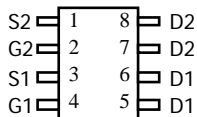


## General Description

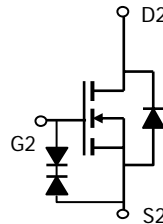
The AOP609 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications. *Standard Product AOP609 is Pb-free (meets ROHS & Sony 259 specifications).*

## Features

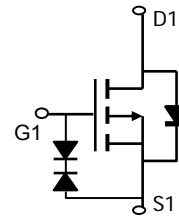
n-channel	p-channel
$V_{DS}$ (V) = 60V	-60V
$I_D$ = 4.7A ( $V_{GS}=10V$ )	-3.5A ( $V_{GS}=-10V$ )
$R_{DS(ON)}$	$R_{DS(ON)}$
< 60m $\Omega$ ( $V_{GS}=10V$ )	< 115m $\Omega$ ( $V_{GS}=-10V$ )
< 75m $\Omega$ ( $V_{GS}=4.5V$ )	< 140m $\Omega$ ( $V_{GS}=-4.5V$ )



PDIP-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	$V_{DS}$	60	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ\text{C}$	4.7	-3.5	A
	$T_A=70^\circ\text{C}$	3.8	-2.9	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	20	-20	
Power Dissipation	$T_A=25^\circ\text{C}$	2.5	2.5	W
	$T_A=70^\circ\text{C}$	1.6	1.6	
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>	$t \leq 10\text{s}$	$R_{\theta JA}$	n-ch	37	50	$^\circ\text{C/W}$
			n-ch	74	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	n-ch	28	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10\text{s}$	$R_{\theta JA}$	p-ch	35	50	$^\circ\text{C/W}$
			p-ch	73	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	p-ch	32	40	$^\circ\text{C/W}$

**N Channel 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	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =48V, 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> = ±20V			250	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	1.5	2.4	3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =10V, V <sub>DS</sub> =5V	20			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =4.7A T <sub>J</sub> =125°C		49 65	60	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3.0A		57	75	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =4.7A		17		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.78	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				3.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =30V, f=1MHz		450	570	pF
C <sub>oss</sub>	Output Capacitance			74		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			30		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		1.65	2	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =4.7A		5.1	7	nC
Q <sub>g(4.5V)</sub>	Total Gate Charge			2.5	3	nC
Q <sub>gs</sub>	Gate Source Charge			1		nC
Q <sub>gd</sub>	Gate Drain Charge			1.4		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, R <sub>L</sub> =6Ω, R <sub>GEN</sub> =3Ω		5.4		ns
t <sub>r</sub>	Turn-On Rise Time			5.5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			17.2		ns
t <sub>f</sub>	Turn-Off Fall Time			2.9		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =4.7A, di/dt=100A/μs		25.4	35	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =4.7A, di/dt=100A/μs		29.4		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<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 ≤ 10s thermal resistance rating.

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

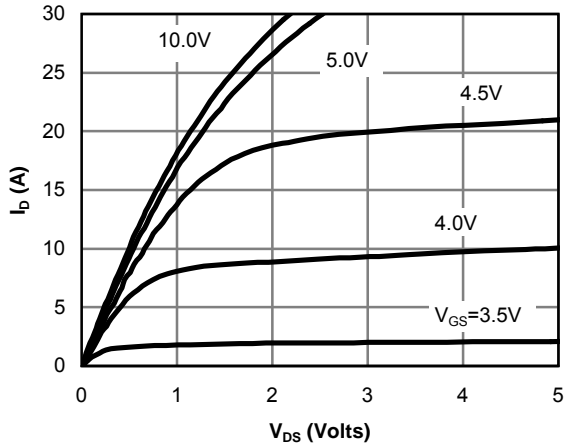
C. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

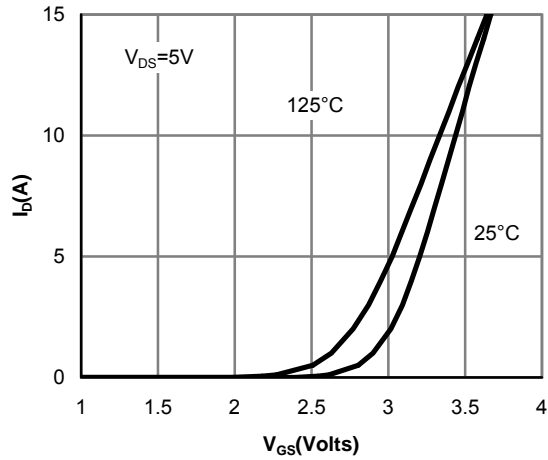
E. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

