

**AO4709**
**P-Channel Enhancement Mode Field Effect Transistor with Schottky Diode**
**General Description**

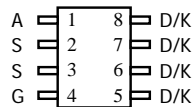
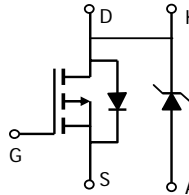
The AO4709 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. A Schottky diode is provided to facilitate the implementation of non-synchronous DC-DC converters. *Standard Product AO4709 is Pb-free (meets ROHS & Sony 259 specifications). AO4709L is a Green Product ordering option. AO4709 and AO4709L are electrically identical.*

**Features**

$V_{DS} (V) = -30V$   
 $I_D = -8A (V_{GS} = -10V)$   
 $R_{DS(ON)} < 33m\Omega (V_{GS} = -10V)$   
 $R_{DS(ON)} < 56m\Omega (V_{GS} = -4.5V)$

**SCHOTTKY**

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


**SOIC-8**

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

Parameter	Symbol	MOSFET	Schottky	Units
Drain-Source Voltage	$V_{DS}$	-30		V
Gate-Source Voltage	$V_{GS}$	$\pm 20$		V
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ C$	-8	A
		$T_A=70^\circ C$	-6.6	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-40		
Schottky reverse voltage	$V_{KA}$		30	V
Continuous Forward Current <sup>A</sup>	$I_F$	$T_A=25^\circ C$	4.4	A
		$T_A=70^\circ C$	3.2	
Pulsed Forward Current <sup>B</sup>	$I_{FM}$		30	
Power Dissipation	$P_D$	$T_A=25^\circ C$	3	W
		$T_A=70^\circ C$	2	
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 <sup>A</sup>	$t \leq 10s$	$R_{\theta JA}$	24	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		54	75	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	21	30	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10s$	$R_{\theta JA}$	36	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		67	75	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	25	30	

Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-1.2	-2	-2.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-8\text{A}$ $T_J=125^\circ\text{C}$		24.5 33	33	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$ , $I_D=-5\text{A}$		41	56	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-8\text{A}$		14.5		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.76	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-4.2	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance			920		pF
$C_{oss}$	Output Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		190		pF
$C_{rss}$	Reverse Transfer Capacitance			122		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		3.6		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge (10V)			18.4		nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-8\text{A}$		9.3		nC
$Q_{gs}$	Gate Source Charge			2.7		nC
$Q_{gd}$	Gate Drain Charge			4.9		nC
$t_{D(on)}$	Turn-On Delay Time			7.1		ns
$t_r$	Turn-On Rise Time	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=1.8\Omega$ , $R_{GEN}=3\Omega$		3.4		ns
$t_{D(off)}$	Turn-Off Delay Time			18.9		ns
$t_f$	Turn-Off Fall Time			8.4		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-8\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$		21.5		ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-8\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$		12.5		nC
<b>SCHOTTKY PARAMETERS</b>						
$V_F$	Forward Voltage Drop	$I_F=1.0\text{A}$		0.45	0.5	V
$I_{rm}$	Maximum reverse leakage current	$V_R=30\text{V}$ $V_R=30\text{V}$ , $T_J=125^\circ\text{C}$ $V_R=30\text{V}$ , $T_J=150^\circ\text{C}$		0.007 3.2 12	0.05 10 20	$\text{mA}$
$C_T$	Junction Capacitance	$V_R=15\text{V}$		37		pF

A: The value of  $R_{\theta JA}$  is measured with the device mounted on  $1\text{in}^2$  FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $t \leq 10\text{s}$  thermal resistance rating.

