ALPHA & OMEGA
SEMICONDUCTOR

AO4701

30V P-Channel MOSFET with Schottky Diode

General Description

The AO4701 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.

Product Summary

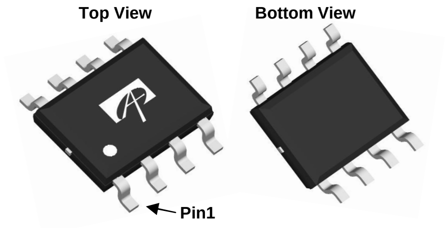
V_{DS}	-30V
I_D (at V_{GS}=-10V)	-5A
$R_{DS(ON)}$ (at V_{GS}=-10V)	< 48mΩ
$R_{DS(ON)}$ (at V_{GS} =-4.5V)	< 57mΩ
$R_{DS(ON)}$ (at V_{GS} =-2.5V)	< 80mΩ

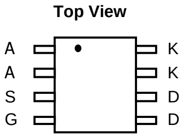
100% UIS Tested
100% R_g Tested

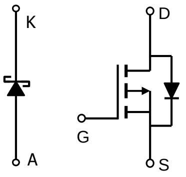
Schottky

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

SOIC-8







Absolute Maximum Ratings T_A=25℃ **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	T_A=25℃	I_D	-5		A
	T_A=70℃		-4		
Pulsed Drain Current [C]		I_{DM}	-25		
Avalanche Current [C]		I_{AS}, I_{AR}	18		A
Avalanche energy L=0.1mH [C]		E_{AS}, E_{AR}	16		mJ
Schottky reverse voltage		V_{KA}		30	V
Continuous Forward Current	T_A=25℃	I_F		4.4	A
	T_A=70℃			3.2	
Power Dissipation [B]	T_A=25℃	P_D	2	2	W
	T_A=70℃		1.3	1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	℃

Thermal Characteristics					
Parameter: MOSFET		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	48	62.5	℃/W
Maximum Junction-to-Ambient [A D]	Steady-State		74	90	℃/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	32	40	℃/W
Parameter: Schottky					
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	49	62.5	℃/W
Maximum Junction-to-Ambient [A D]	Steady-State		72	90	℃/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	31	40	℃/W

Electrical Characteristics (T_J=25℃ 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}=-30V, V_{GS}=0V			-1	µA
		T_J=55℃			-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	-0.5	-0.9	-1.3	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-5A		40	48	mΩ
		T_J=125℃		60	72	
		V_{GS}=-4.5V, I_D=-4A		45	57	mΩ
		V_{GS}=-2.5V, I_D=-1A		60	80	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5A		18		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		-0.7	-1	V
I_S	Maximum Body-Diode Continuous Current				-2.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		645	780	pF
C_{oss}	Output Capacitance			80		pF
C_{rss}	Reverse Transfer Capacitance			55		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	4	7.8	12	Ω
SWITCHING PARAMETERS						
Q_g(4.5V)	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-15V, I_D=-5A		7		nC
Q_{gs}	Gate Source Charge			1.5		nC
Q_{gd}	Gate Drain Charge			2.5		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=3Ω, R_{GEN}=3Ω		6.5		ns
t_r	Turn-On Rise Time			3.5		ns
$t_{D(off)}$	Turn-Off DelayTime			41		ns
t_f	Turn-Off Fall Time			9		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5A, dI/dt=100A/µs		11		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5A, dI/dt=100A/µs		3.5		nC
SCHOTTKY PARAMETERS						
V_F	Forward Voltage Drop	I_F=1A		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℃		3.2	10	
		V_R=30V, T_J=150℃		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℃. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on $T_{J(MAX)}$=150℃, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150℃. Ratings are based on low frequency and duty cycles to keep initialT_J=25℃.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedence which is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150℃. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

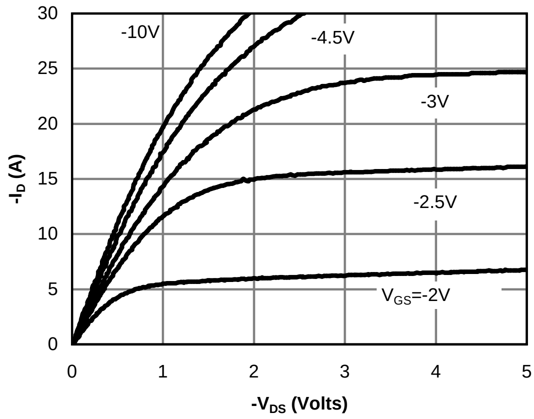


Fig 1: On-Region Characteristics (Note E)

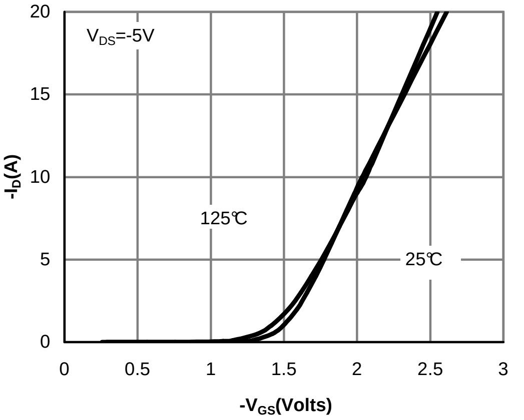


Figure 2: Transfer Characteristics (Note E)

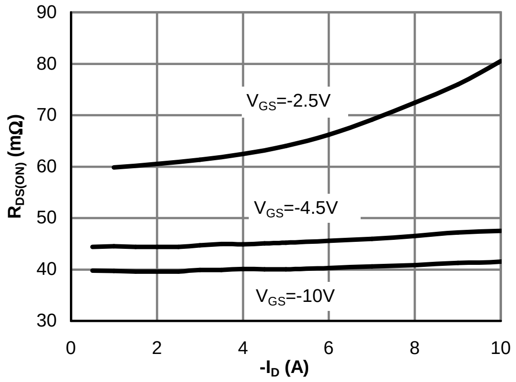


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

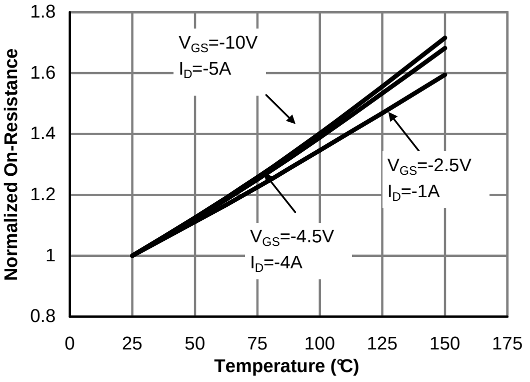


Figure 4: On-Resistance vs. Junction Temperature (Note E)

