



**AOP610**

**Complementary Enhancement Mode Field Effect Transistor**

**General Description**

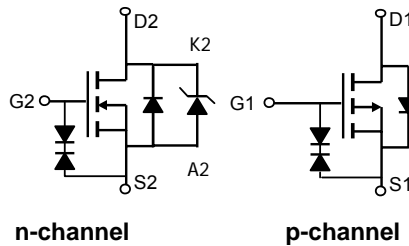
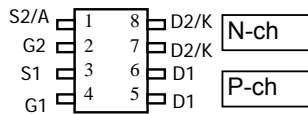
The AOP610 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. A Schottky diode in parallel with the n-channel FET reduces body diode related losses. It is ESD protected. *Standard product AOP610 is Pb-free (meets ROHS & Sony 259 specifications). AOP610L is a Green Product ordering option. AOP610 and AOP610L are electrically identical.*

**Features**

n-channel	p-channel
$V_{DS} (V) = 30V$	-30V
$I_D = 7.7A (V_{GS}=10V)$	-6.2A ( $V_{GS}=10V$ )
$R_{DS(ON)}$	$R_{DS(ON)}$
< 24m $\Omega$ ( $V_{GS}=10V$ )	< 37m $\Omega$ ( $V_{GS} = -10V$ )
< 42m $\Omega$ ( $V_{GS}=4.5V$ )	< 60m $\Omega$ ( $V_{GS} = -4.5V$ )

ESD rating: 1500V (HBM)

**PDIP-8**



**Absolute Maximum Ratings  $T_A=25^\circ C$  unless otherwise noted**

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ C$	7.7	-6.2
		$T_A=70^\circ C$	6.1	-4.9
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	-30	A
Power Dissipation	$P_D$	$T_A=25^\circ C$	2.3	2.3
		$T_A=70^\circ C$	1.45	1.45
Avalanche Current <sup>B</sup>	$I_{AR}$	15	20	A
Repetitive avalanche energy 0.1mH <sup>B</sup>	$E_{AR}$	11	20	mJ
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

**Thermal Characteristics: n-channel+schottky and p-channel**

Parameter	Symbol	Typ	Max		Units
			n-ch	p-ch	
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	n-ch	45	55	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>			Steady-State	78	95
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	n-ch	30	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>			$t \leq 10s$	38.5	55
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	p-ch	78	95	$^\circ C/W$
Maximum Junction-to-Lead <sup>C</sup>			Steady-State	28	40

N-Channel+Schottky 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		2	50 125	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			10	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1	2	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> =7.7A T <sub>J</sub> =125°C		20 29	24 35	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A		34	42	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =7.7A	10	18		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A		0.5	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				3	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		543	630	pF
C <sub>oss</sub>	Output Capacitance			142		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			76		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		2.1	3	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub> (10V)	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =7.7A		11	15	nC
Q <sub>g</sub> (4.5V)	Total Gate Charge			5.3	7	nC
Q <sub>gs</sub>	Gate Source Charge			1.9		nC
Q <sub>gd</sub>	Gate Drain Charge			4		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.9Ω, R <sub>GEN</sub> =3Ω		4.7	7	ns
t <sub>r</sub>	Turn-On Rise Time			4.9	10	ns
t <sub>D(off)</sub>	Turn-Off DelayTime			16.2	22	ns
t <sub>f</sub>	Turn-Off Fall Time			3.5	7	ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =7.7A, di/dt=100A/μs		15.7	20	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =7.7A, di/dt=100A/μs		7.9	10	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<sub>s</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. R<sub>θJL</sub> and R<sub>θJC</sub> are equivalent terms referring to thermal resistance from junction to drain lead.

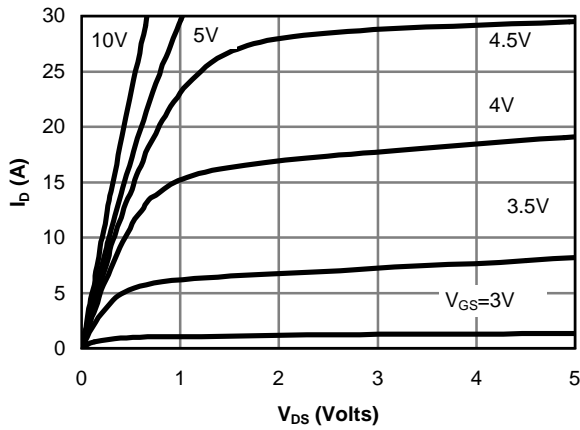
D: The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 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.

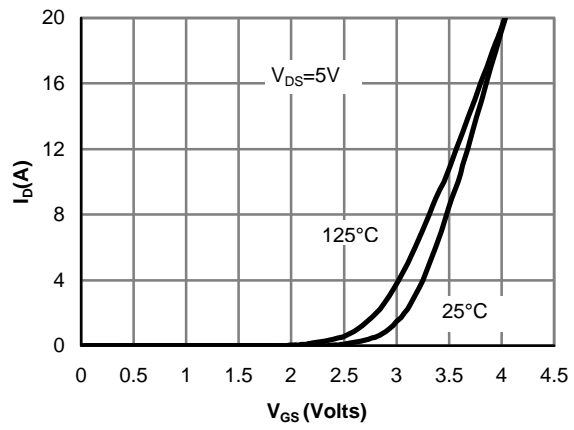
F: Rev 0: October 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

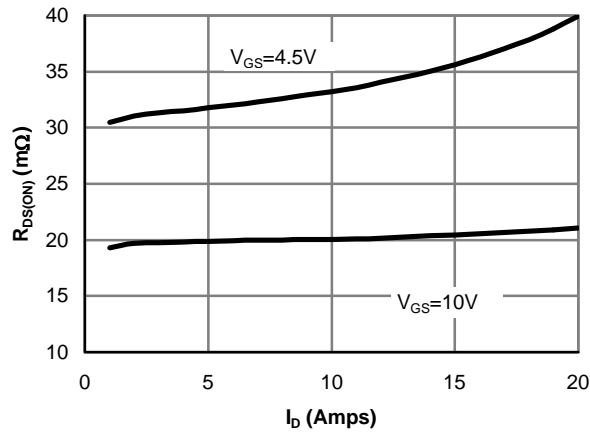
**N-CH+SCHOTTKY TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