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

C: The  $R_{\theta JA}$  is the sum of the thermal impedance 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  $80\mu\text{s}$  pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on  $1\text{in}^2$  FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating. Rev 4: Sept 2005

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P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

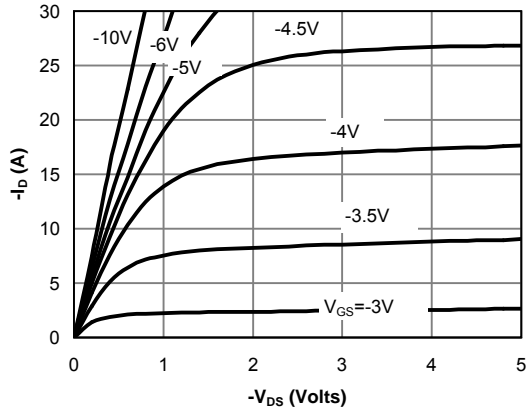


Fig 1: On-Region Characteristics

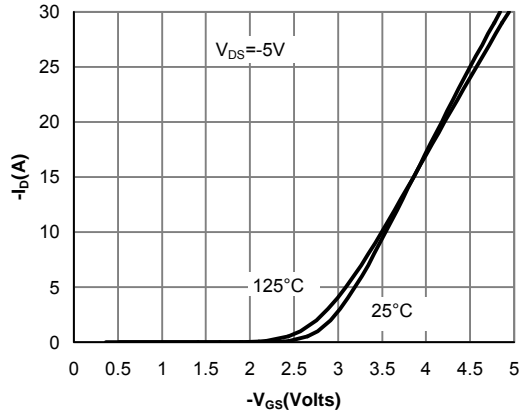


Figure 2: Transfer Characteristics

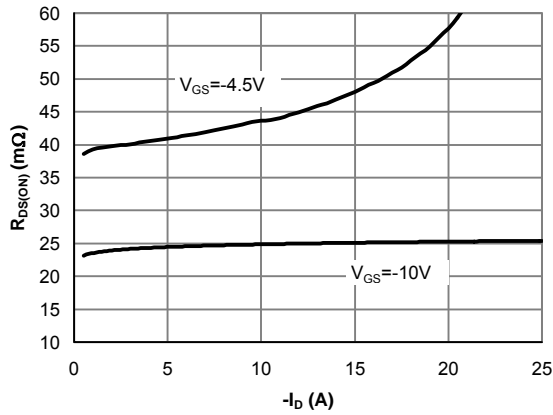


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

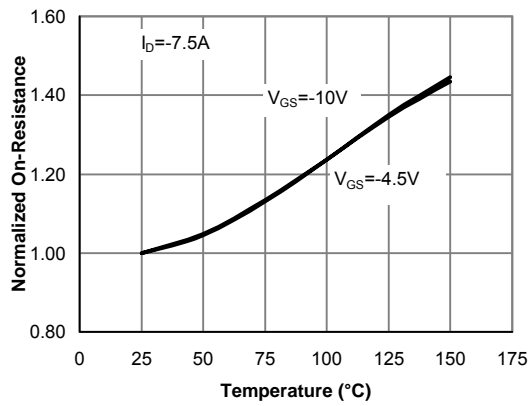


Figure 4: On-Resistance vs. Junction Temperature

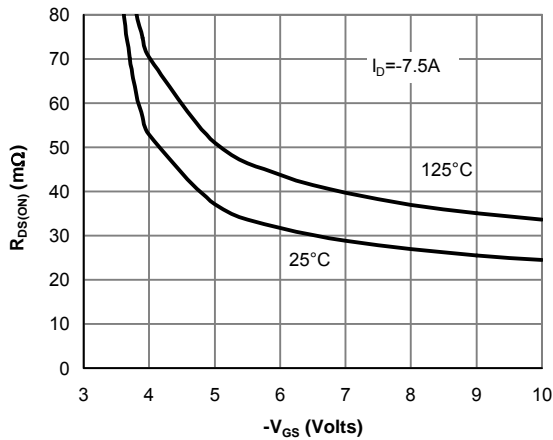


Figure 5: On-Resistance vs. Gate-Source Voltage

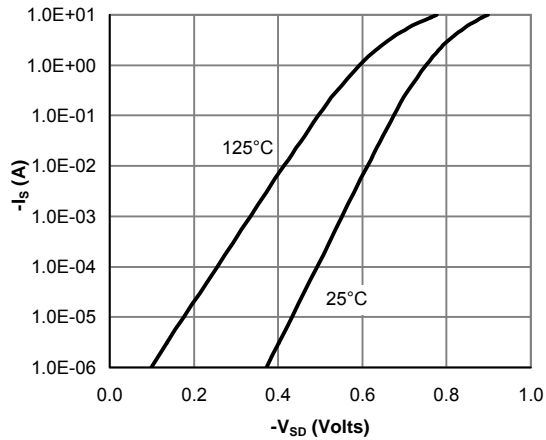


Figure 6: Body-Diode Characteristics

P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

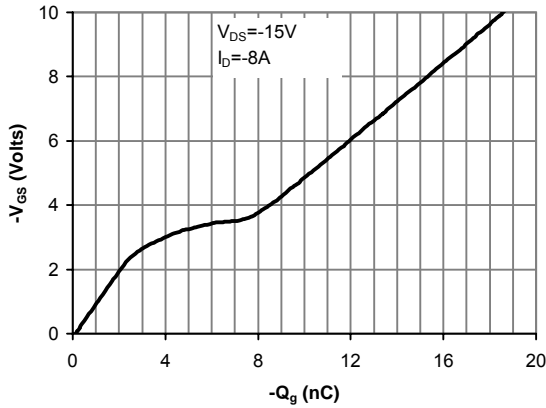


Figure 7: Gate-Charge Characteristics

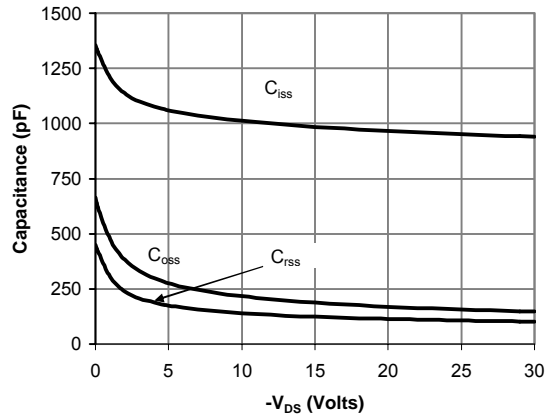


Figure 8: Capacitance Characteristics

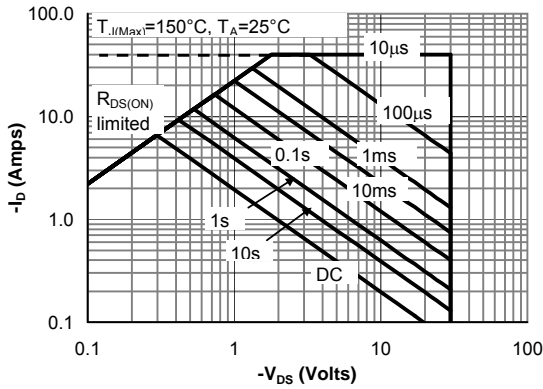


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

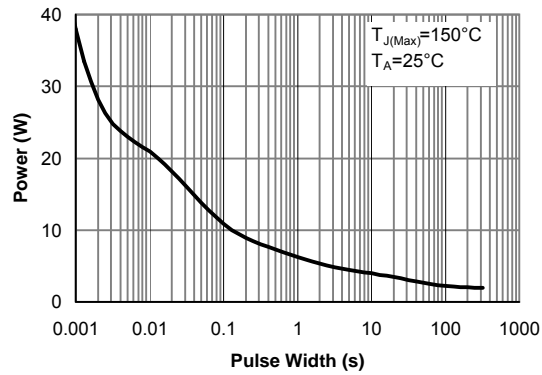


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

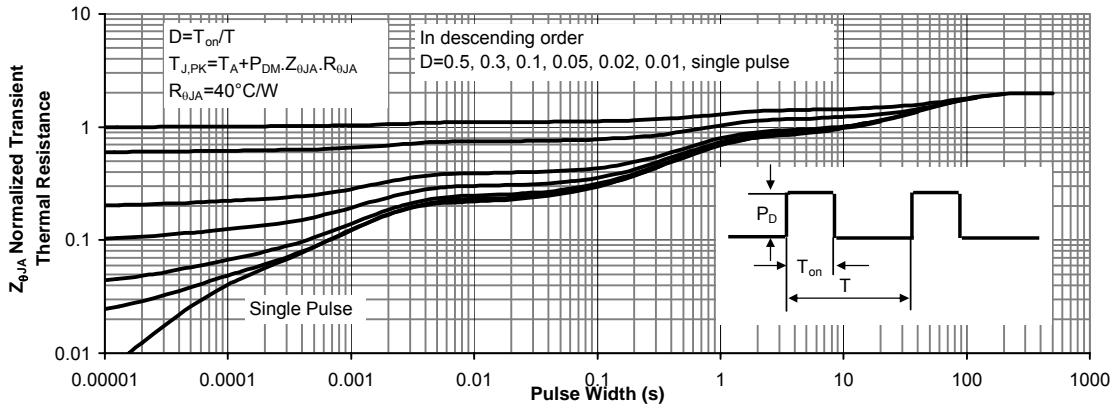


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

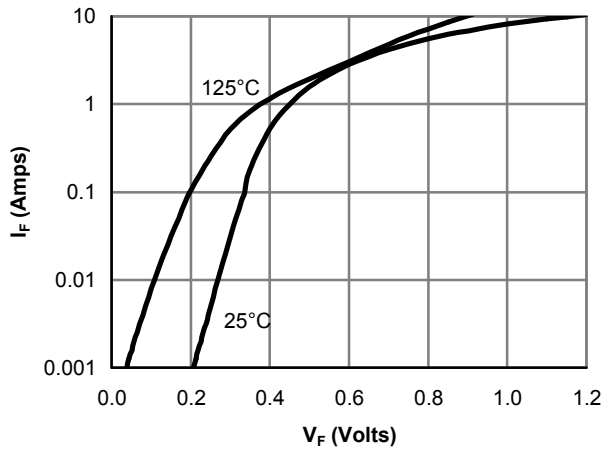


Figure 12: Schottky Forward Characteristics

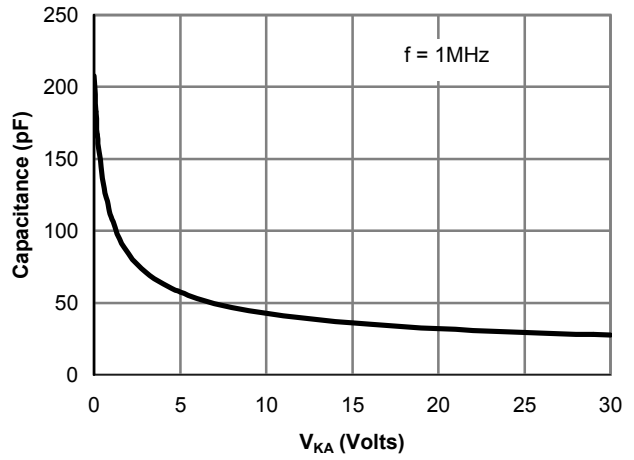


Figure 13: Schottky Capacitance Characteristics

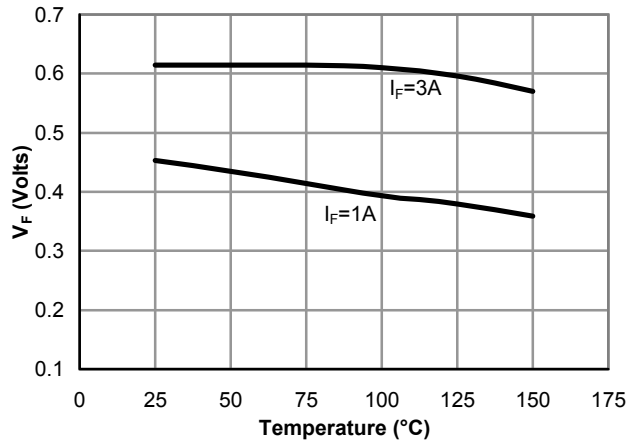


Figure 14: Schottky Forward Drop vs. Junction Temperature

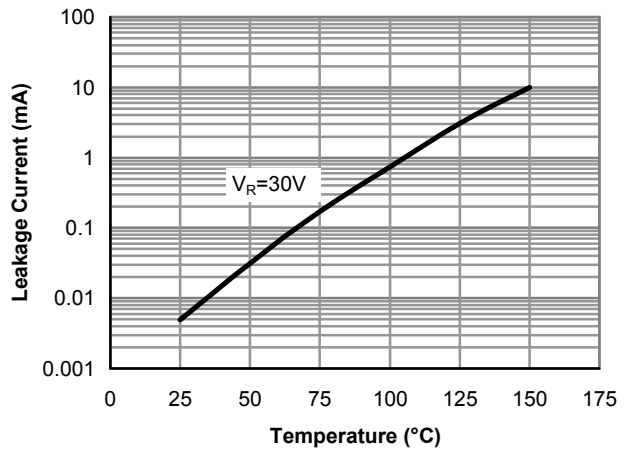


Figure 15: Schottky Leakage current vs. Junction Temperature

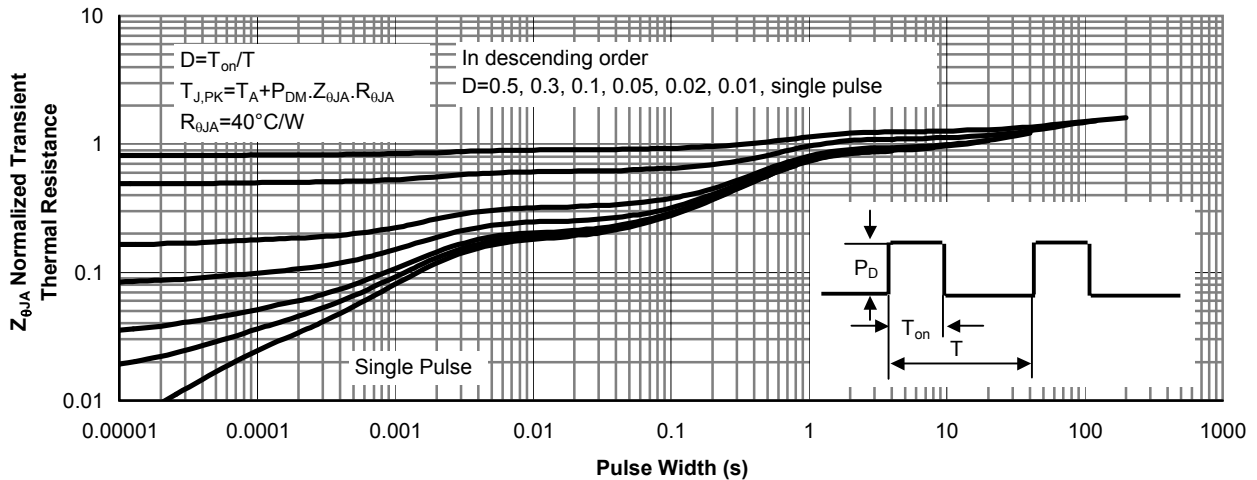


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance