

AO3701

P-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

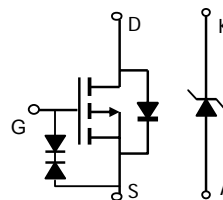
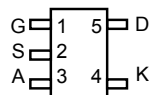
General Description

The AO3701 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, or for DC-DC conversion applications. It is ESD protected. *Standard Product AO3701 is Pb-free (meets ROHS & Sony 259 specifications). AO3701L is a Green Product ordering option. AO3701 and AO3701L are electrically identical.*

Features

$V_{DS} (V) = -20V$
 $I_D = -3A (V_{GS} = -10V)$
 $R_{DS(ON)} < 80m\Omega (V_{GS} = -10V)$
 $R_{DS(ON)} < 100m\Omega (V_{GS} = -4.5V)$
 $R_{DS(ON)} < 145m\Omega (V_{GS} = -2.5V)$
 ESD Rating: 2000V HBM
SCHOTTKY
 $V_{DS} (V) = 20V, I_F = 1A, V_F < 0.5V @ 0.5A$

SOT-23-5
Top View



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

Parameter	Symbol	MOSFET	Schottky	Units
Drain-Source Voltage	V_{DS}	-20		V
Gate-Source Voltage	V_{GS}	± 12		V
Continuous Drain Current ^A	I_D	$T_A=25^\circ C$	-3	A
		$T_A=70^\circ C$	-2.3	
Pulsed Drain Current ^B	I_{DM}	-10		
Schottky reverse voltage	V_{KA}		20	V
Continuous Forward Current ^A	I_F	$T_A=25^\circ C$	2	A
		$T_A=70^\circ C$	1	
Pulsed Forward Current ^B	I_{FM}		10	
Power Dissipation	P_D	$T_A=25^\circ C$	1.14	W
		$T_A=70^\circ C$	0.72	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ C$

Parameter: Thermal Characteristics MOSFET	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A $t \leq 10s$	$R_{\theta JA}$	80.3	110	$^\circ C/W$
Maximum Junction-to-Ambient ^A Steady-State		117	150	
Maximum Junction-to-Lead ^C Steady-State	$R_{\theta JL}$	43	80	
Thermal Characteristics Schottky				
Maximum Junction-to-Ambient ^A $t \leq 10s$	$R_{\theta JA}$	109.4	135	$^\circ C/W$
Maximum Junction-to-Ambient ^A Steady-State		136.5	175	
Maximum Junction-to-Lead ^C Steady-State	$R_{\theta JL}$	58.5	80	

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	-20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-16V, V _{GS} =0V T _J =55°C			-0.5 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±10V			±1	μA
		V _{DS} =0V, V _{GS} =±12V			±10	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250μA	-0.6	-0.9	-1.4	V
I _{D(ON)}	On state drain current	V _{GS} =-4.5V, V _{DS} =-5V	-10			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-10V, I _D =-3A T _J =125°C		65 91	80 110	mΩ
		V _{GS} =-4.5V, I _D =-2A		82	100	mΩ
		V _{GS} =-2.5V, I _D =-1A		117	145	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-3A		6.8		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V	-0.65	-0.8	-0.95	V
I _S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-10V, f=1MHz		512	620	pF
C _{oss}	Output Capacitance		77		pF	
C _{rss}	Reverse Transfer Capacitance		62		pF	
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		9.2	13	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-10V, I _D =-3A		5.5	6.6	nC
Q _{gs}	Gate Source Charge		0.8		nC	
Q _{gd}	Gate Drain Charge		1.9		nC	
t _{D(on)}	Turn-On DelayTime	V _{GS} =-10V, V _{DS} =-10V, R _L =2.8Ω, R _{GEN} =3Ω		5		ns
t _r	Turn-On Rise Time		6.7		ns	
t _{D(off)}	Turn-Off DelayTime		28		ns	
t _f	Turn-Off Fall Time		13.5		ns	
t _{rr}	Body Diode Reverse Recovery Time	I _F =-3A, dI/dt=100A/μs		9.8	12	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-3A, dI/dt=100A/μs		2.7		nC
SCHOTTKY PARAMETERS						
V _F	Forward Voltage Drop	I _F =0.5A		0.39	0.45	V
I _{rm}	Maximum reverse leakage current	V _R =16V			0.1	mA
		V _R =16V, T _J =125°C			20	
C _T	Junction Capacitance	V _R =10V		34		pF
t _{rr}	Schottky Reverse Recovery Time	I _F =1A, dI/dt=100A/μs		5.2	10	ns
Q _{rr}	Schottky Reverse Recovery Charge	I _F =1A, dI/dt=100A/μs		0.8		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_θ ≤ 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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Alpha & Omega Semiconductor, Ltd.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

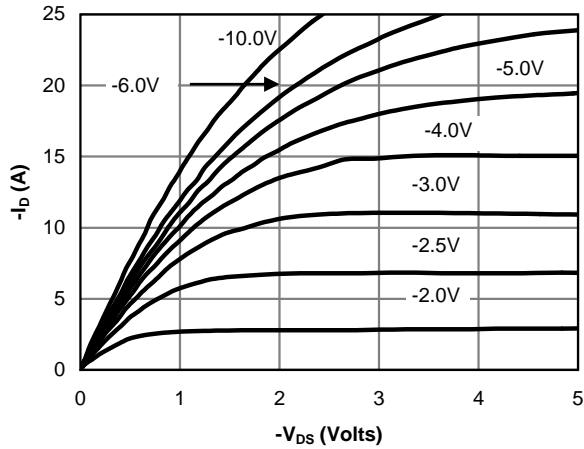


Fig 1: On-Region Characteristics

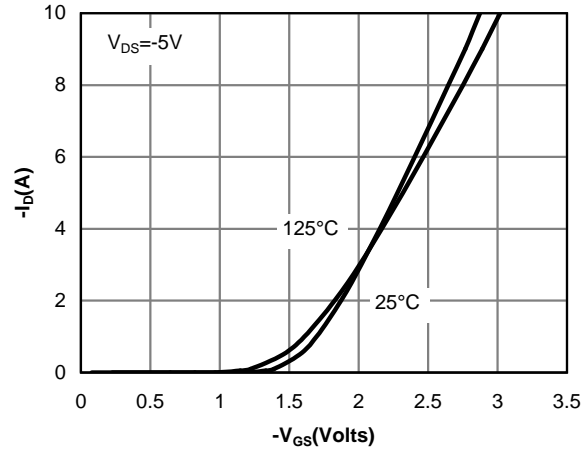


Figure 2: Transfer Characteristics

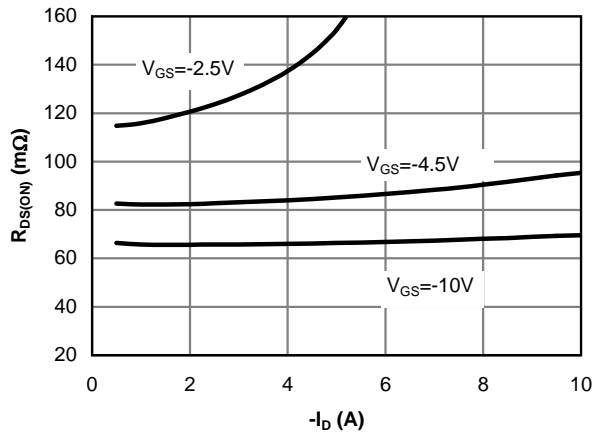


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

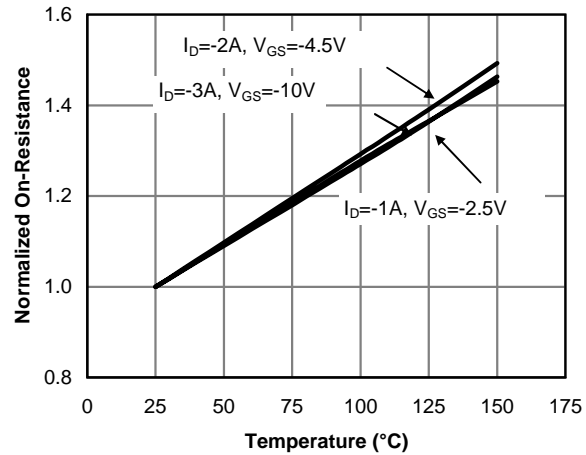


Figure 4: On-Resistance vs. Junction Temperature

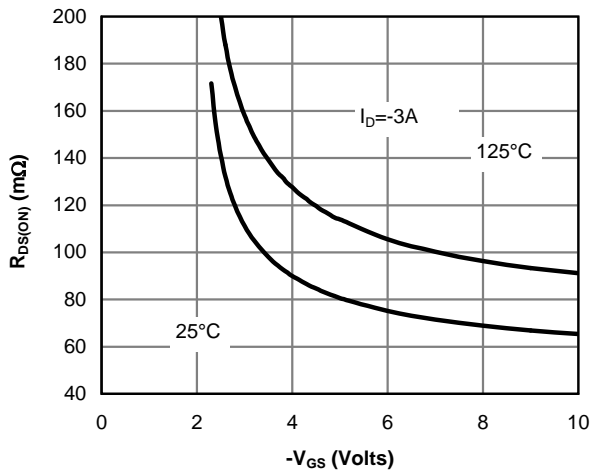


Figure 5: On-Resistance vs. Gate-Source Voltage

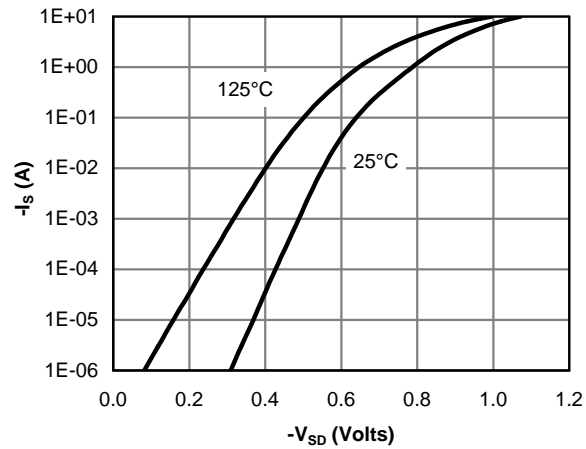


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

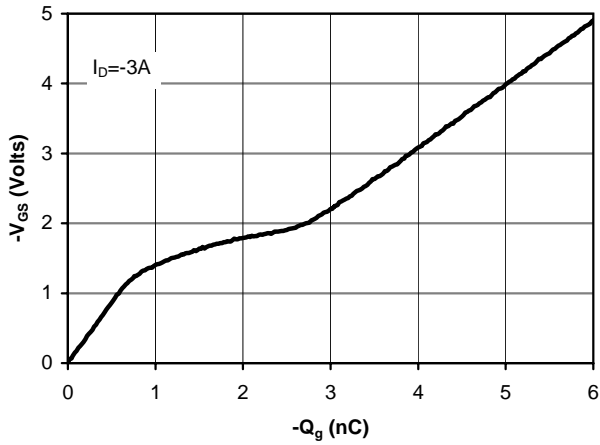


Figure 7: Gate-Charge Characteristics

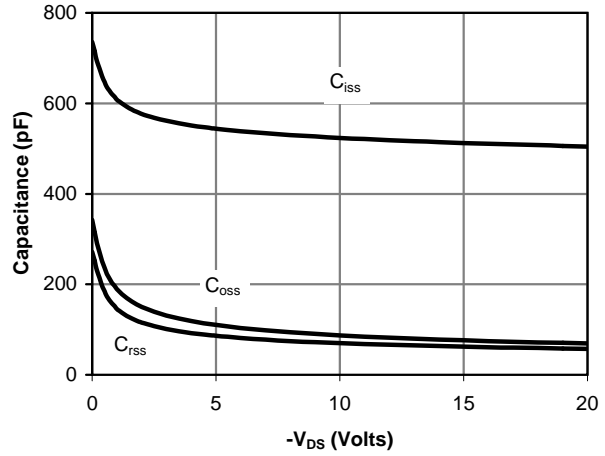


Figure 8: Capacitance Characteristics

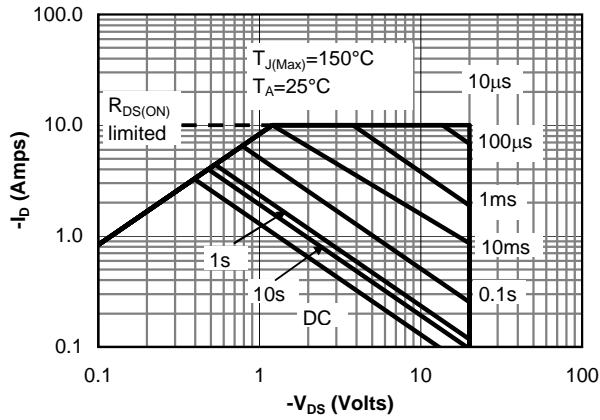


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

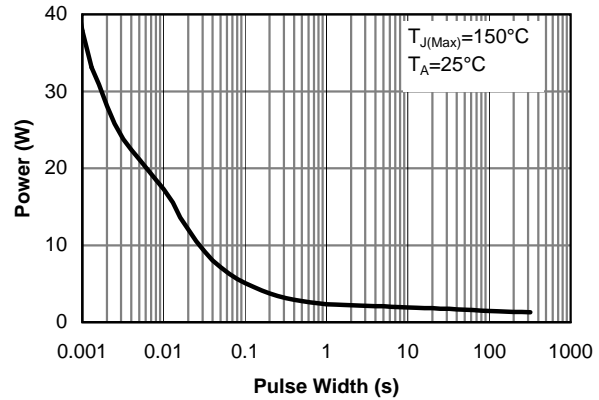


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

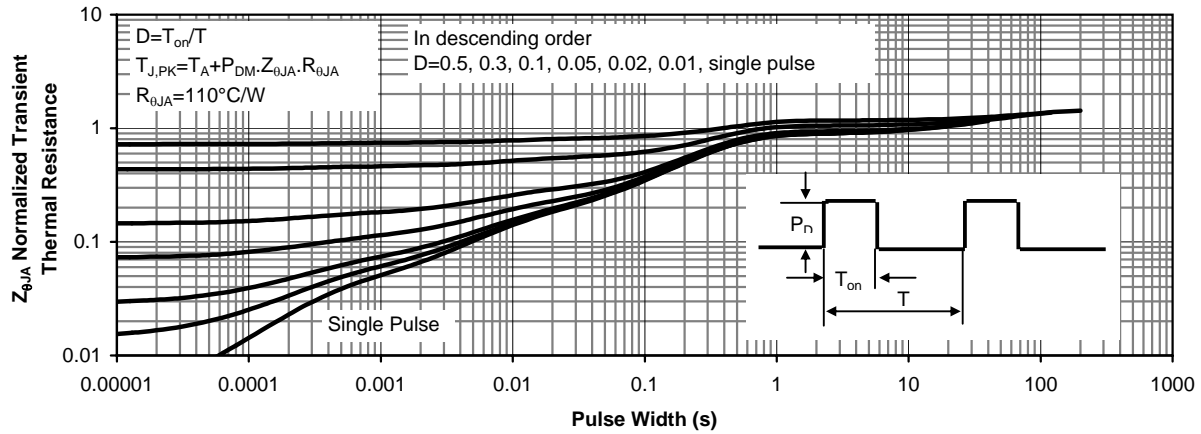


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

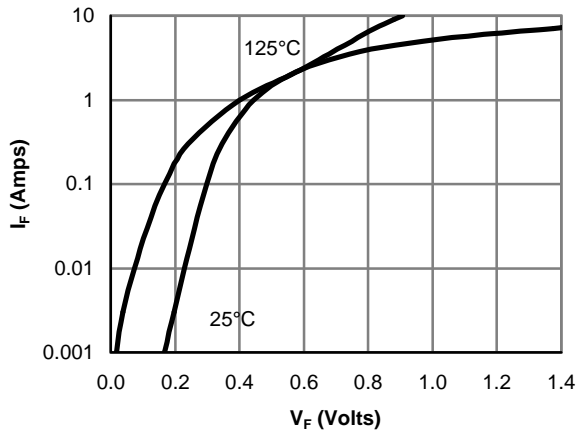


Figure 12: Schottky Forward Characteristics

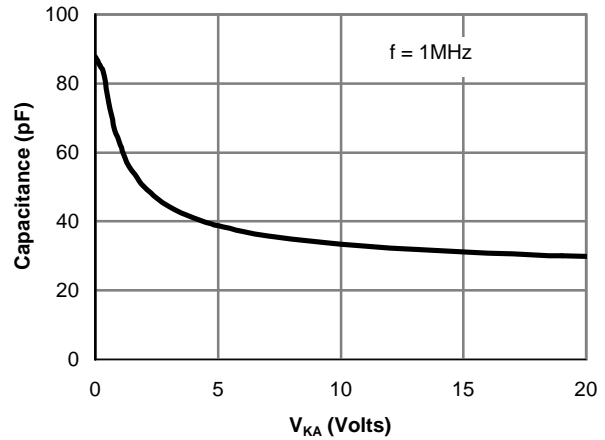