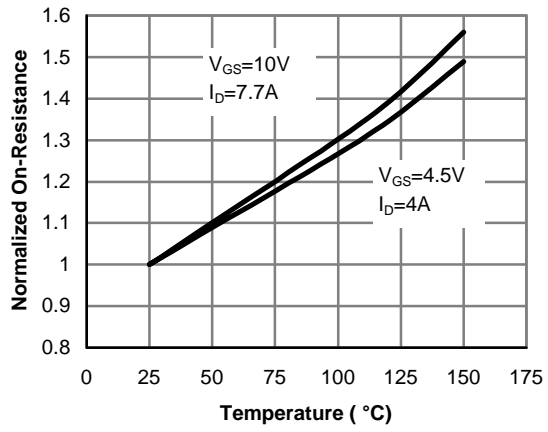
**Fig 1: On-Region Characteristics**



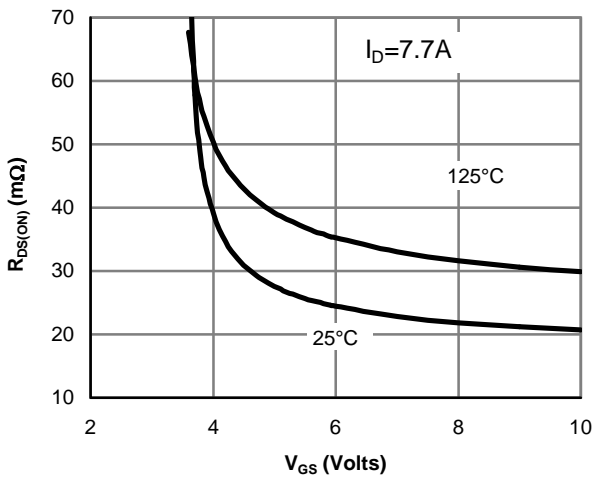
**Figure 2: Transfer Characteristics**



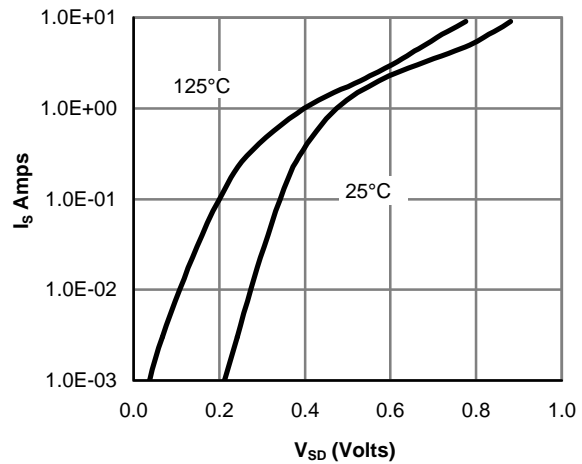
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



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



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



**Figure 6: Body diode characteristics**

**N-CH+SCHOTTKY TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

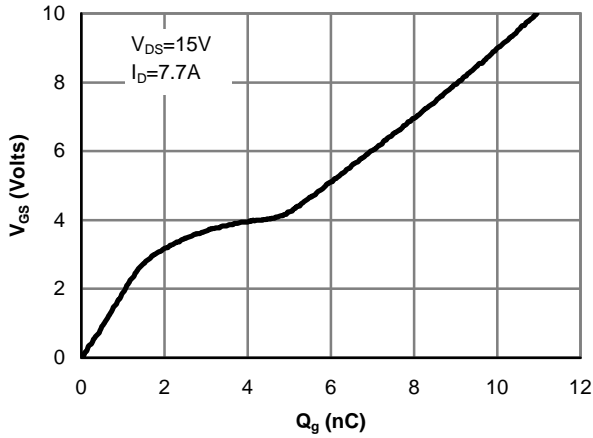


Figure 7: Gate-Charge characteristics

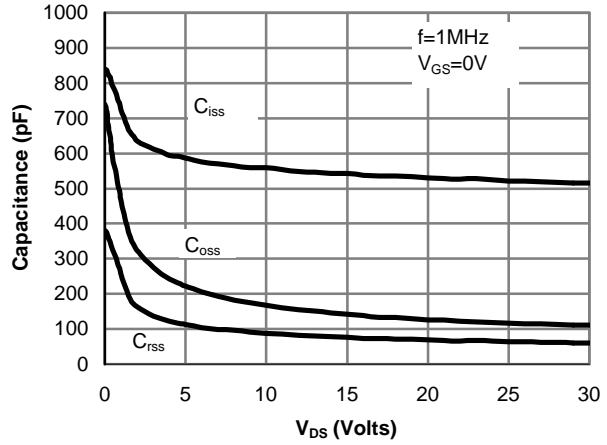


Figure 8: Capacitance Characteristics

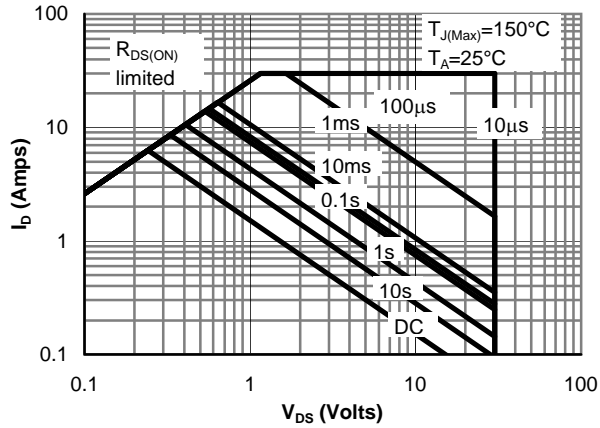


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

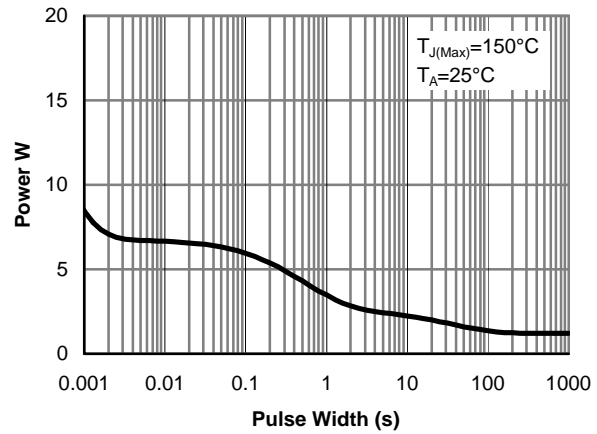


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

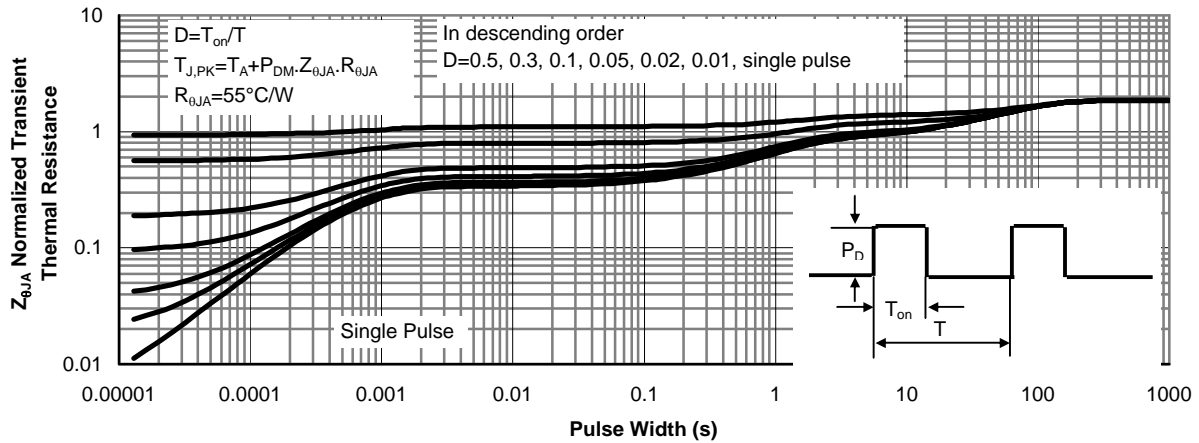


Figure 11: Normalized Maximum Transient Thermal Impedance

**P-Channel 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> =±20V			10	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =-250μA	-1	-1.8	-3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V	30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-6.2A T <sub>J</sub> =125°C		30.5 43	37 52	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =4A		47	60	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-6.2A		12.5		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		-0.77	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				3	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		1040	1250	pF
C <sub>oss</sub>	Output Capacitance			179		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			134		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		5	10	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge (10V)	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-6.2A		16.8	22	nC
Q <sub>g(4.5V)</sub>	Total Gate Charge (4.5V)			8.7	12	nC
Q <sub>gs</sub>	Gate Source Charge			3.4		nC
Q <sub>gd</sub>	Gate Drain Charge			5		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =2.5Ω, R <sub>GEN</sub> =3Ω		9	12	ns
t <sub>r</sub>	Turn-On Rise Time			5.7	11	ns
t <sub>D(off)</sub>	Turn-Off DelayTime			22.7	30	ns
t <sub>f</sub>	Turn-Off Fall Time			10.2	20	ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-6.2A, di/dt=100A/μs		21.7	27	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-6.2A, di/dt=100A/μs		13.6	18	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<sub>s</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. R<sub>θJL</sub> and R<sub>θJC</sub> are equivalent terms referring to thermal resistance from junction to drain lead.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using 80μs 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.

F: Rev 0: October 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

P-CH TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

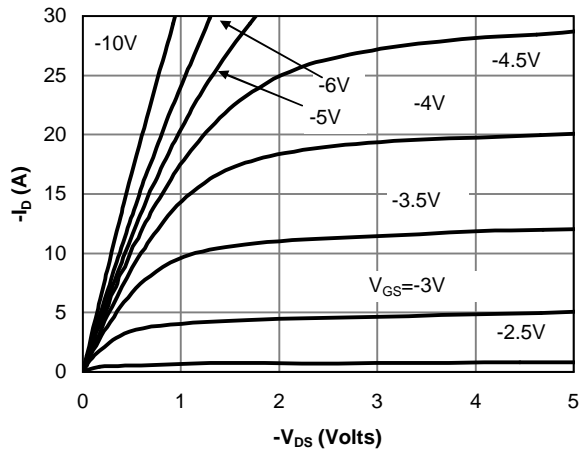


Fig 1: On-Region Characteristics

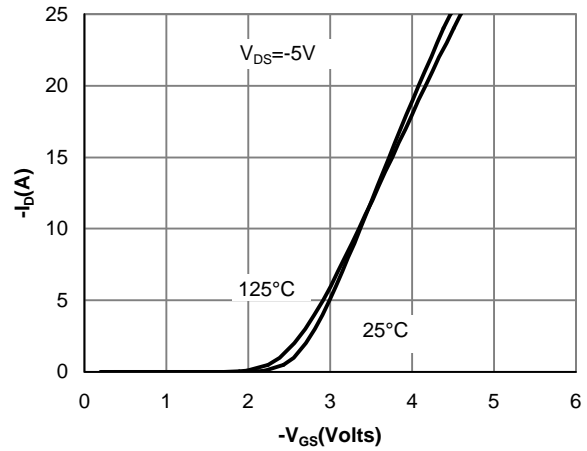


Figure 2: Transfer Characteristics

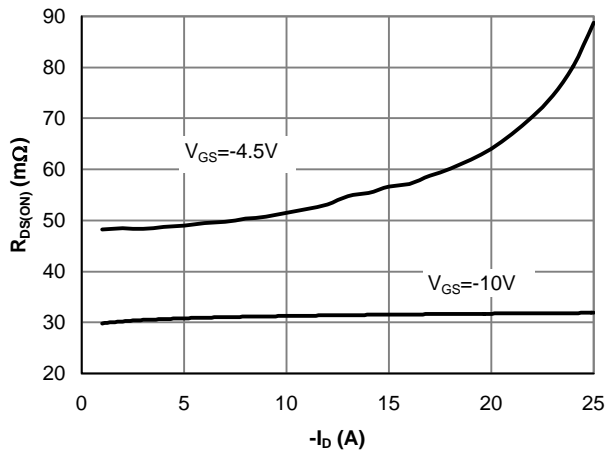


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

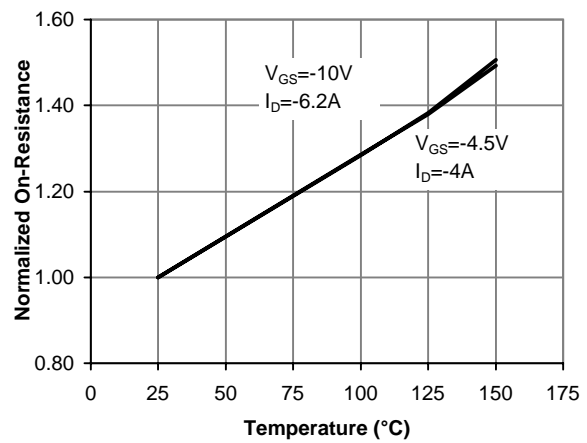


Figure 4: On-Resistance vs. Junction Temperature

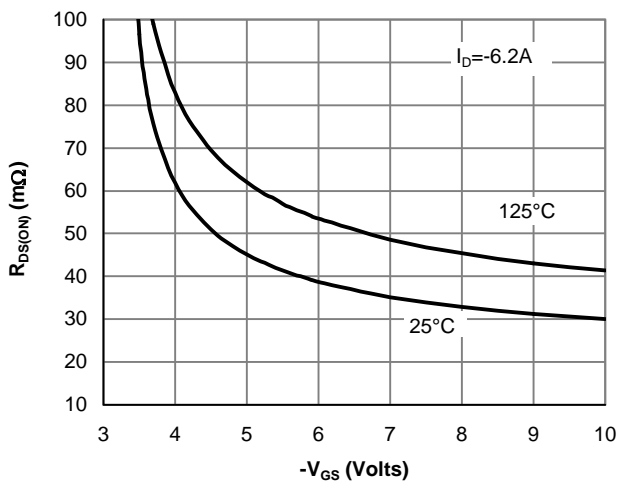


Figure 5: On-Resistance vs. Gate-Source Voltage

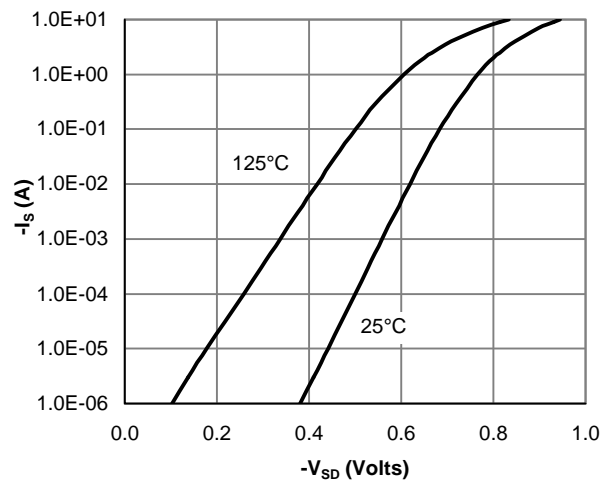


Figure 6: Body-Diode Characteristics

P-CH TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

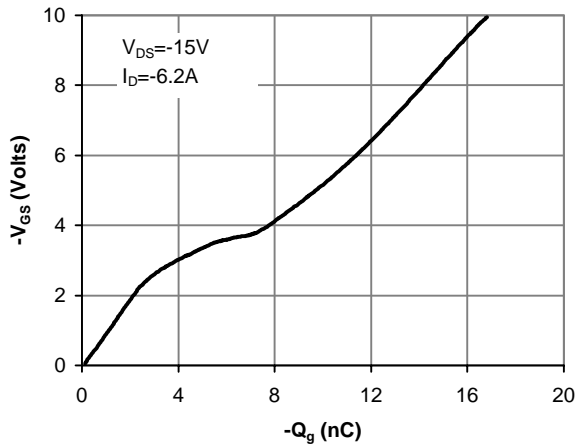


Figure 7: Gate-Charge Characteristics

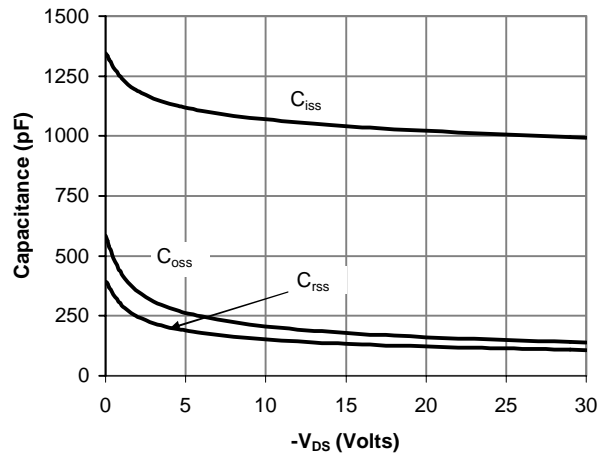


Figure 8: Capacitance Characteristics

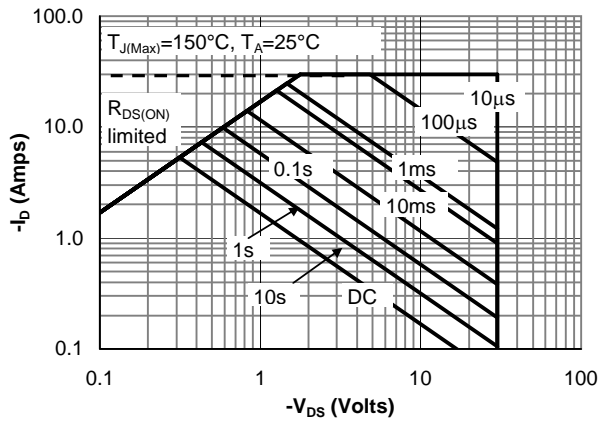


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

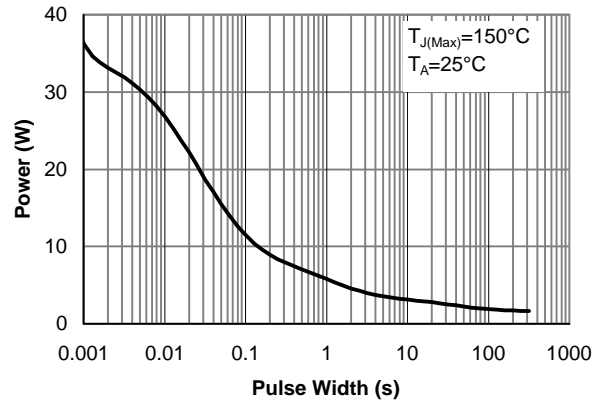


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

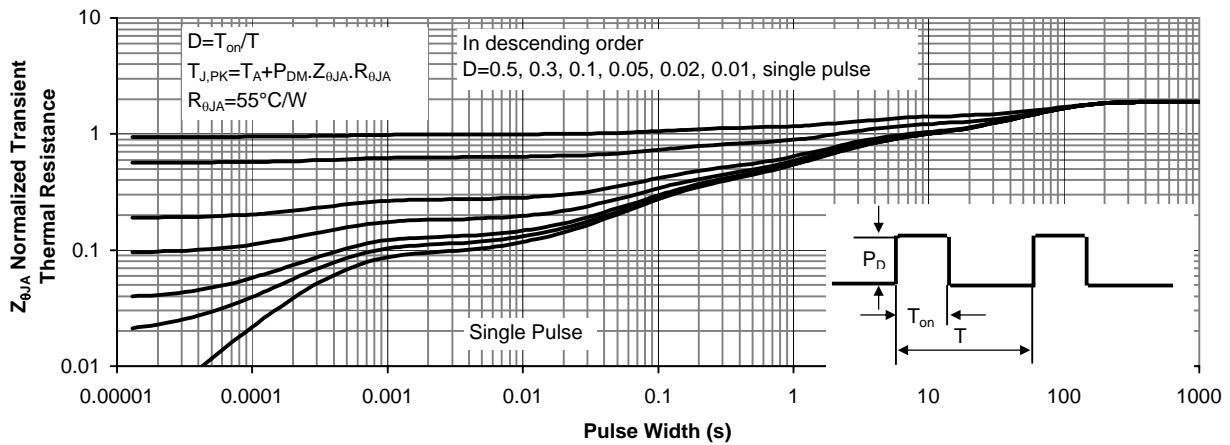


Figure 11: Normalized Maximum Transient Thermal Impedance