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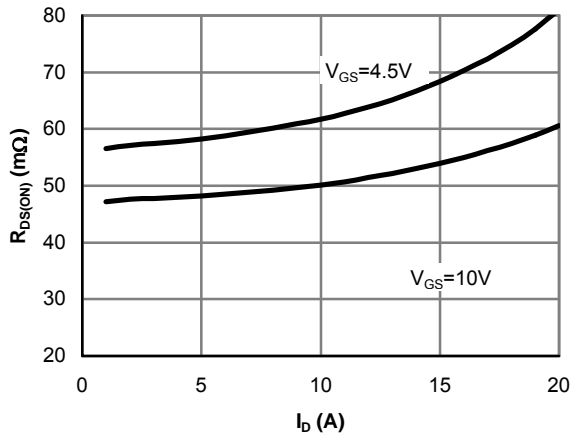
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL**



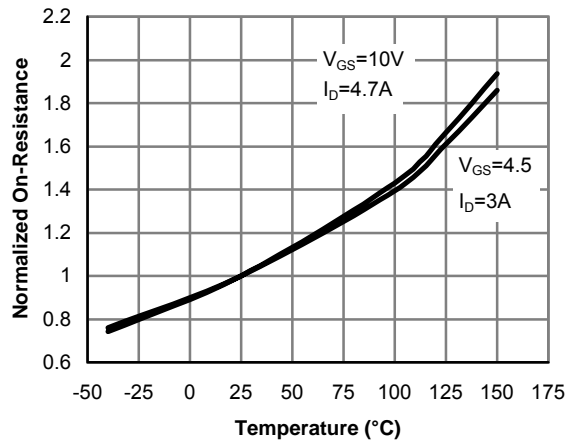
**Fig 1: On-Region Characteristics**



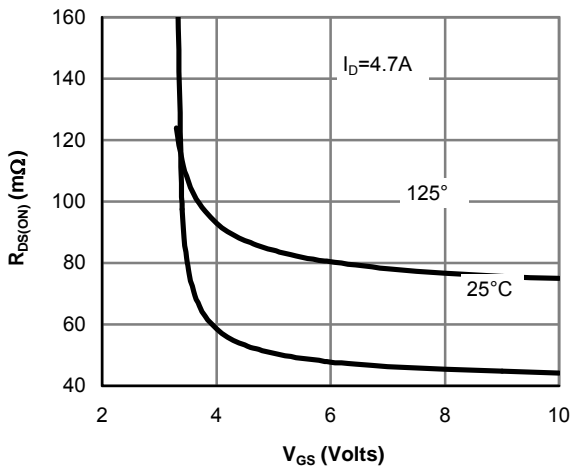
**Figure 2: Transfer Characteristics**



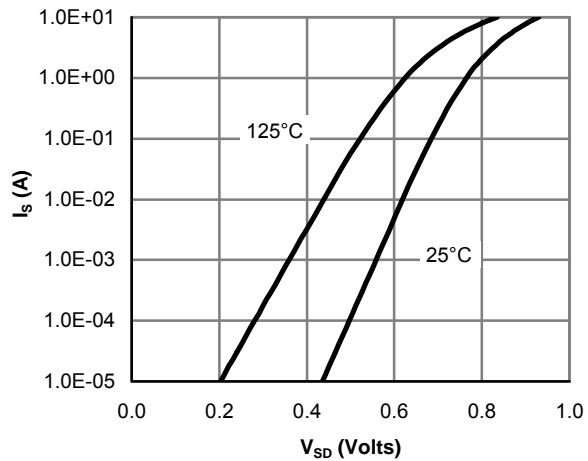
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**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**