Figure 13: Schottky Capacitance Characteristics

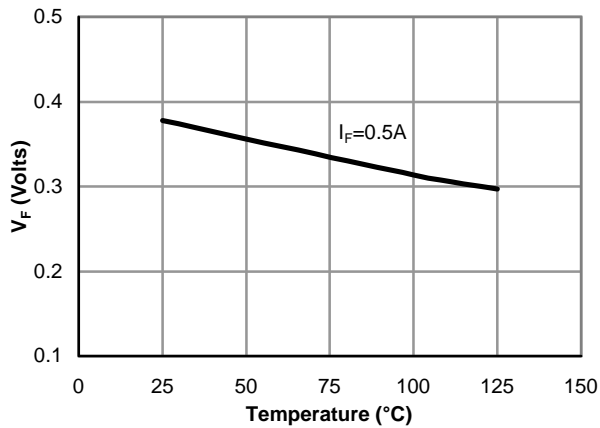


Figure 14: Schottky Forward Drop vs. Junction Temperature

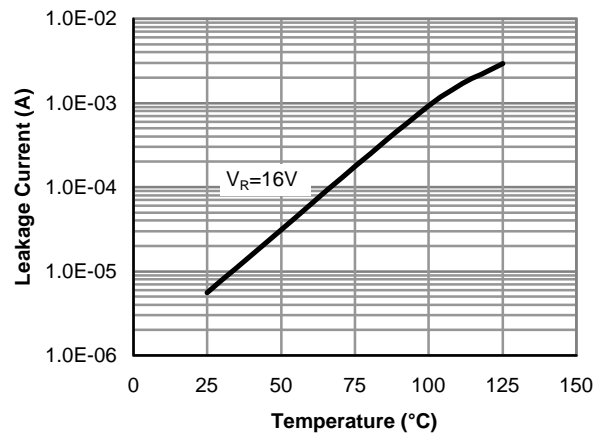


Figure 15: Schottky Leakage current vs. Junction Temperature

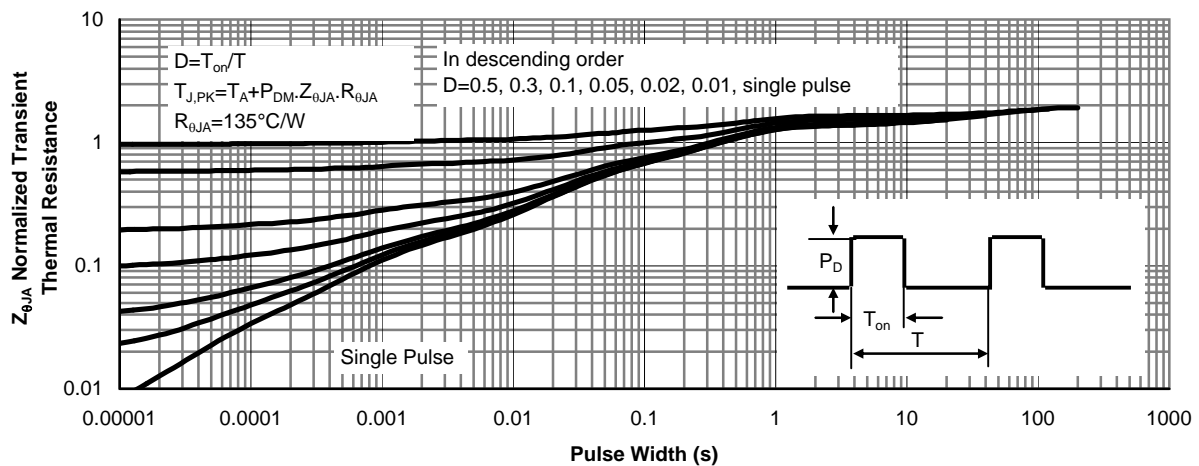


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance