



ALPHA & OMEGA
SEMICONDUCTOR



AO4610

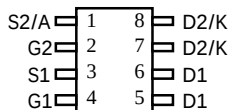
Complementary Enhancement Mode Field Effect Transistor

General Description

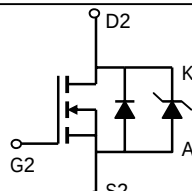
The AO4610 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in inverter and other applications. A Schottky diode is co-packaged with the n-channel FET to minimize body diode losses. *Standard Product AO4610 is Pb-free (meets ROHS & Sony 259 specifications). AO4610L is a Green Product ordering option. AO4610 and AO4610L are electrically identical.*

Features

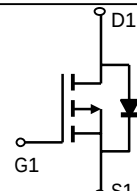
n-channel	p-channel
$V_{DS} (V) = 30V$	-30V
$I_D = 8.5A (V_{GS}=10V)$	-7.1A ($V_{GS} = -10V$)
$R_{DS(ON)}$	$R_{DS(ON)}$
$< 18m\Omega (V_{GS}=10V)$	$< 25m\Omega (V_{GS} = -10V)$
$< 28m\Omega (V_{GS}=4.5V)$	$< 40m\Omega (V_{GS} = -4.5V)$
$V_F < 0.5V @ 1A$	



SOIC-8



n-channel



p-channel

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}	± 20	± 20	V
Continuous Drain Current ^A	I_D	8.5	-7.1	A
$T_A=25^\circ C$				
$T_A=70^\circ C$		6.6	-5.6	
Pulsed Drain Current ^B	I_{DM}	30	-30	
Power Dissipation	P_D	2	2	W
		1.28	1.28	
$T_A=25^\circ C$				
$T_A=70^\circ C$				
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ C$
Parameter	Symbol	Maximum Schottky	Units	
Reverse Voltage	V_{DS}	30	V	
Continuous Forward Current ^A	I_D	3	A	
$T_A=25^\circ C$				
$T_A=70^\circ C$		2		
Pulsed Forward Current ^B	I_{DM}	20		
Power Dissipation ^A	P_D	2	W	
		1.28		
$T_A=25^\circ C$				
$T_A=70^\circ C$				
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ C$	

Thermal Characteristics: n-channel, Schottky and p-channel						
Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	n-ch	48	62.5	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		n-ch	74	110	°C/W
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	n-ch	35	60	°C/W
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	p-ch	48	62.5	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		p-ch	74	110	°C/W
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	p-ch	35	40	°C/W
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	Schottky	47.5	62.5	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		Schottky	71	110	°C/W
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	Schottky	32	40	°C/W

N-Channel + Schottky 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	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V T _J =55°C			25	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1	1.8	3	V
I _{D(ON)}	On state drain current	V _{GS} =4.5V, V _{DS} =5V	40			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =8.5A T _J =125°C		15.5	18	mΩ
		V _{GS} =4.5V, I _D =6.6A		22.3	27	mΩ
				23	28	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =8.5A	10	23		S
V _{SD}	Body-Diode+Schottky Forward Voltage	I _S =1A		0.75	1	V
I _S	Maximum Body-Diode+Schottky Continuous Current				5.5	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		1040		pF
C _{oss}	Output Capacitance (FET+Schottky)			180		pF
C _{rss}	Reverse Transfer Capacitance			110		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		0.7		Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =8.5A		19.2		nC
Q _g (4.5V)	Total Gate Charge			9.36		nC
Q _{gs}	Gate Source Charge			2.6		nC
Q _{gd}	Gate Drain Charge			4.2		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.8Ω, R _{GEN} =3Ω		5.2		ns
t _r	Turn-On Rise Time			4.4		ns
t _{D(off)}	Turn-Off DelayTime			17.3		ns
t _f	Turn-Off Fall Time			3.3		ns
t _{rr}	Body-Diode+Schottky Reverse Recovery Time	I _F =8.5A, dI/dt=100A/μs		16.7		ns
Q _{rr}	Body-Diode+Schottky Reverse Recovery Charge	I _F =8.5A, dI/dt=100A/μs		6.7		nC
SCHOTTKY PARAMETERS						
V _F	Forward Voltage Drop	I _F =1.0A		0.45	0.5	V
I _{rm}	Maximum reverse leakage current	V _R =30V		0.007	0.05	mA
		V _R =30V, T _J =125°C		3.2	10	
		V _R =30V, T _J =150°C		12	20	
C _T	Junction Capacitance	V _R =15V		37		pF

A: The value of R_{θJA} is measured with the device mounted on 1 in² 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_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} 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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

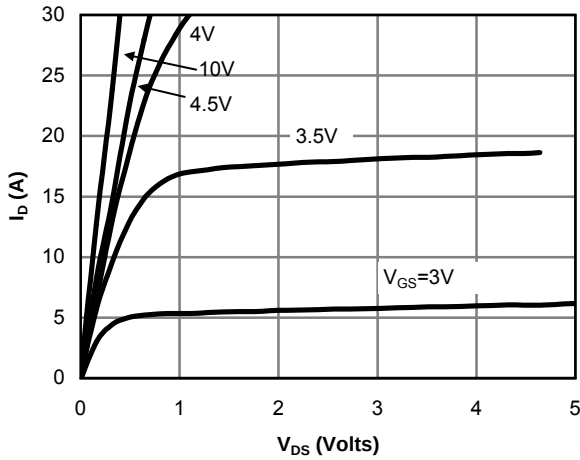


Fig 1: On-Region Characteristics

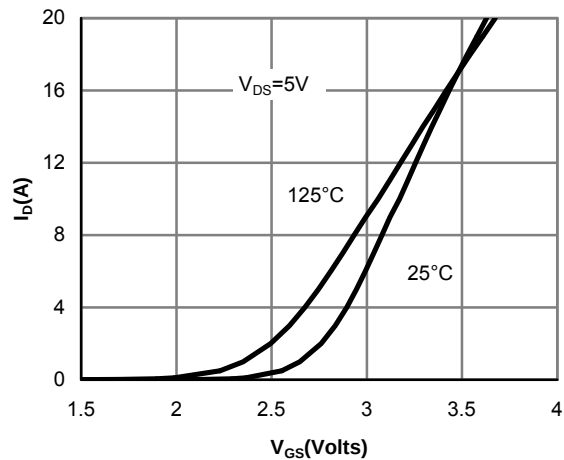


Figure 2: Transfer Characteristics

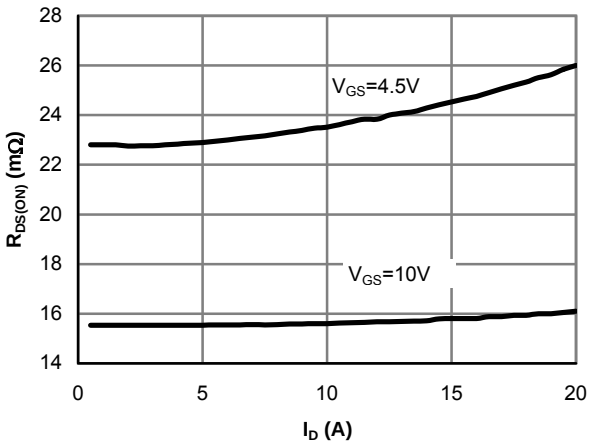


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

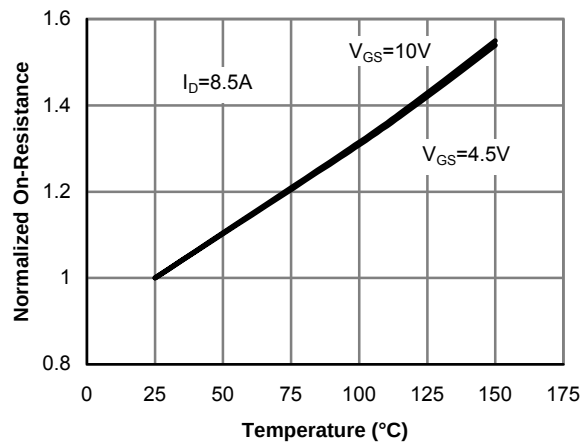


Figure 4: On-Resistance vs. Junction Temperature

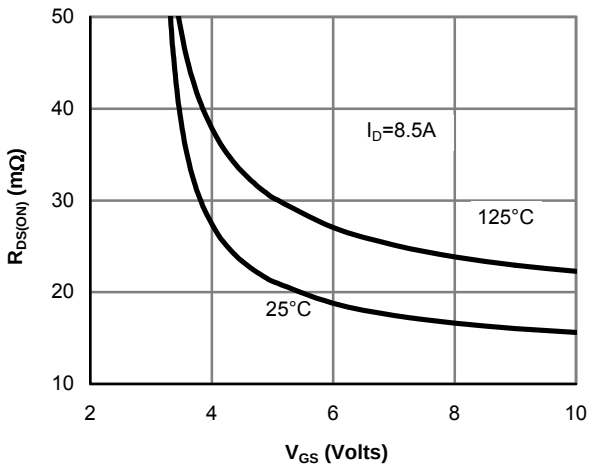


Figure 5: On-Resistance vs. Gate-Source Voltage

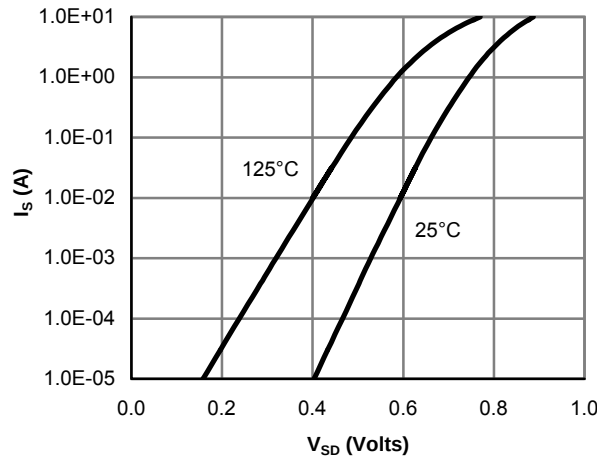


Figure 6: Body-Diode Characteristics

N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

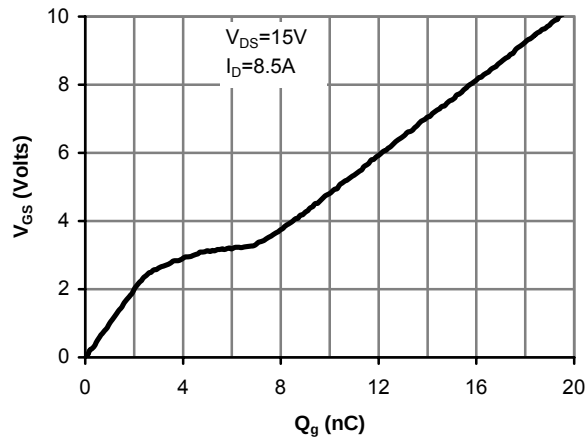


Figure 7: Gate-Charge Characteristics

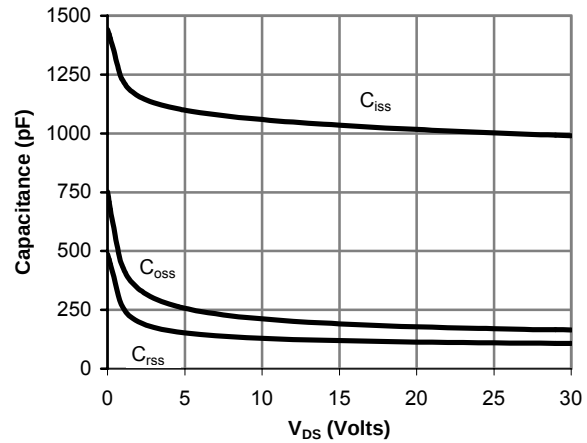


