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AOP609

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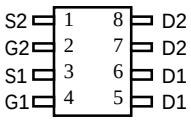
ALPHA & OMEGA SEMICONDUCTOR

AOP609
Complementary Enhancement Mode Field Effect Transistor

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)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 60mΩ (V_{GS}=10V)	< 115mΩ (V_{GS} =-10V)
< 75mΩ (V_{GS}=4.5V)	< 140mΩ (V_{GS} =-4.5V)
ESD Rating: 1500V HBM	3000V HMB



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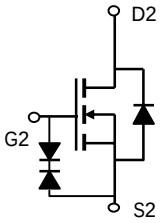
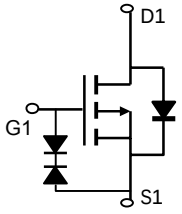


n-channel



p-channel

Absolute Maximum Ratings T_A=25°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}	±20	±20	V
Continuous Drain Current [A]	T_A=25°C	I_D	4.7	-3.5	A
	T_A=70°C		3.8	-2.9	
Pulsed Drain Current [B]		I_{DM}	20	-20	
Power Dissipation	T_A=25°C	P_D	2.5	2.5	W
	T_A=70°C		1.6	1.6	
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	Device	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	n-ch	37	50	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		n-ch	74	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	n-ch	28	40	°C/W
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	p-ch	35	50	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		p-ch	73	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	p-ch	32	40	°C/W

AOP609

N Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250µA, V_{GS}=0V	60			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=48V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±20V			250	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA	1.5	2.4	3	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V	20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=4.7A		49	60	mΩ
		T_J=125°C		65		
		V_{GS}=4.5V, I_D=3.0A		57	75	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=4.7A		17		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.78	1	V
I_S	Maximum Body-Diode Continuous Current				3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=30V, f=1MHz		450	570	pF
C_{oss}	Output Capacitance			74		pF
C_{rss}	Reverse Transfer Capacitance			30		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1.65	2	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=30V, I_D=4.7A		5.1	7	nC
Q_g(4.5V)	Total Gate Charge			2.5	3	nC
Q_{gs}	Gate Source Charge			1		nC
Q_{gd}	Gate Drain Charge			1.4		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=30V, R_L=6Ω, R_{GEN}=3Ω		5.4		ns
t_r	Turn-On Rise Time			5.5		ns
$t_{D(off)}$	Turn-Off DelayTime			17.2		ns
t_f	Turn-Off Fall Time			2.9		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=4.7A, dI/dt=100A/µs		25.4	35	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=4.7A, dI/dt=100A/µs		29.4		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°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 $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ 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^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.
Rev 2 : Sept 2007

AOP609

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

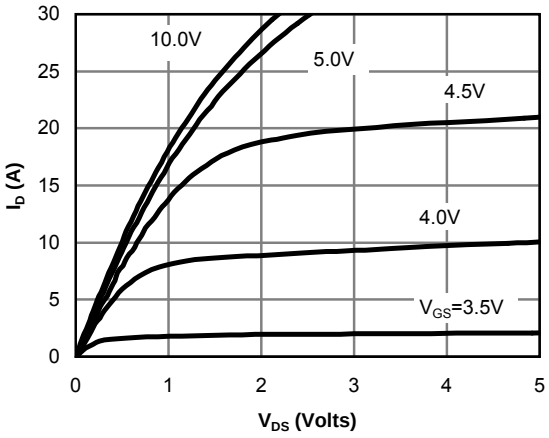


Fig 1: On-Region Characteristics

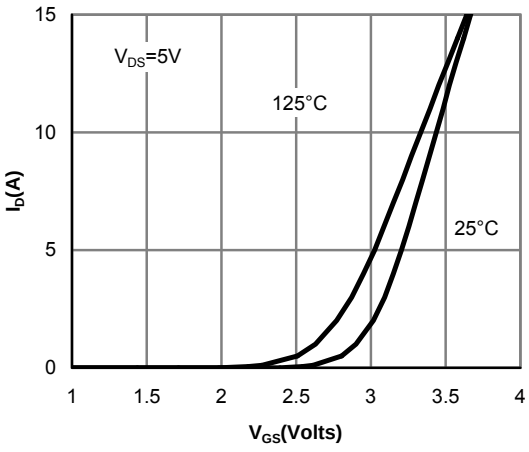


Figure 2: Transfer Characteristics

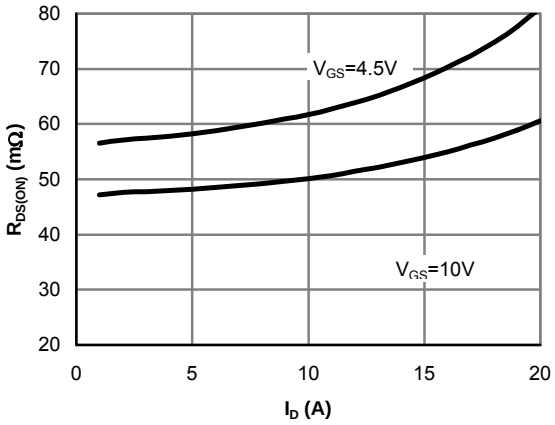


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

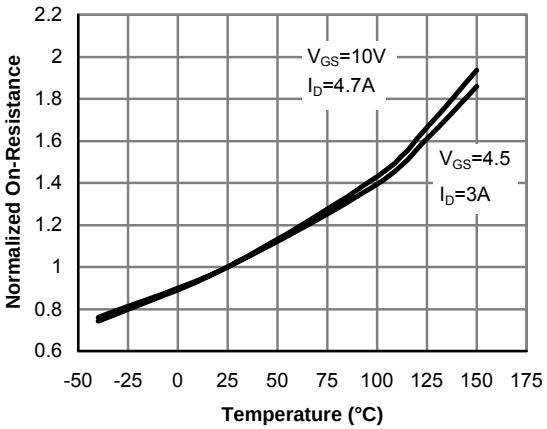


Figure 4: On-Resistance vs. Junction Temperature

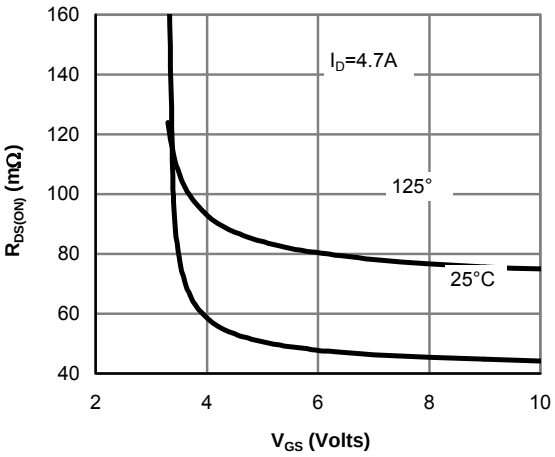


Figure 5: On-Resistance vs. Gate-Source Voltage

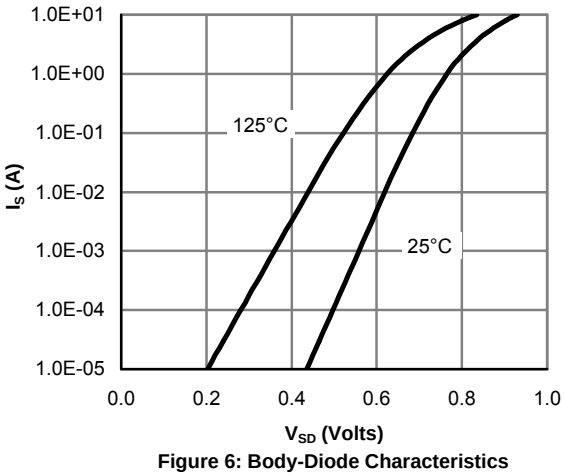


Figure 6: Body-Diode Characteristics

AOP609

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

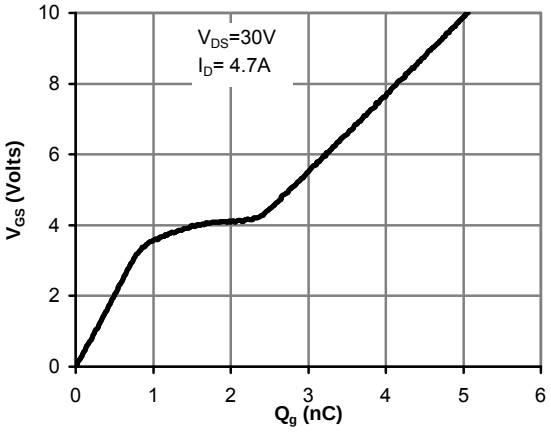


Figure 7: Gate-Charge Characteristics

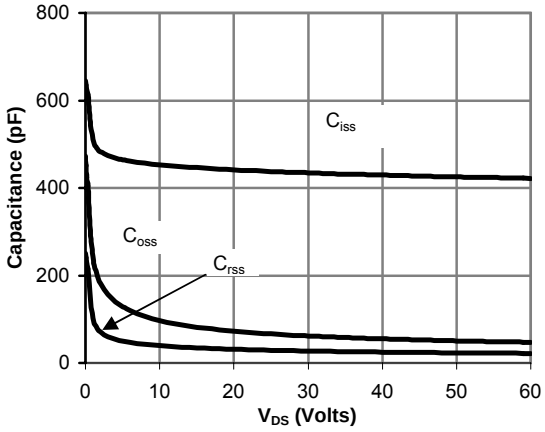


Figure 8: Capacitance Characteristics

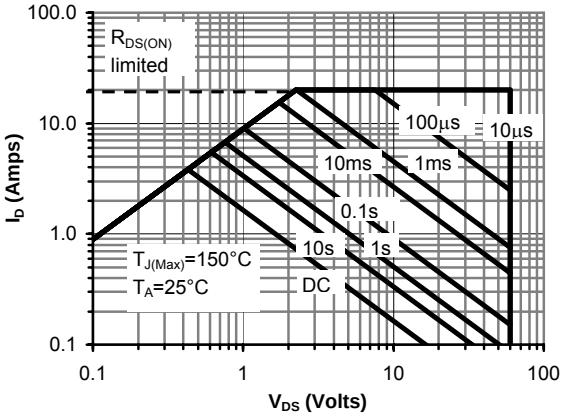


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

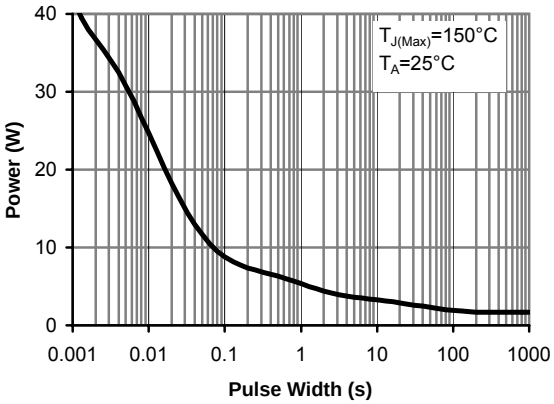


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

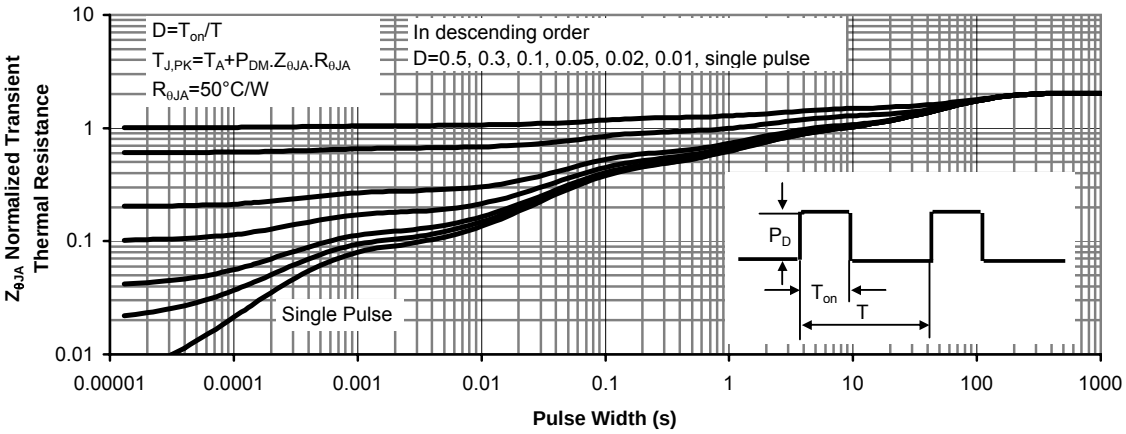


Figure 11: Normalized Maximum Transient Thermal Impedance

AOP609

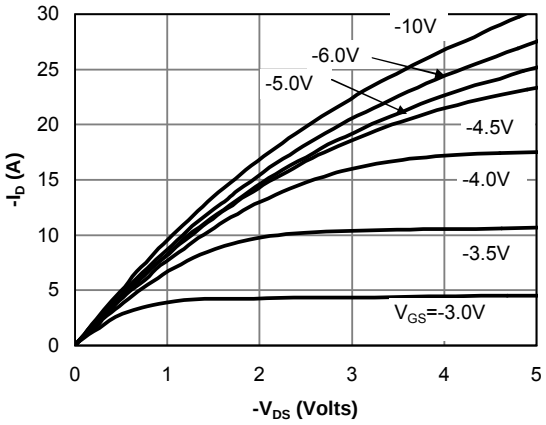
P-Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=-250µA, V_{GS}=0V	-60			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-48V, V_{GS}=0V			-1	µA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			100	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-1.5	-1.8	-3	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-3.5A		95	115	mΩ
		T_J=125°C		133		
		V_{GS}=-4.5V, I_D=-2.8A		112	140	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-3.5A		9		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.77	-1	V
I_S	Maximum Body-Diode Continuous Current				-3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-30V, f=1MHz		897	1080	pF
C_{oss}	Output Capacitance			88		pF
C_{rss}	Reverse Transfer Capacitance			36		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		7.2	9	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge (10V)	V_{GS}=-10V, V_{DS}=-30V, I_D=-3.5A		8.1	10	nC
Q_g(4.5V)	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 DelayTime	V_{GS}=-10V, V_{DS}=-30V, R_L=8.1Ω, R_{GEN}=3Ω		9		ns
t_r	Turn-On Rise Time			7.2		ns
$t_{D(off)}$	Turn-Off DelayTime			35		ns
t_f	Turn-Off Fall Time			25.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-3.5A, dI/dt=100A/µs		25.8	35	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-3.5A, dI/dt=100A/µs		28.8		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°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 $R_{\theta JA}$ is the sum of the thermal impedence 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^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.
Rev2:Sept 2007

AOP609

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL



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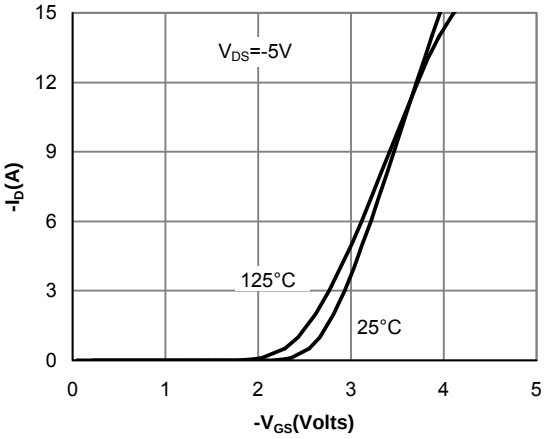

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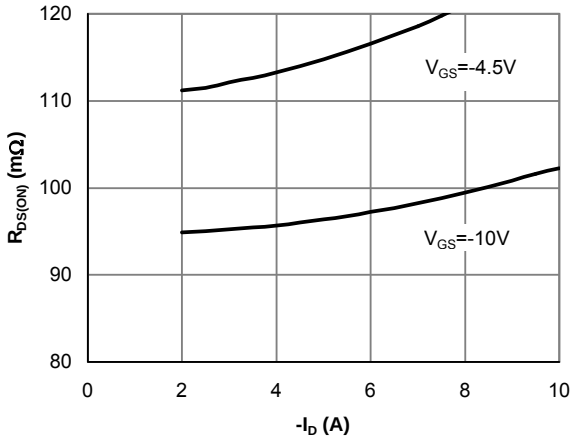

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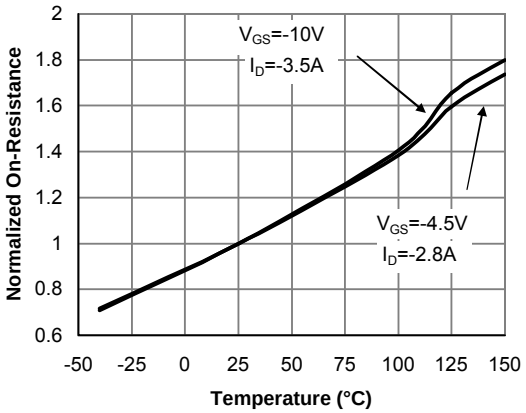

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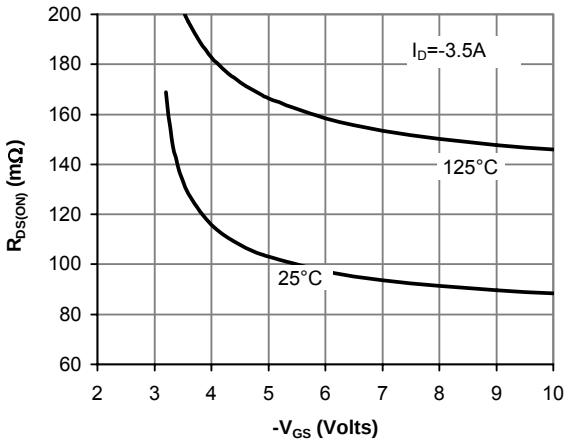

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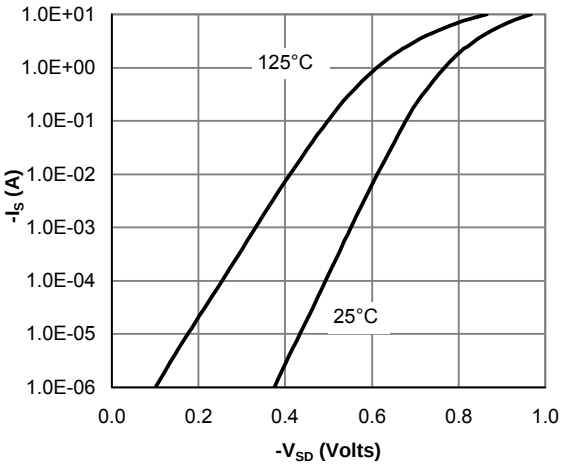

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AOP609

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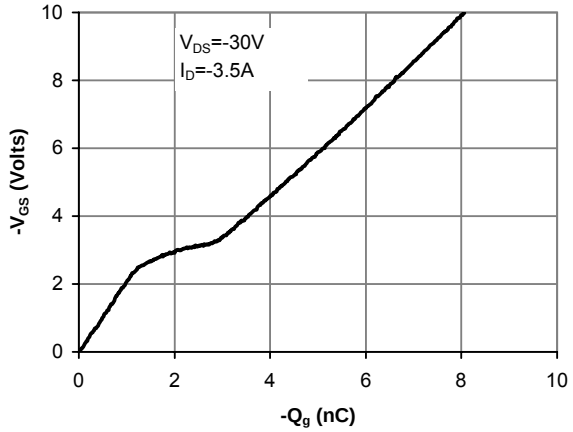

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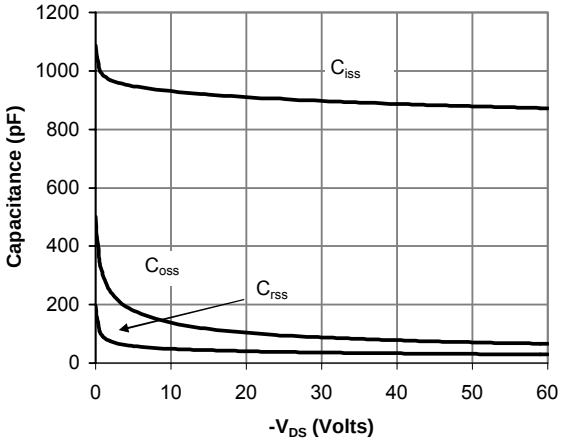

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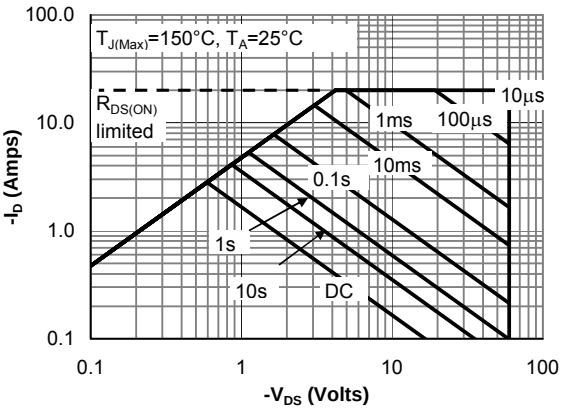

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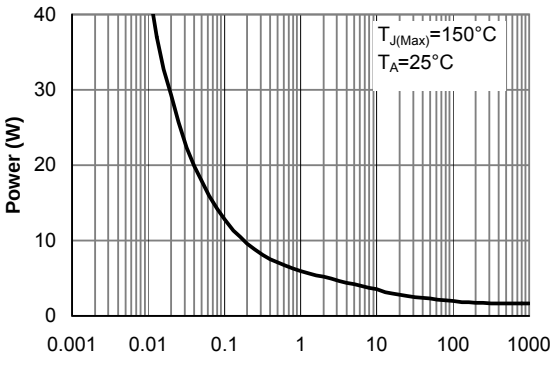

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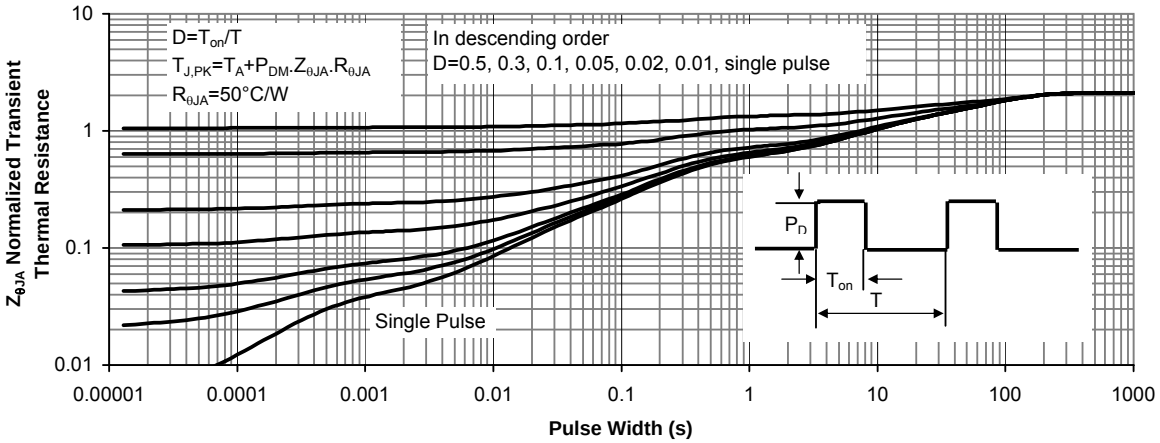

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