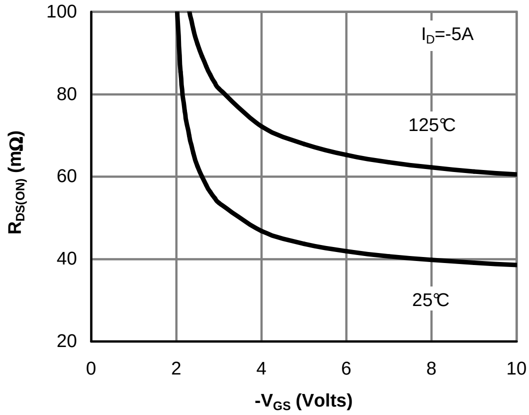


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

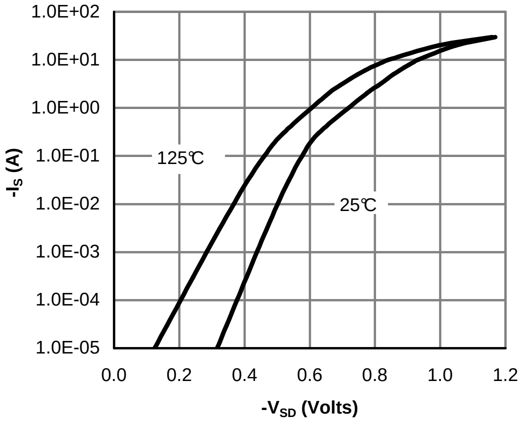


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

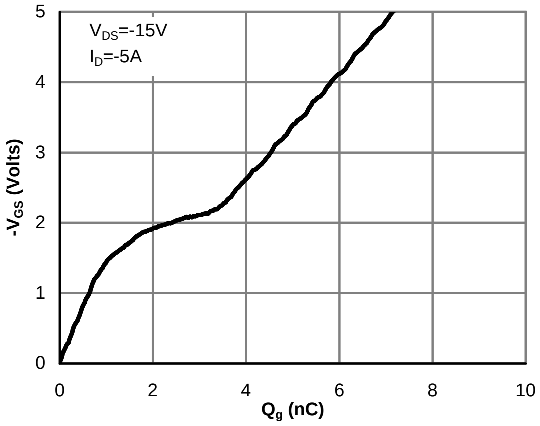


Figure 7: Gate-Charge Characteristics

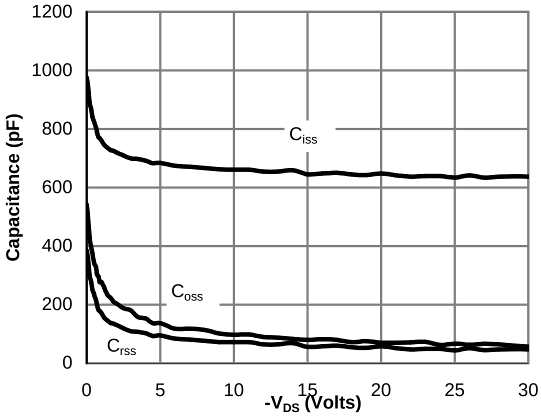


Figure 8: Capacitance Characteristics

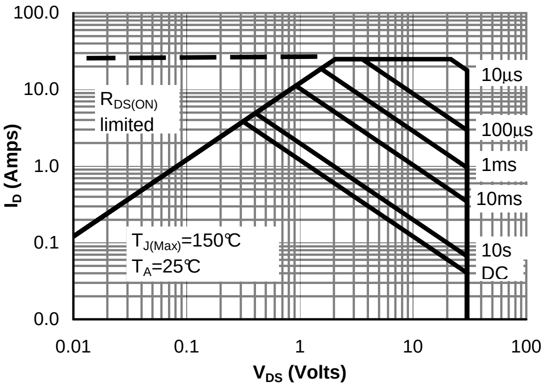


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

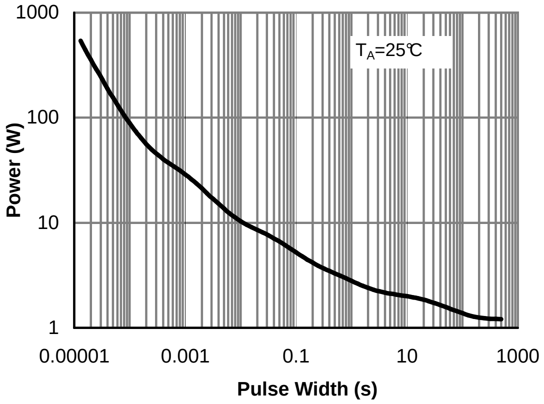


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

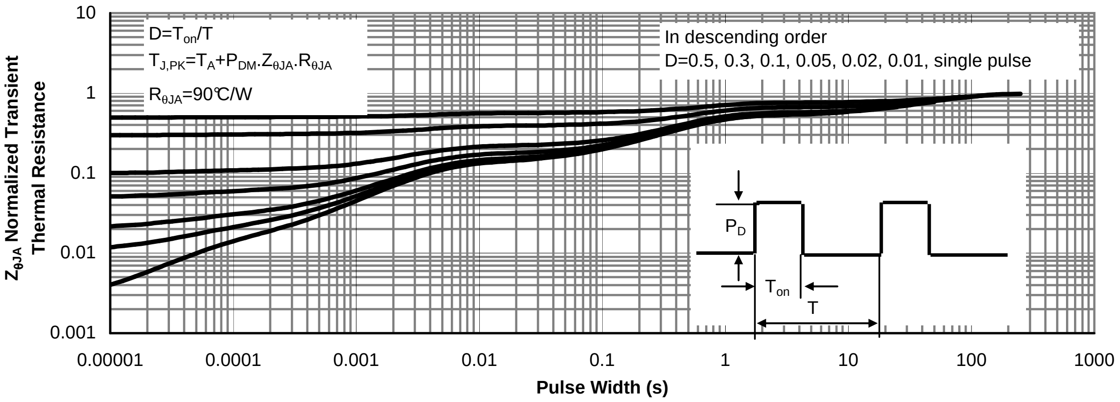


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

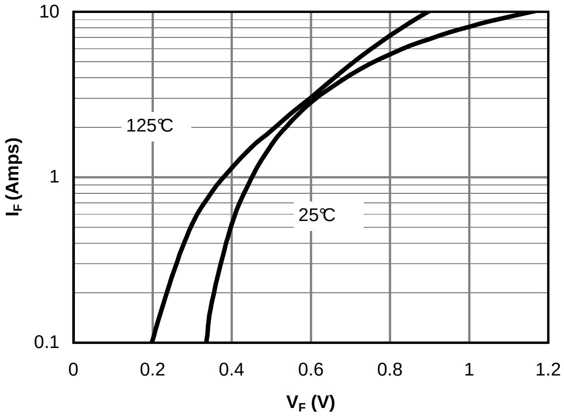


Figure 12: Schottky Forward Characteristics

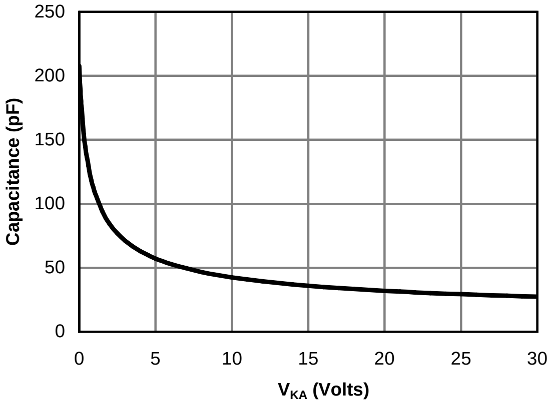


Figure 13: Schottky Capacitance Characteristics

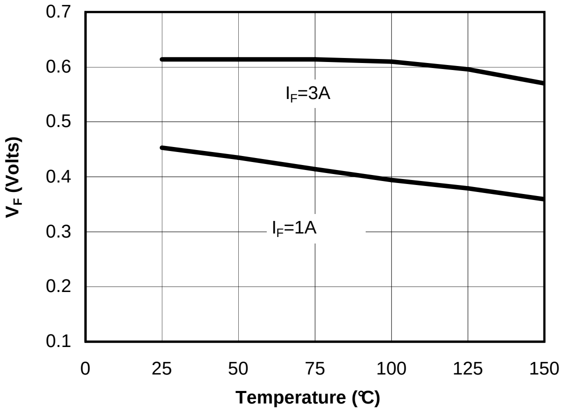


Figure 14: Schottky Forward Drop vs. Junction Temperature

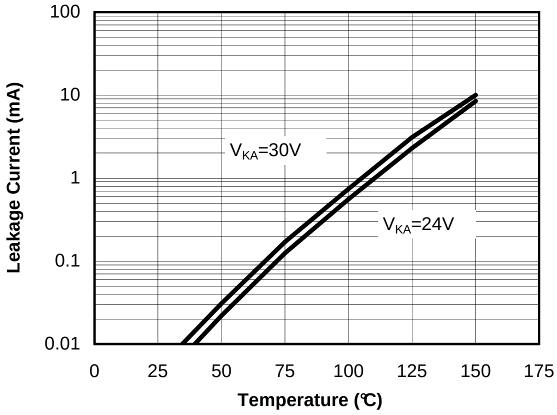
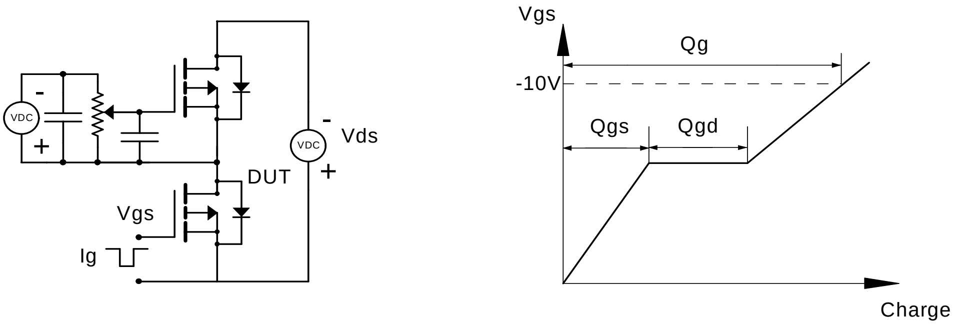
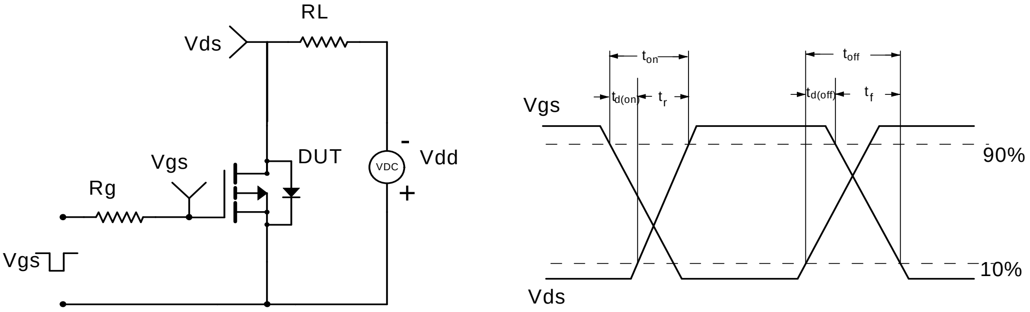


Figure 15: Schottky Leakage Current vs. Junction Temperature

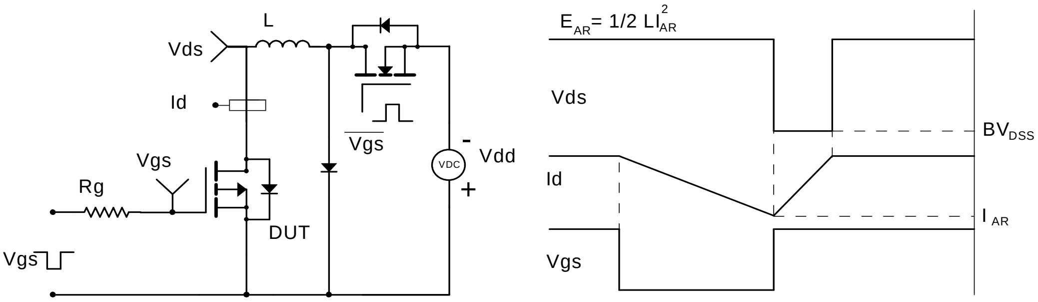
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms