ALPHA & OMEGA SEMICONDUCTOR, LTD.

Rev 1: Oct 2004

AO8701, AO8701L (Green Product)
P-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

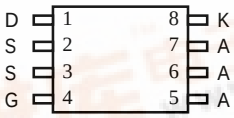
General Description

The AO8701 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch. AO8701L (Green Product) is offered in a lead-free package.

Features

V_{DS} (V) = -30V
I_D = -4.2A
$R_{DS(ON)}$ < 50mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 65mΩ (V_{GS} = 4.5V)
$R_{DS(ON)}$ < 120mΩ (V_{GS} = 2.5V)

SCHOTTKY
V_{DS} (V) = 30V, I_F = 3A, V_F=0.5V@1A



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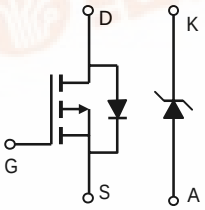

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	MOSFET	Schottky	Units
Drain-Source Voltage		V_{DS}	-30		V
Gate-Source Voltage		V_{GS}	±12		V
Continuous Drain Current[A]	T_A=25°C	I_D	-4.2		A
	T_A=70°C		-3.5		
Pulsed Drain Current[B]		I_{DM}	-30		
Schottky reverse voltage		V_{KA}		30	V
Continuous Forward Current[A]	T_A=25°C	I_F		3	A
	T_A=70°C			2	
Pulsed Forward Current[B]		I_{FM}		40	
Power Dissipation	T_A=25°C	P_D	1.4	1.4	W
	T_A=70°C		1	1	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Parameter: Thermal Characteristics MOSFET		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	73	90	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		96	125	
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	63	75	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	75	90	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		97	125	
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	63	75	

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			-1	µA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±12V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-0.7	-1	-1.3	V
$I_{D(ON)}$	On state drain current	V_{GS}=-4.5V, V_{DS}=-5V	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-4.2A		43	50	mΩ
		T_J=125°C			75	
		V_{GS}=-4.5V, I_D=-4A		54	65	mΩ
		V_{GS}=-2.5V, I_D=-1A		82	120	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5A	7	11		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.75	-1	V
I_S	Maximum Body-Diode Continuous Current				-2.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		954		pF
C_{oss}	Output Capacitance			115		pF
C_{rss}	Reverse Transfer Capacitance			77		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		6.1		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-15V, I_D=-4A		9.4		nC
Q_{gs}	Gate Source Charge			2		nC
Q_{gd}	Gate Drain Charge			3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=3.6Ω, R_{GEN}=6Ω		6.3		ns
t_r	Turn-On Rise Time			3.2		ns
$t_{D(off)}$	Turn-Off DelayTime			38.2		ns
t_f	Turn-Off Fall Time			12		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-4A, dI/dt=100A/µs		20.2		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-4A, dI/dt=100A/µs		11.2		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 $R_{\theta JA}$ 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 a 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 80 µs 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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

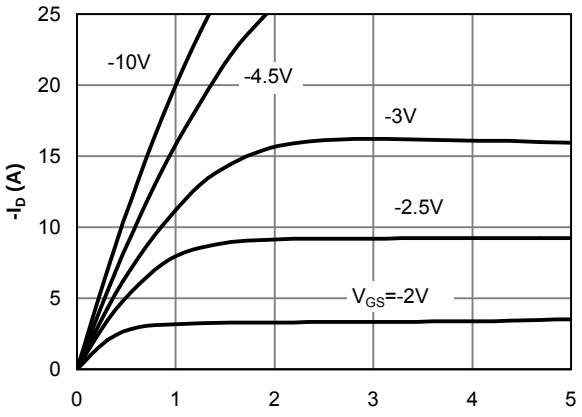

Fig 1: On-Region Characteristics

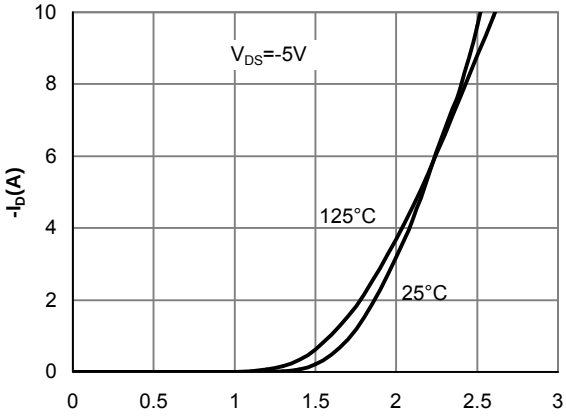

Figure 2: Transfer Characteristics

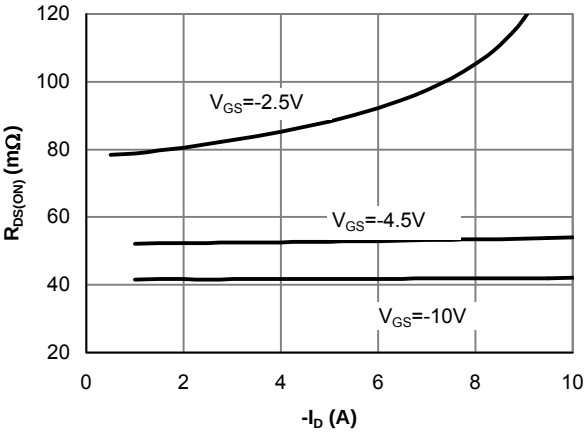

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

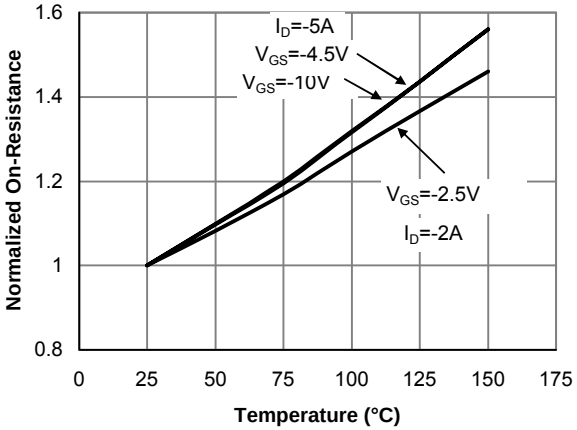

Figure 4: On-Resistance vs. Junction Temperature

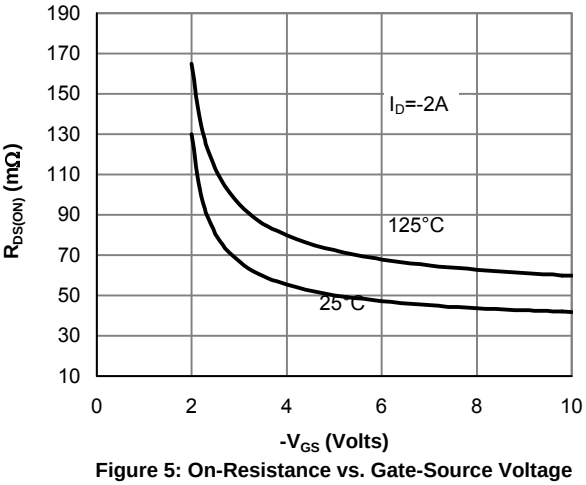

Figure 5: On-Resistance vs. Gate-Source Voltage

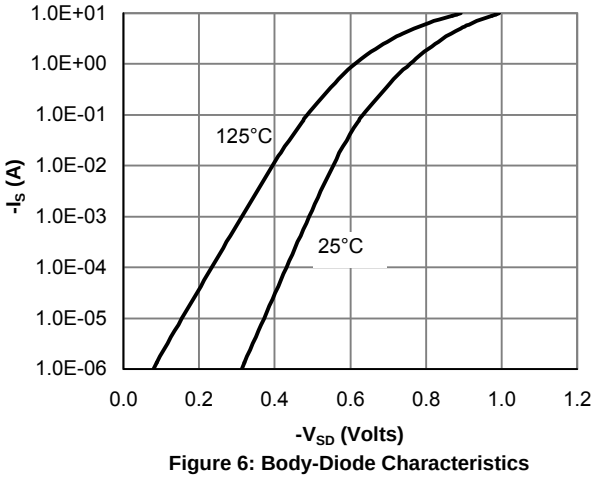

Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

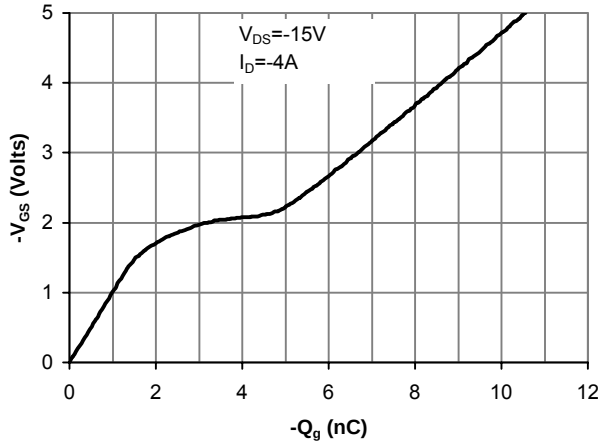

Figure 7: Gate-Charge Characteristics

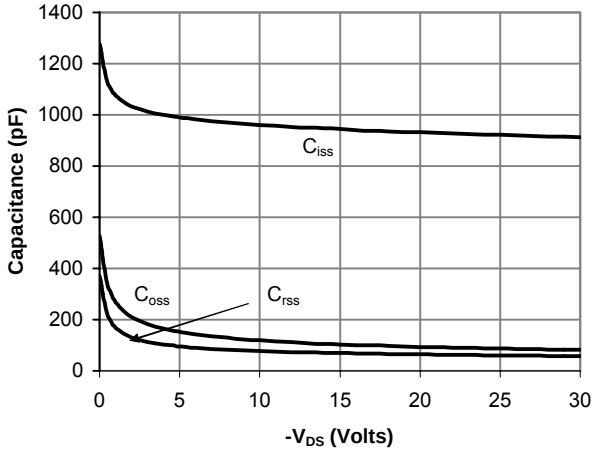

Figure 8: Capacitance Characteristics

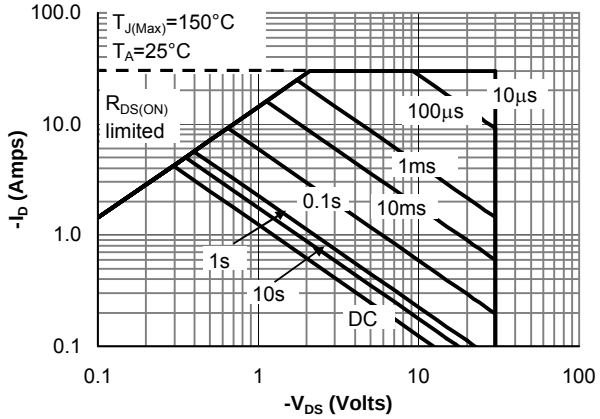

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

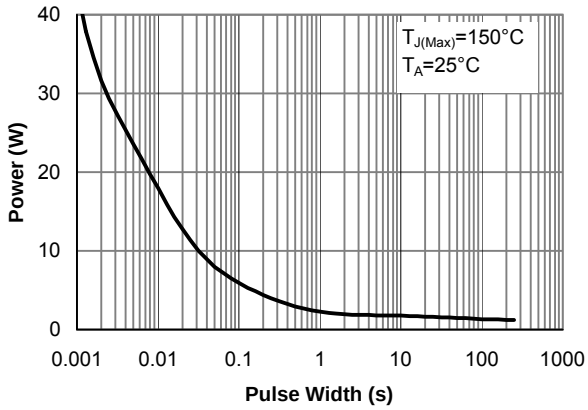

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

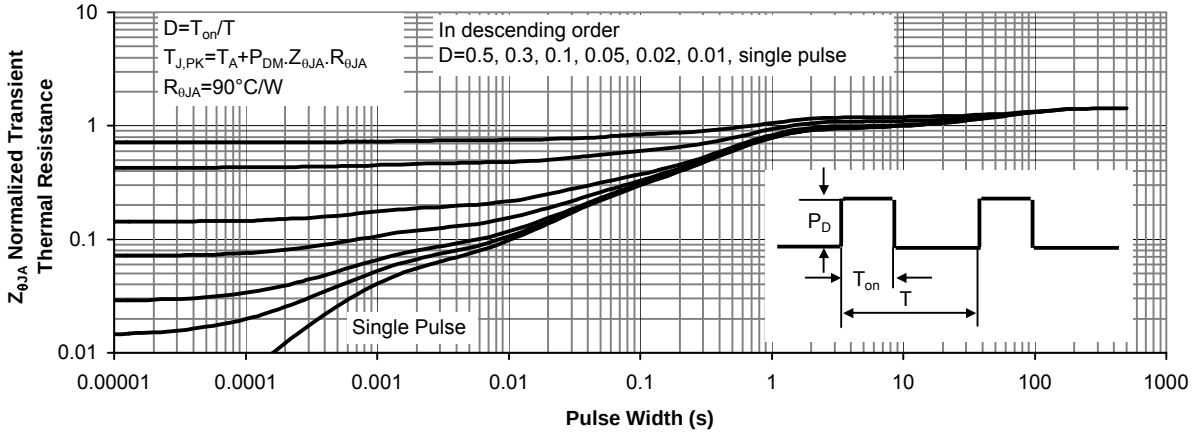

Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

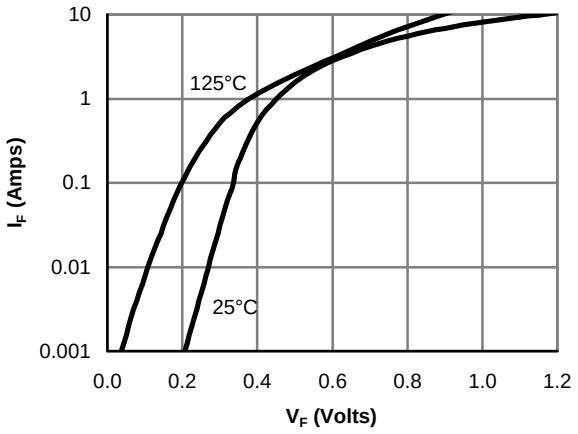

Figure 12: Schottky Forward Characteristics

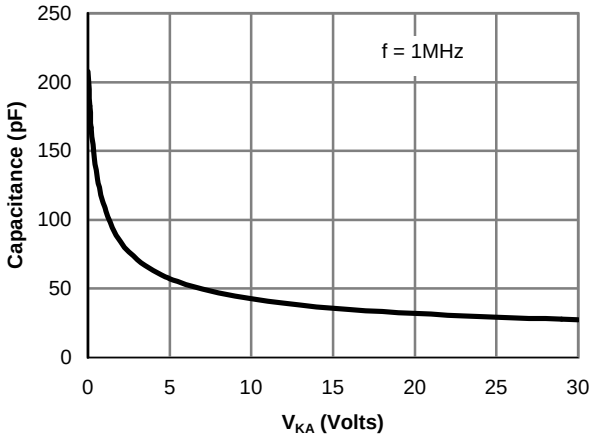

Figure 13: Schottky Capacitance Characteristics

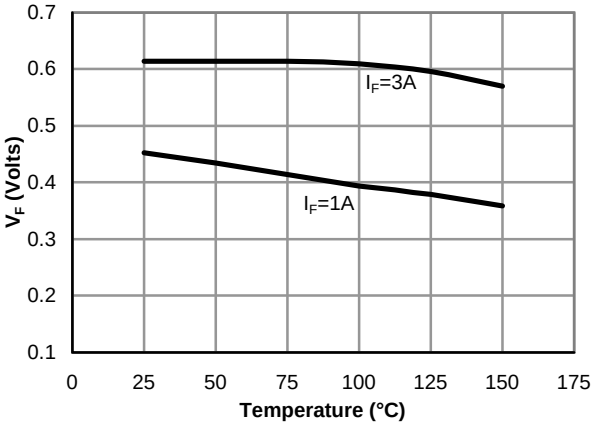

Figure 14: Schottky Forward Drop vs. Junction Temperature

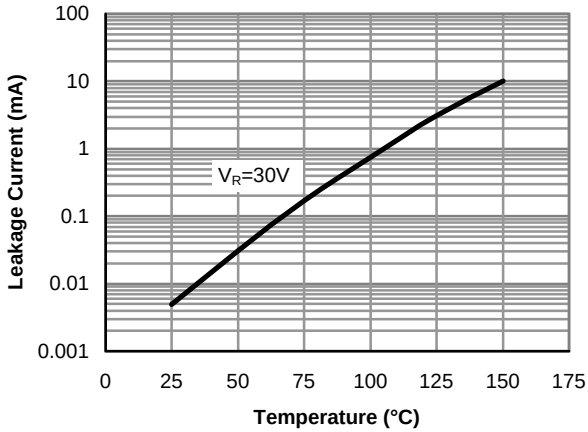

Figure 15: Schottky Leakage current vs. Junction Temperature

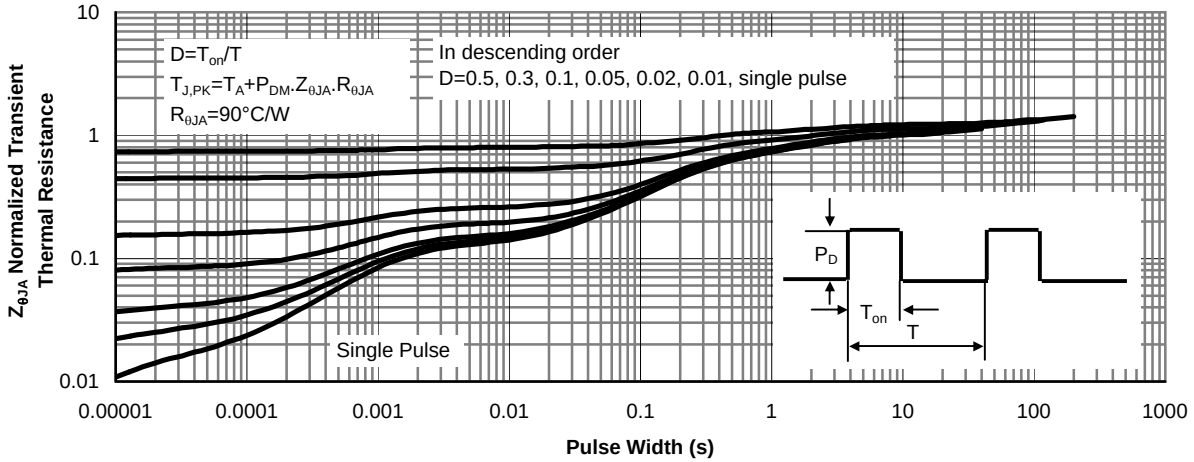

Figure 15: Schottky Normalized Maximum Transient Thermal Impedance