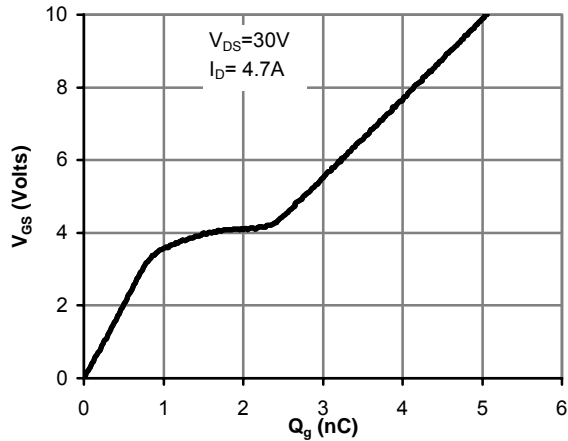


Figure 7: Gate-Charge Characteristics

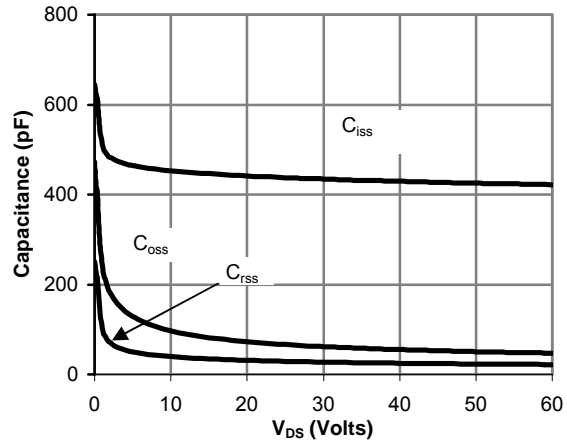


Figure 8: Capacitance Characteristics

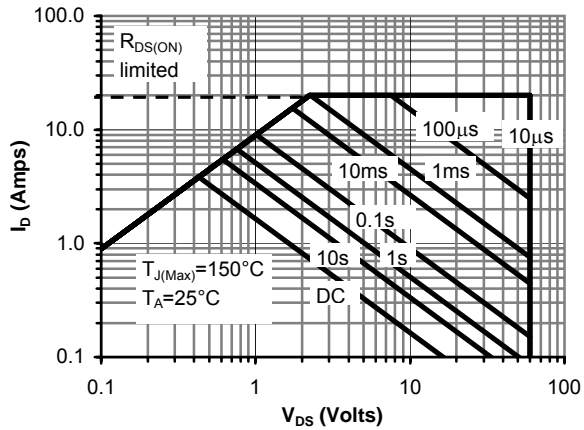


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

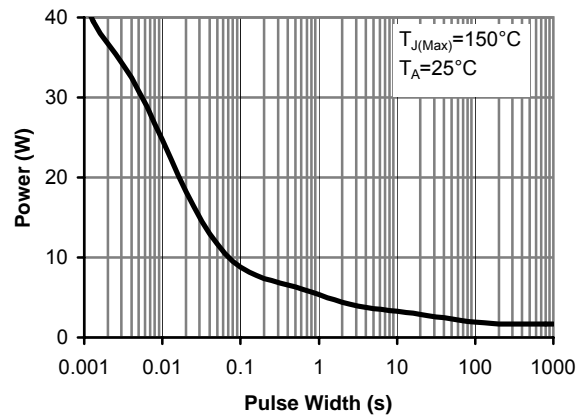


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

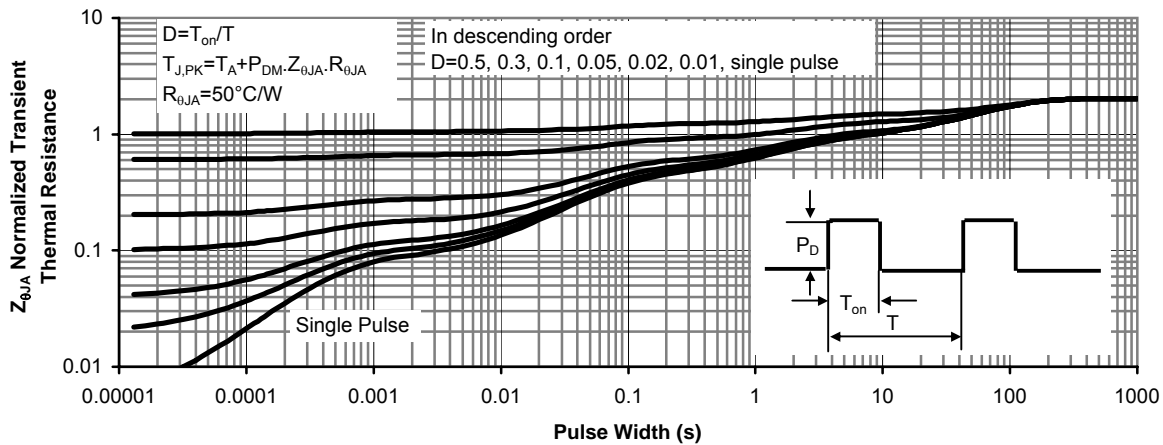


Figure 11: Normalized Maximum Transient Thermal Impedance

**P-Channel 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	$I_D=-250\mu\text{A}, V_{GS}=0\text{V}$	-60			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-48\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$			100	$\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-1.5	-1.8	-3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}, V_{DS}=-5\text{V}$	-20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}, I_D=-3.5\text{A}$ $T_J=125^\circ\text{C}$		95 133	115	m $\Omega$
		$V_{GS}=-4.5\text{V}, I_D=-2.8\text{A}$		112	140	
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=-3.5\text{A}$		9		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}, V_{GS}=0\text{V}$		-0.77	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-3.5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-30\text{V}, f=1\text{MHz}$		897	1080	pF
$C_{oss}$	Output Capacitance			88		pF
