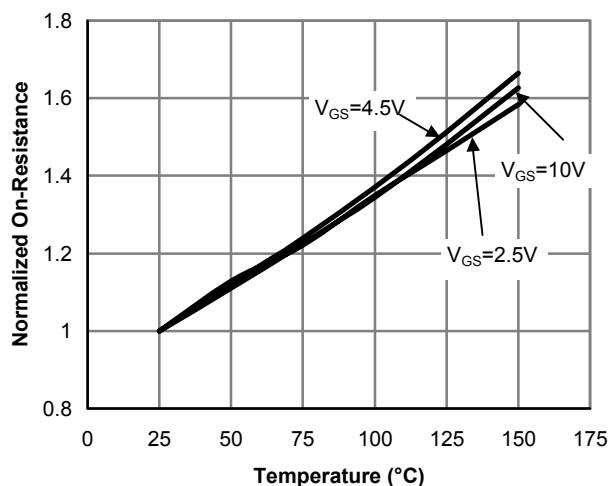


Figure 4: On-Resistance vs. Junction Temperature

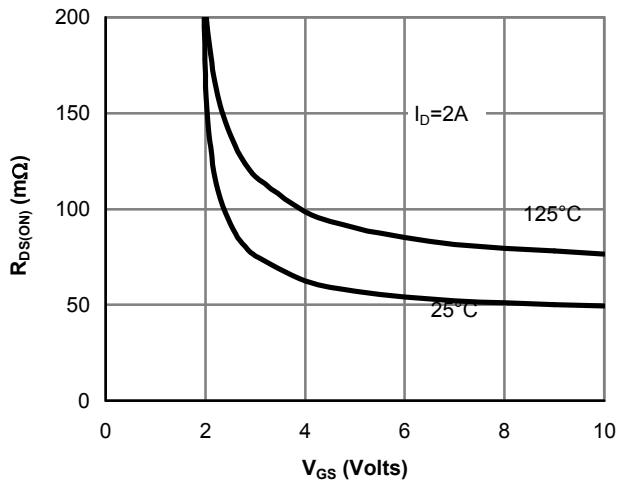


Figure 5: On-Resistance vs. Gate-Source Voltage

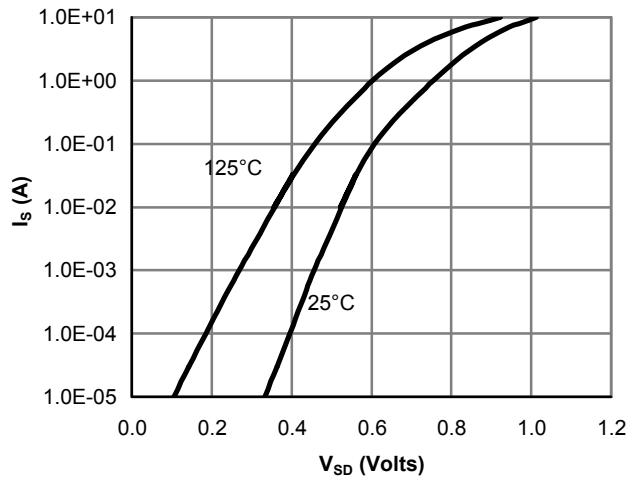


Figure 6: Body-Diode Characteristics

## AO6601 n-channel typical characteristics

### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

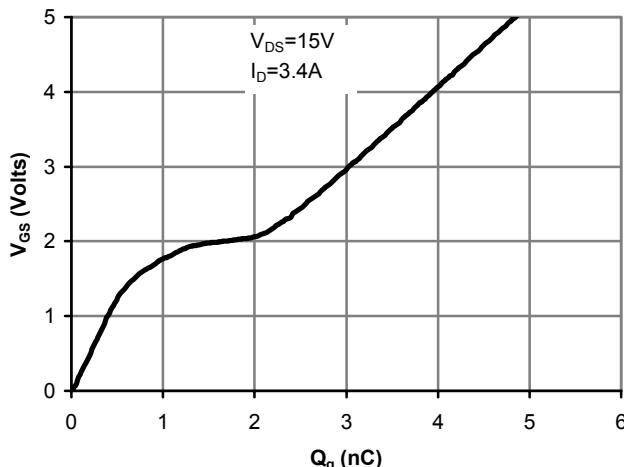


Figure 7: Gate-Charge Characteristics

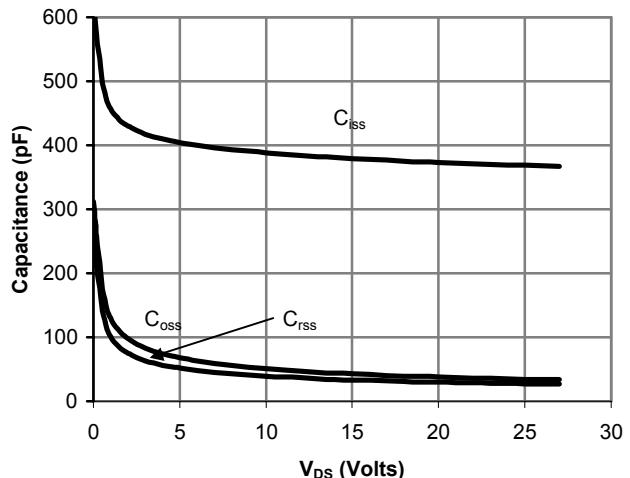


Figure 8: Capacitance Characteristics

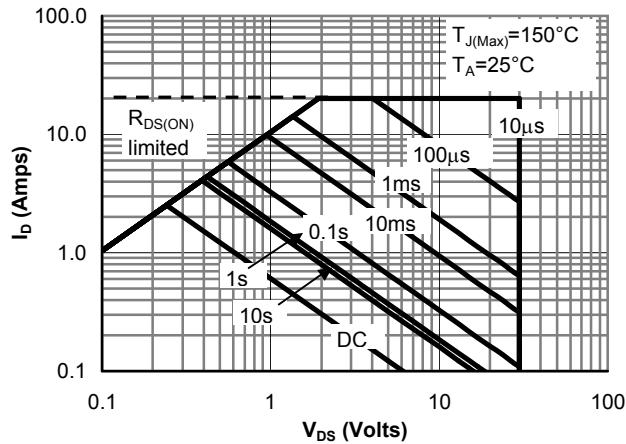


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

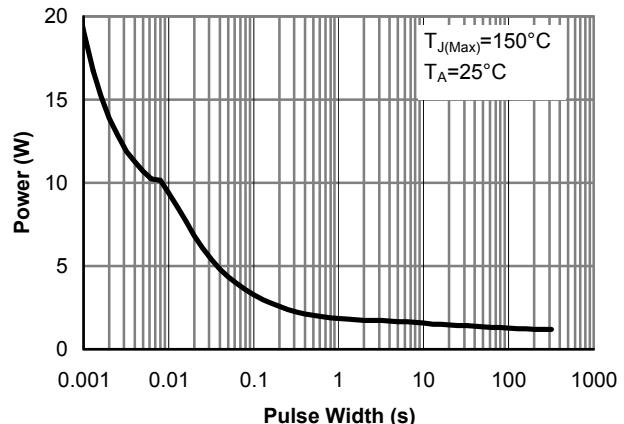


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

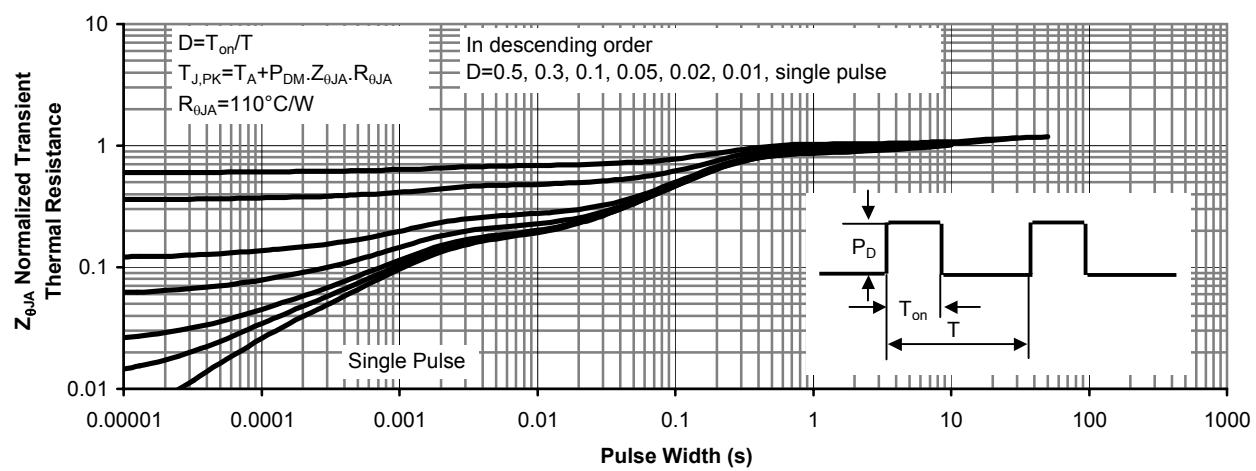


Figure 11: Normalized Maximum Transient Thermal Impedance

**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>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-30			V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$	$T_J=55^\circ\text{C}$	-1	-5	$\mu\text{A}$
$I_{\text{GSS}}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 12\text{V}$			$\pm 100$	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ $I_D=-250\mu\text{A}$	-0.6	-1	-1.4	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-5\text{V}$	-10			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-2.3\text{A}$		107	135	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$ , $I_D=-2\text{A}$		135	185	
		$V_{GS}=-2.5\text{V}$ , $I_D=-1\text{A}$		195	265	
$g_{\text{FS}}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-2.3\text{A}$		8		S
$V_{\text{SD}}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.85	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-1.35	A
<b>DYNAMIC PARAMETERS</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		409		pF
$C_{\text{oss}}$	Output Capacitance			55		pF
$C_{\text{rss}}$	Reverse Transfer Capacitance			42		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		12		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-2.5\text{A}$		4.8		nC
$Q_{\text{gs}}$	Gate Source Charge			1.34		nC
$Q_{\text{gd}}$	Gate Drain Charge			0.72		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=6\Omega$ , $R_{\text{GEN}}=6\Omega$		13		ns
$t_r$	Turn-On Rise Time			10		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			28		ns
$t_f$	Turn-Off Fall Time			13		ns
$t_{\text{rr}}$	Body Diode Reverse Recovery Time	$I_F=-2.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		26		ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge	$I_F=-2.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		15.6		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 <300μs 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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## P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

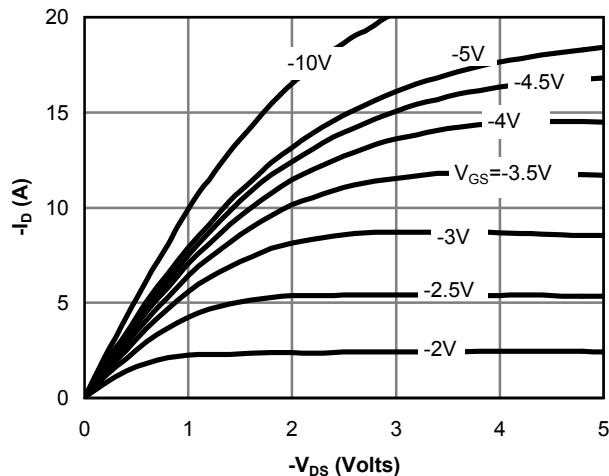


Fig 1: On-Region Characteristics

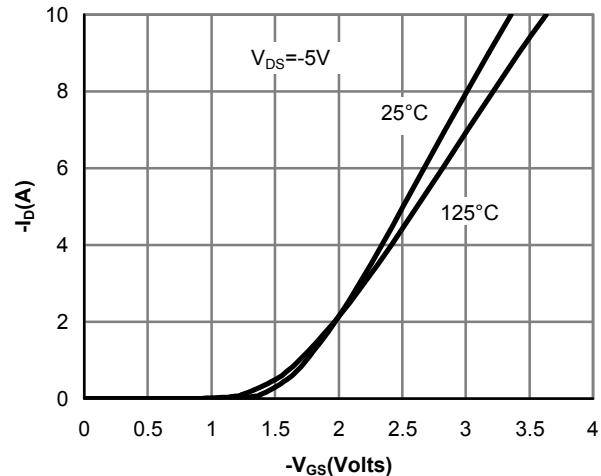


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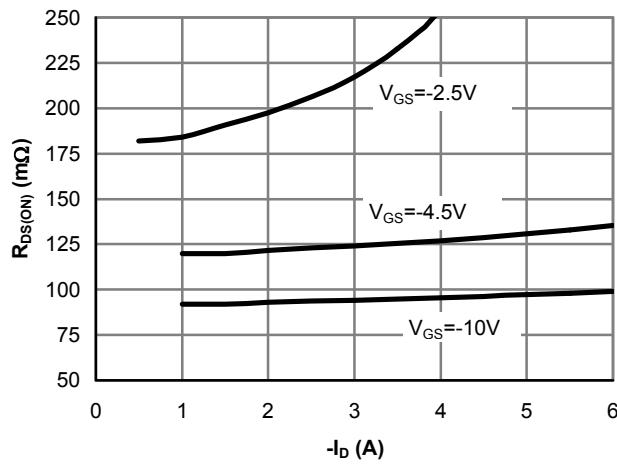


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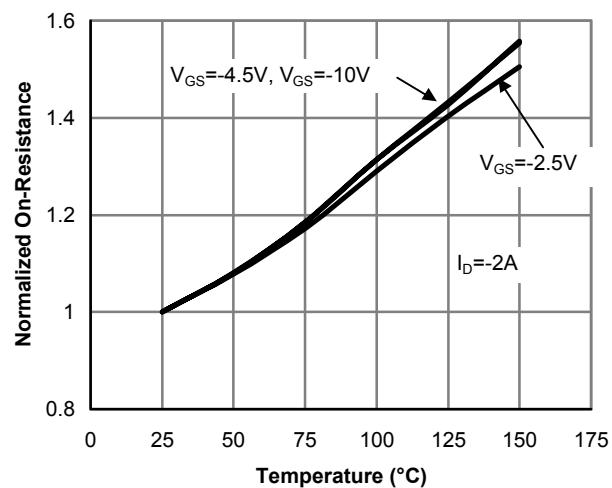


Figure 4: On-Resistance vs. Junction Temperature

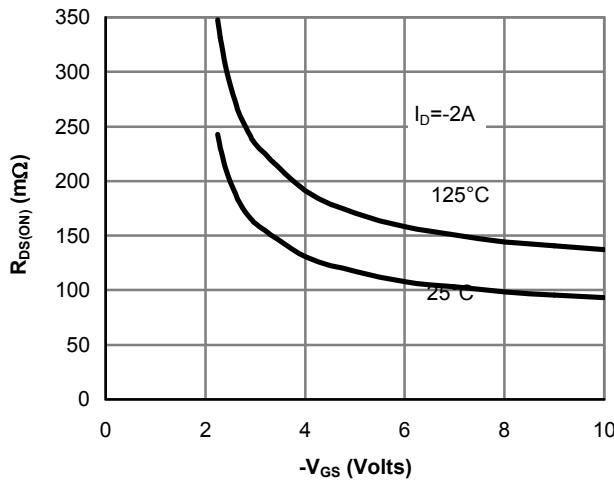


Figure 5: On-Resistance vs. Gate-Source Voltage

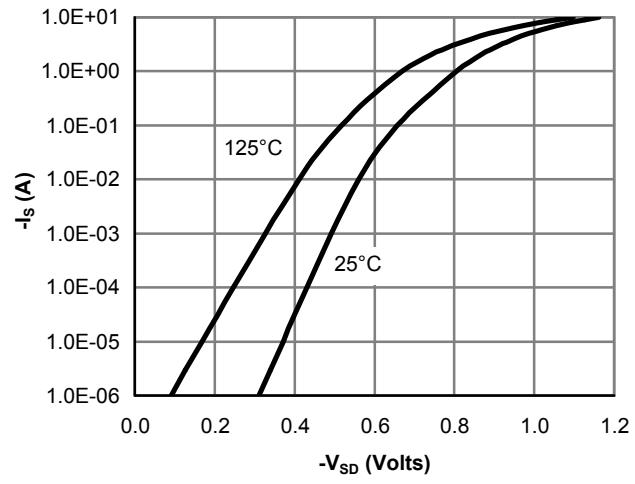


Figure 6: Body-Diode Characteristics

## AO6601 p-channel typical characteristics

### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