Figure 8: Capacitance Characteristics

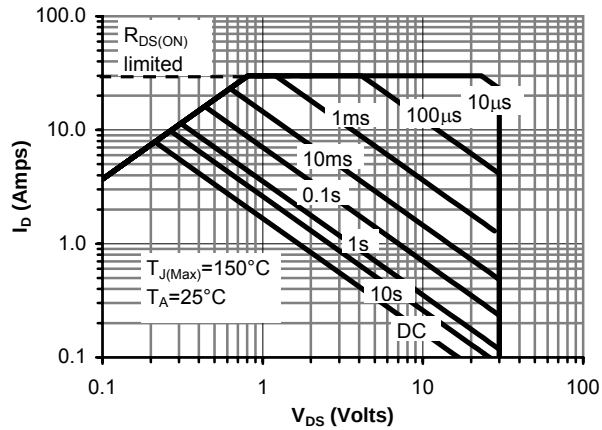


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

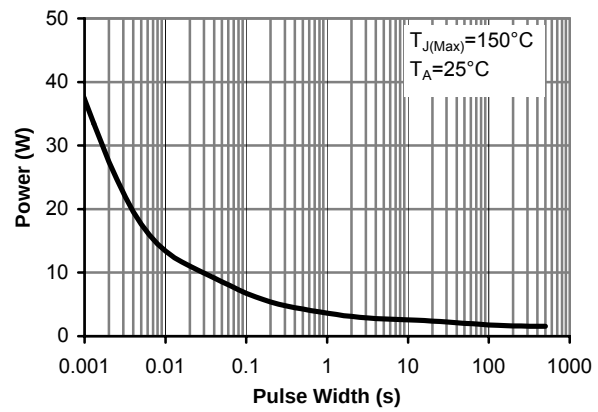


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

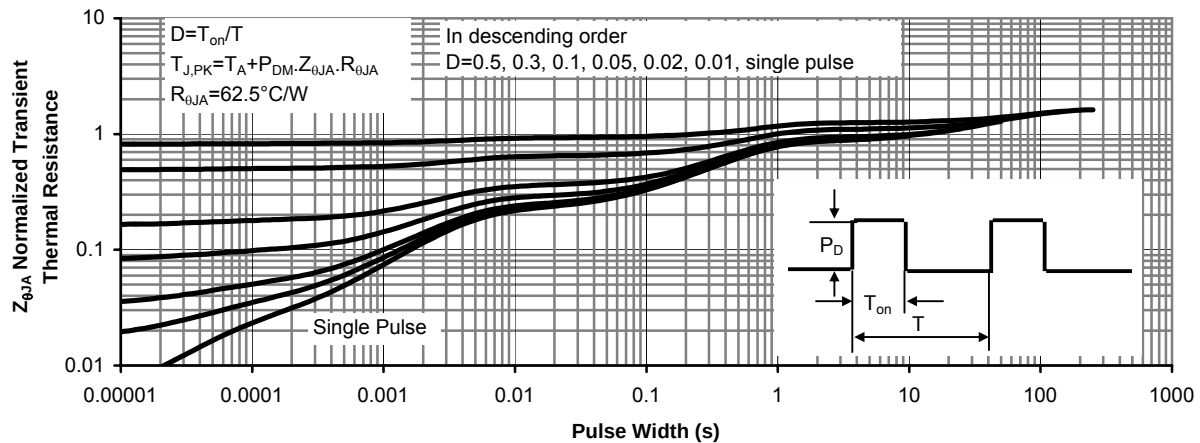


Figure 11: Normalized Maximum Transient Thermal Impedance

P-Channel 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	-30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-24V, V _{GS} =0V T _J =55°C			-1 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250μA	-1.4	-2	-2.7	V
I _{D(ON)}	On state drain current	V _{GS} =-10V, V _{DS} =-5V	-30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-10V, I _D =-7.1A T _J =125°C		20 27	25 33	mΩ
		V _{GS} =-4.5V, I _D =-5.6A		29	40	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-7.1A		19.6		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V		-0.7	-1	V
I _S	Maximum Body-Diode Continuous Current				-4.2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V, f=1MHz		1573		pF
C _{oss}	Output Capacitance			319		pF
C _{rss}	Reverse Transfer Capacitance			211		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		6.7		Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge (10V)	V _{GS} =-10V, V _{DS} =-15V, I _D =-7.1A		30.9		nC
Q _g (4.5V)	Total Gate Charge (4.5V)			16.1		nC
Q _{gs}	Gate Source Charge			8		nC
Q _{gd}	Gate Drain Charge			4.4		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-10V, V _{DS} =-15V, R _L =2.2Ω, R _{GEN} =3Ω		9.5		ns
t _r	Turn-On Rise Time			8		ns
t _{D(off)}	Turn-Off DelayTime			44.2		ns
t _f	Turn-Off Fall Time			22.2		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-7.1A, dI/dt=100A/μs		25.5		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-7.1A, dI/dt=100A/μs		14.7		nC

A: The value of R_{θJA} is measured with the device mounted on 1in² 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_{θJA} ≤ 10s thermal resistance rating.

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

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

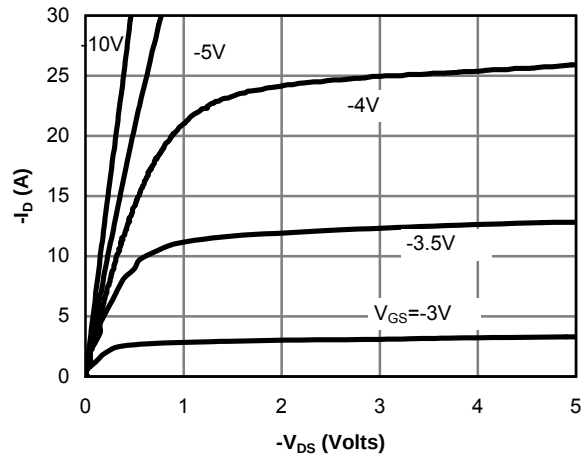


Fig 16: On-Region Characteristics

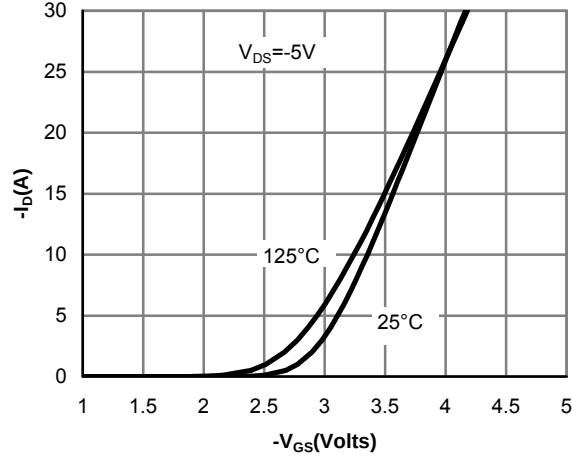


Figure 17: Transfer Characteristics

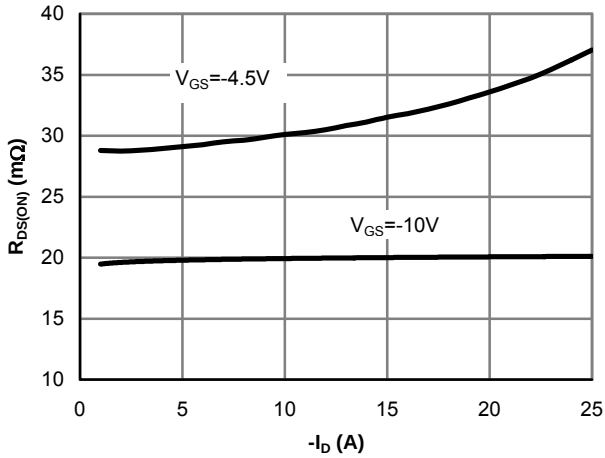


Figure 18: On-Resistance vs. Drain Current and Gate Voltage

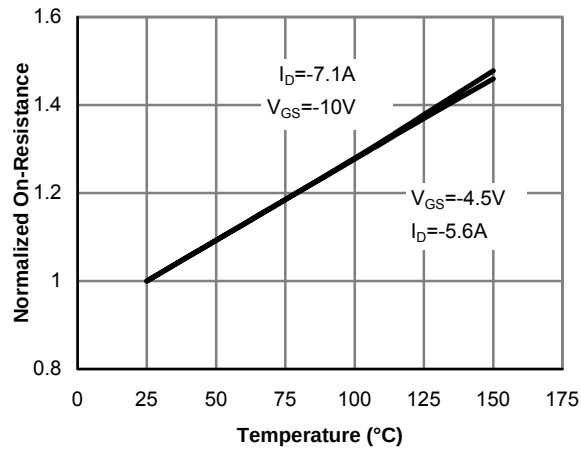


Figure 19: On-Resistance vs. Junction Temperature

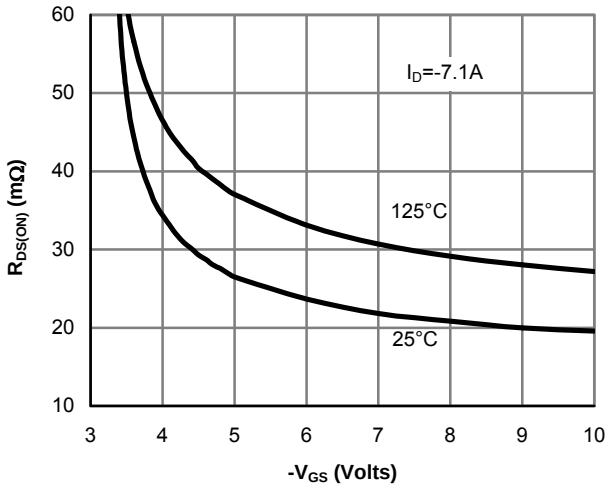


Figure 20: On-Resistance vs. Gate-Source Voltage

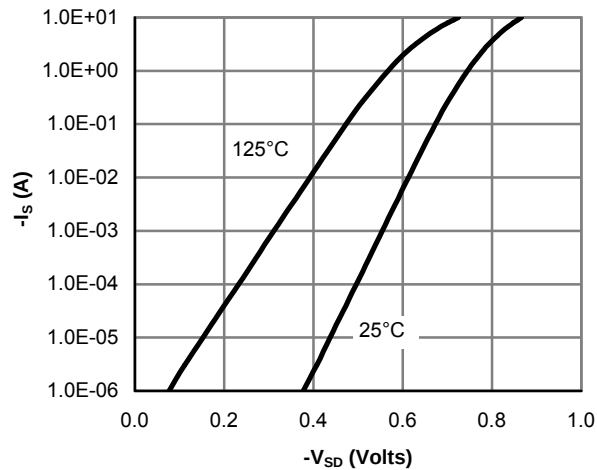
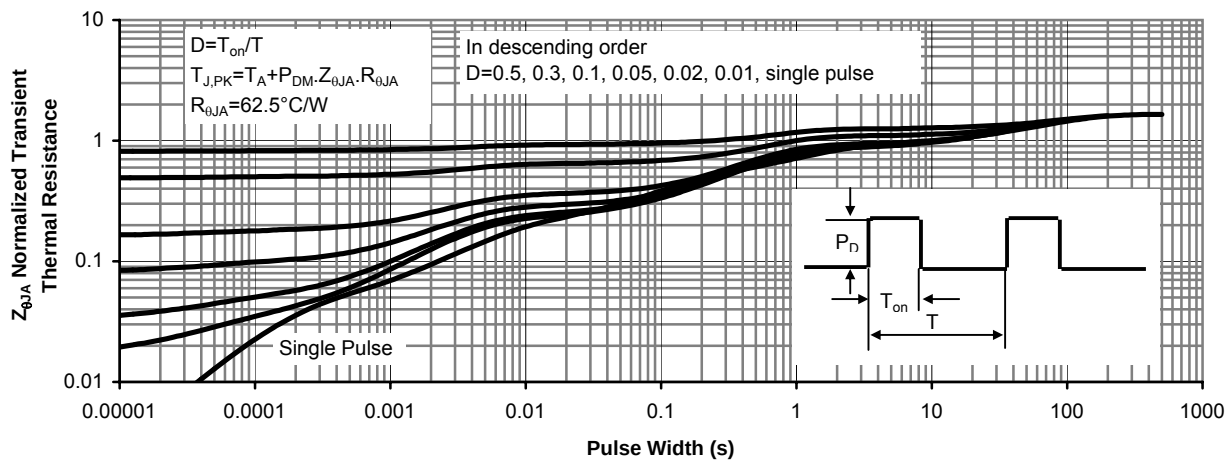
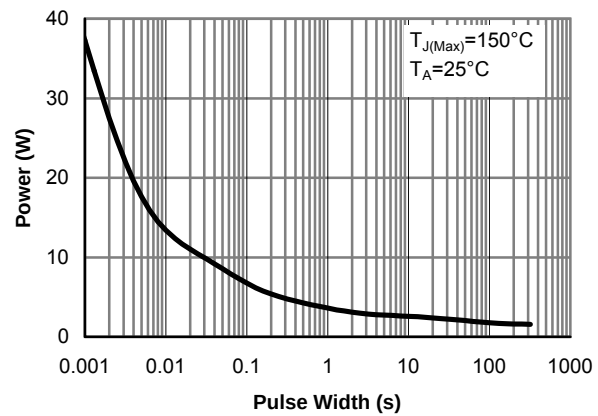
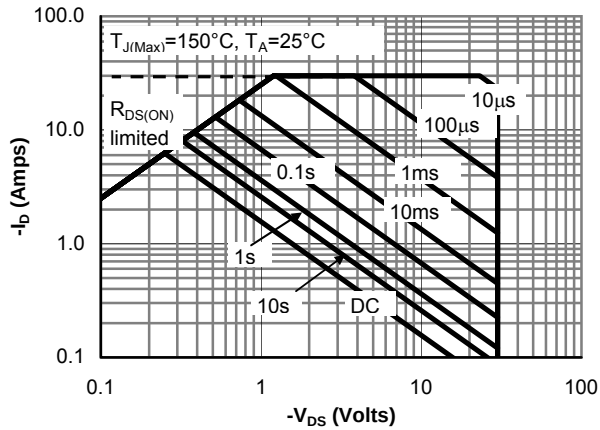
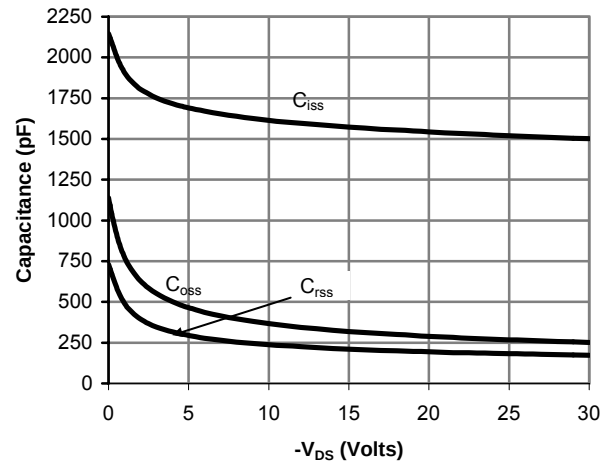
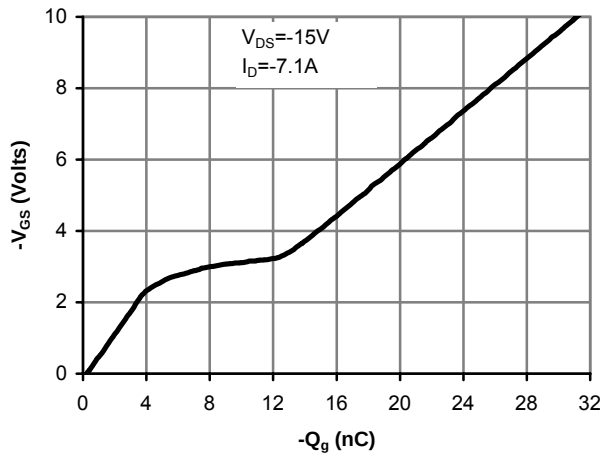


Figure 21: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

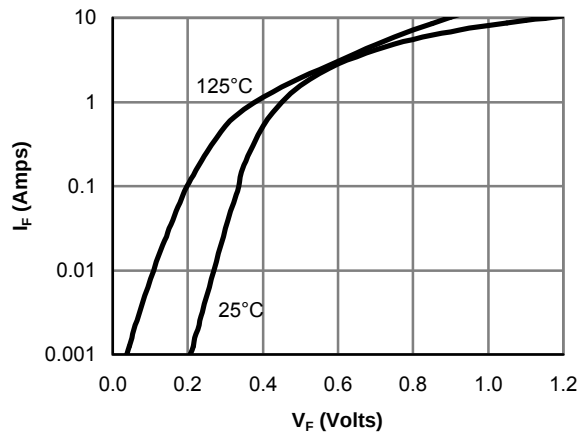


Figure 12: Schottky Forward Characteristics

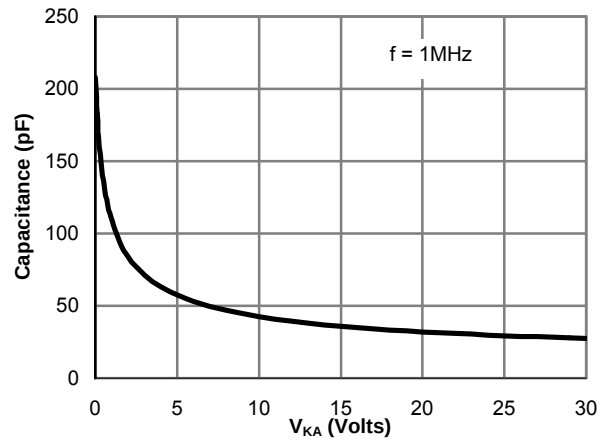


Figure 13: Schottky Capacitance Characteristics

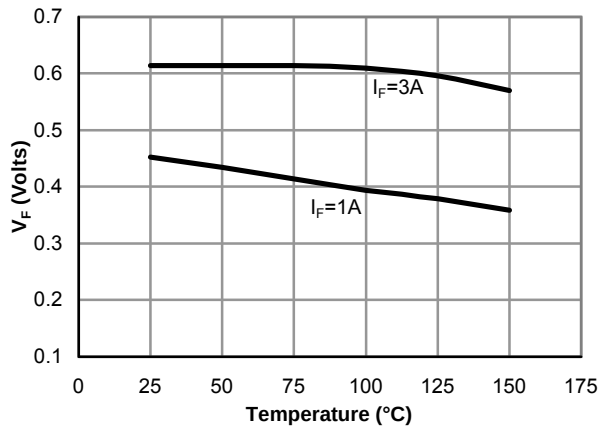


Figure 14: Schottky Forward Drop vs. Junction Temperature

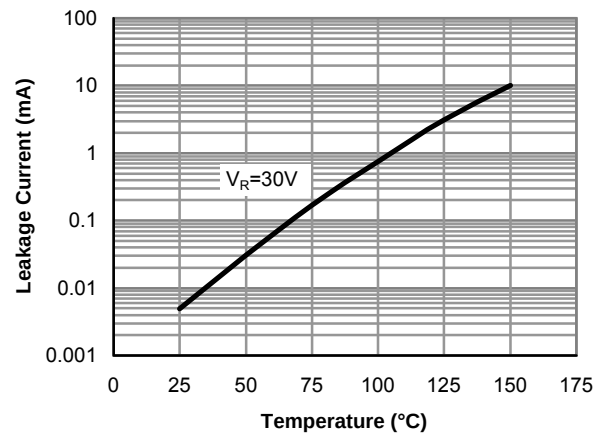


Figure 15: Schottky Leakage current vs. Junction Temperature

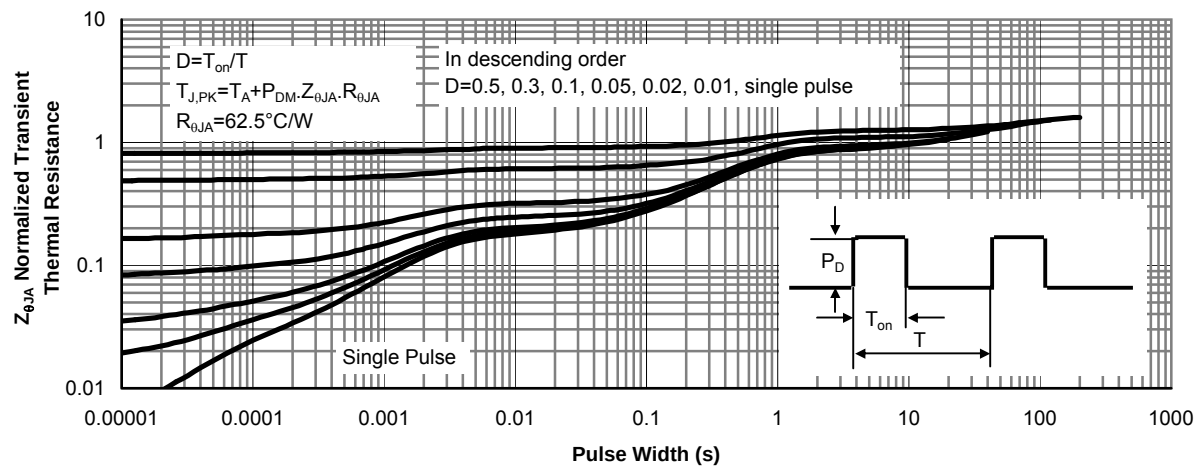


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance



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