$C_{rss}$	Reverse Transfer Capacitance			36		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		7.2	9	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}, V_{DS}=-30\text{V}, I_D=-3.5\text{A}$		8.1	10	nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			3.9	5	nC
$Q_{gs}$	Gate Source Charge			1.4		nC
$Q_{gd}$	Gate Drain Charge			1.7		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-10\text{V}, V_{DS}=-30\text{V}, R_L=8.1\Omega,$ $R_{GEN}=3\Omega$		9		ns
$t_r$	Turn-On Rise Time			7.2		ns
$t_{D(off)}$	Turn-Off Delay Time			35		ns
$t_f$	Turn-Off Fall Time			25.5		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-3.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		25.8	35	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-3.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		28.8		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.

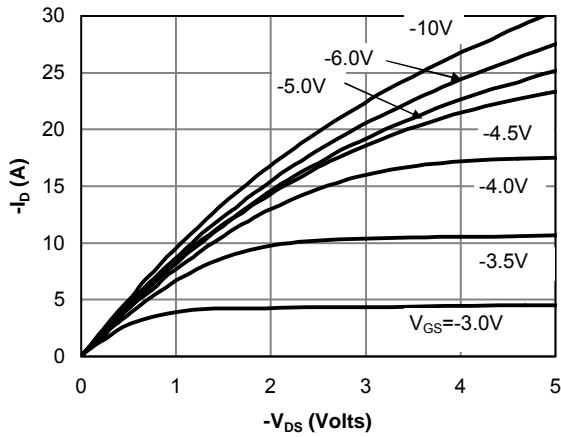
C: The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

D: The static characteristics in Figures 1 to 6, 12, 14 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

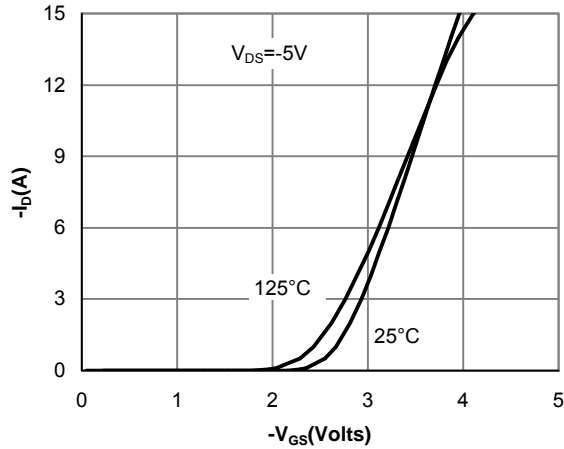
E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

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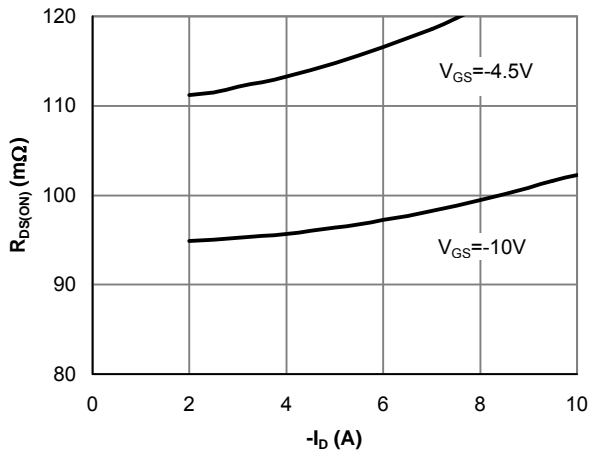
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**



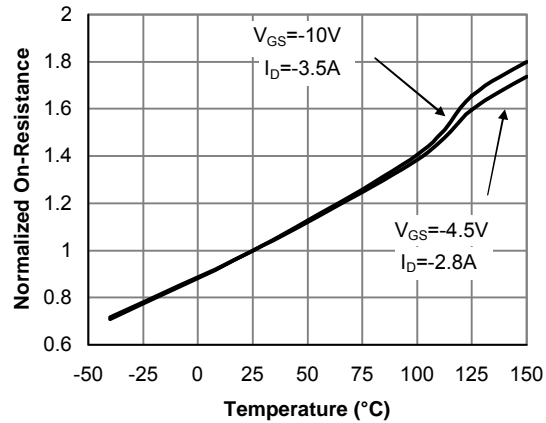
**Fig 1: On-Region Characteristics**



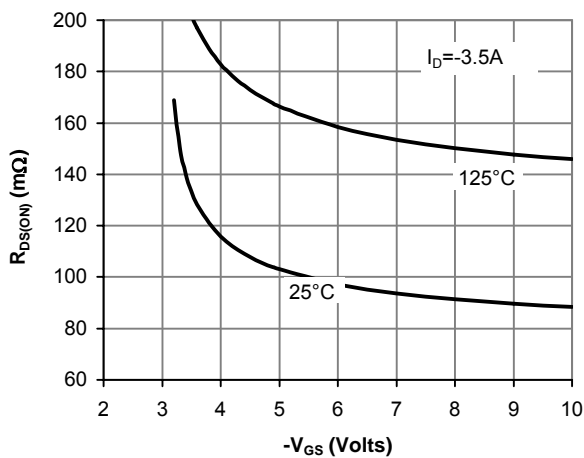
**Figure 2: Transfer Characteristics**



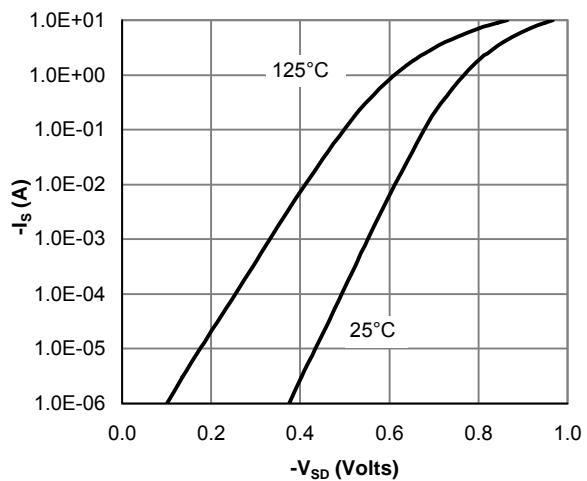
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**



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



**Figure 6: Body-Diode Characteristics**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**

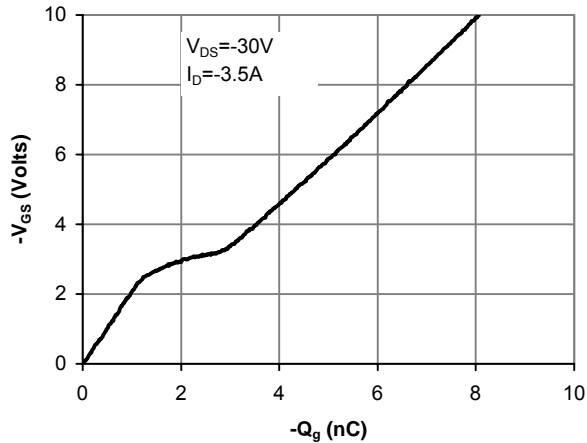


Figure 7: Gate-Charge Characteristics

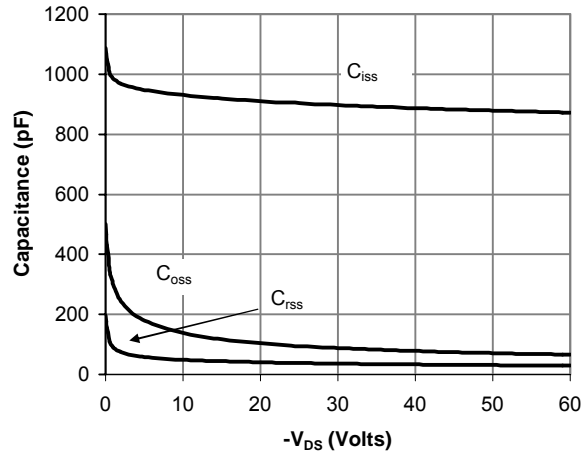


Figure 8: Capacitance Characteristics

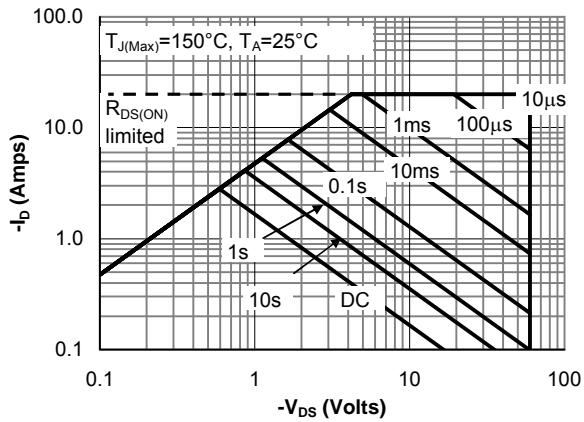


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

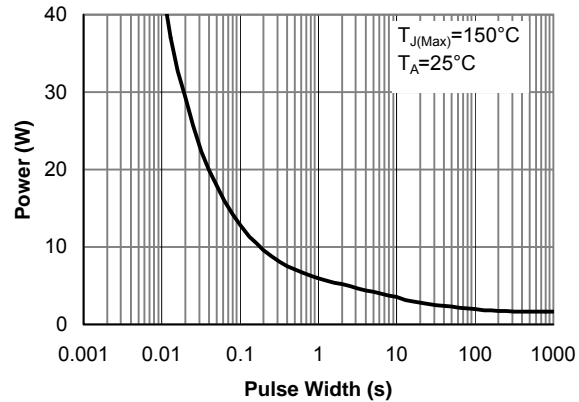


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

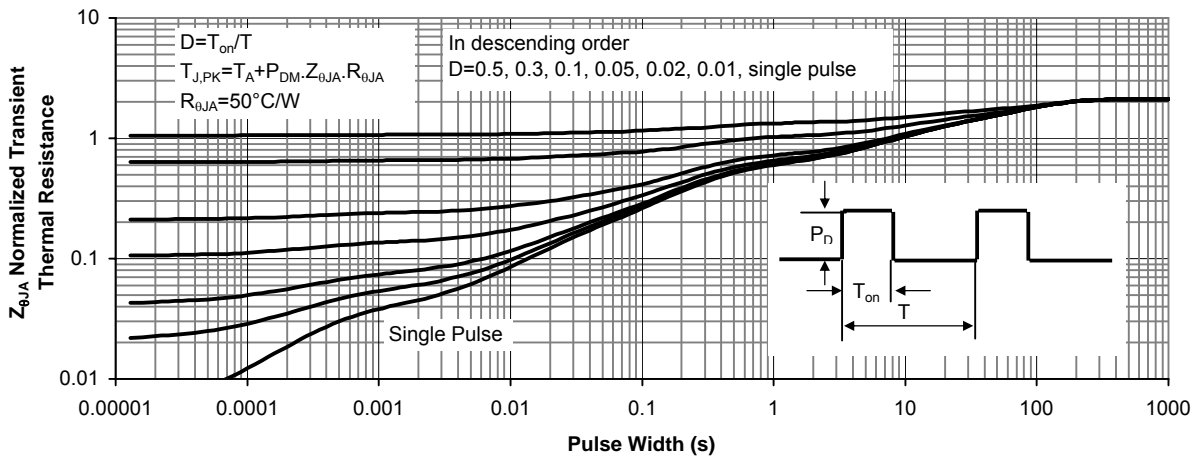


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