

AO4904
Dual N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode
General Description

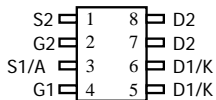
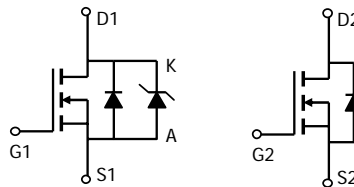
The AO4904 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A Schottky diode is co-packaged in parallel with the synchronous MOSFET to boost efficiency further. *Standard Product AO4904 is Pb-free (meets ROHS & Sony 259 specifications). AO4904L is a Green Product ordering option. AO4904 and AO4904L are electrically identical.*

Features

$V_{DS} (V) = 30V$
 $I_D = 6.9A (V_{GS} = 10V)$
 $R_{DS(ON)} < 27m\Omega (V_{GS} = 10V)$
 $R_{DS(ON)} < 32m\Omega (V_{GS} = 4.5V)$
 $R_{DS(ON)} < 50m\Omega (V_{GS} = 2.5V)$

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}	± 12		V
Continuous Drain Current ^A	I_D	$T_A=25^\circ C$	6.9	A
		$T_A=70^\circ C$	5.8	
Pulsed Drain Current ^B	I_{DM}	40		
Schottky reverse voltage	V_{KA}		30	V
Continuous Forward Current ^A	I_F	$T_A=25^\circ C$	3	A
		$T_A=70^\circ C$	2	
Pulsed Forward Current ^B	I_{FM}		40	
Power Dissipation	P_D	$T_A=25^\circ C$	2	W
		$T_A=70^\circ C$	1.44	
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	$t \leq 10s$	$R_{\theta JA}$	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient ^A	Steady-State		74	110	
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	35	40	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	47.5	62.5	$^\circ C/W$
Maximum Junction-to-Ambient ^A	Steady-State		71	110	
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	32	40	

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
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	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 12\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	0.7	1	1.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}$, $V_{DS}=5\text{V}$	25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$, $I_D=6.9\text{A}$ $T_J=125^\circ\text{C}$		22.6 33	27 40	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}$, $I_D=6.0\text{A}$		27	32	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}$, $I_D=5\text{A}$		42	50	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}$, $I_D=5\text{A}$	12	16		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}$		0.71	1	V
I_S	Maximum Body-Diode Continuous Current				3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance			846	1050	pF
C_{oss}	Output Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=15\text{V}$, $f=1\text{MHz}$		96		pF
C_{rss}	Reverse Transfer Capacitance			67		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		1.24	3.6	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge			9.6	12	nC
Q_{gs}	Gate Source Charge	$V_{GS}=4.5\text{V}$, $V_{DS}=15\text{V}$, $I_D=6.9\text{A}$		1.65		nC
Q_{gd}	Gate Drain Charge			3		nC
$t_{D(on)}$	Turn-On Delay Time			5.7	8.55	ns
t_r	Turn-On Rise Time	$V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $R_L=2.2\Omega$, $R_{GEN}=3\Omega$		13	6.2	ns
$t_{D(off)}$	Turn-Off Delay Time			37	40	ns
t_f	Turn-Off Fall Time			4.2	5.5	ns
t_{rr}	Body Diode Reverse Recovery time	$I_F=5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		15.5	20	ns
Q_{rr}	Body Diode Reverse Recovery charge	$I_F=5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		7.9		nC
SCHOTTKY PARAMETERS						
V_F	Forward Voltage Drop	$I_F=1.0\text{A}$		0.45	0.5	V
I_{rm}	Maximum reverse leakage current	$V_R=30\text{V}$		0.007	0.05	mA
		$V_R=30\text{V}$, $T_J=125^\circ\text{C}$		3.2	10	
		$V_R=30\text{V}$, $T_J=150^\circ\text{C}$		12	20	
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 1in² 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 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 $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

Rev 3 : August 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

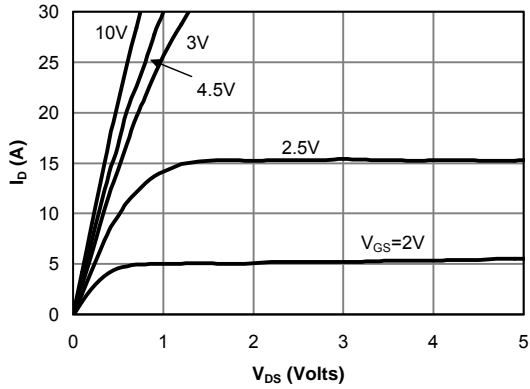


Fig 1: On-Region Characteristics

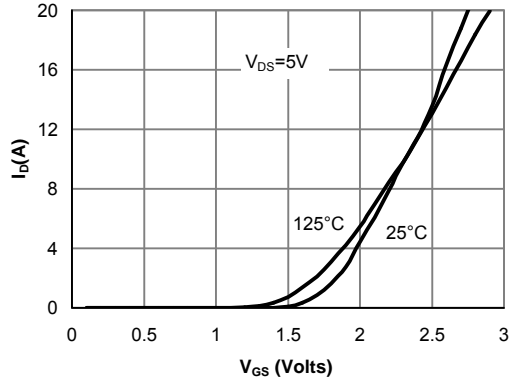


Figure 2: Transfer Characteristics

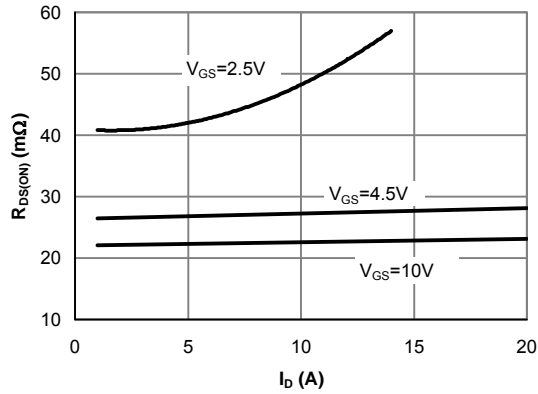


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

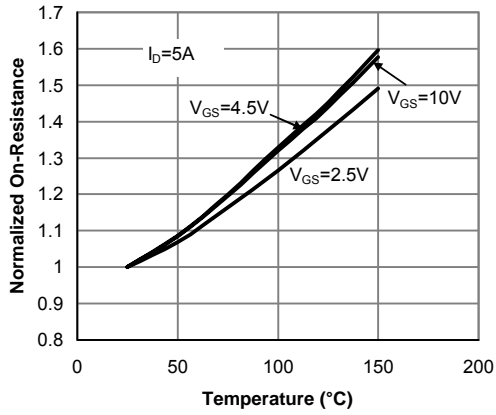


Figure 4: On resistance vs. Junction Temperature

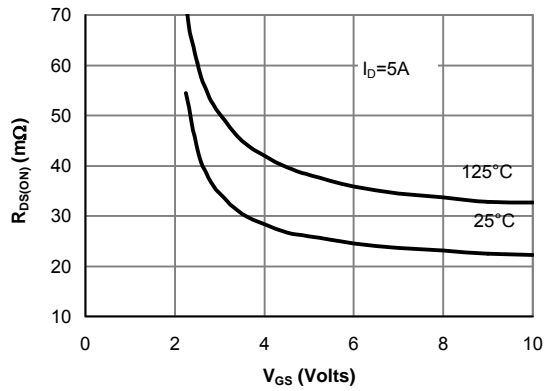


Figure 5: On resistance vs. Gate-Source Voltage

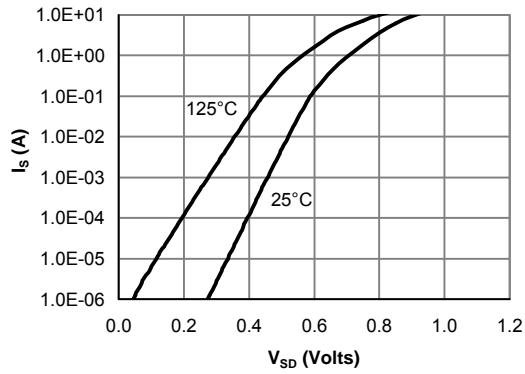


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

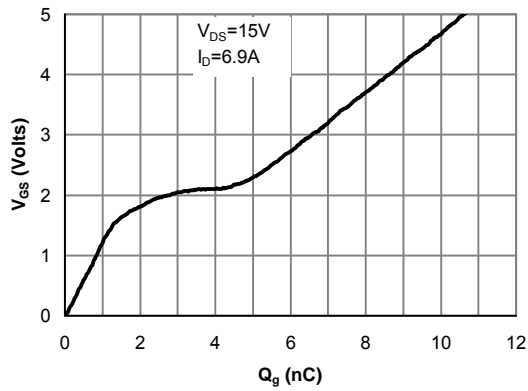


Figure 7: Gate-Charge Characteristics

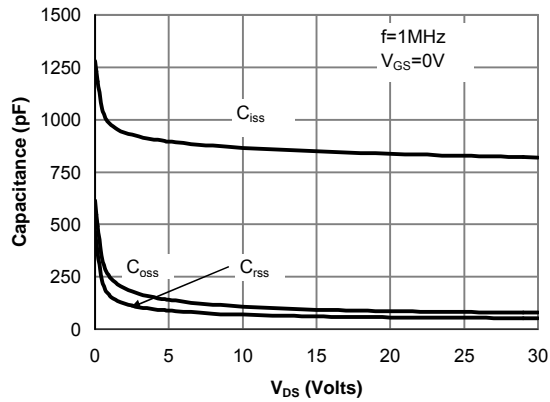


Figure 8: Capacitance Characteristics

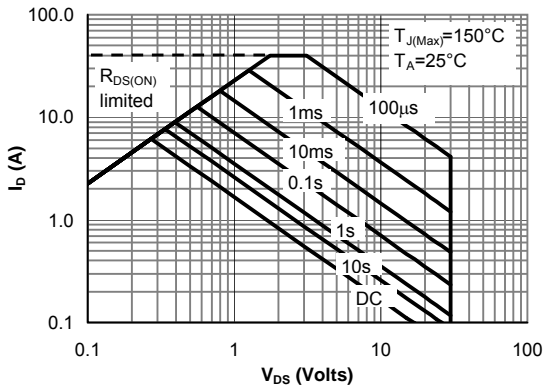


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

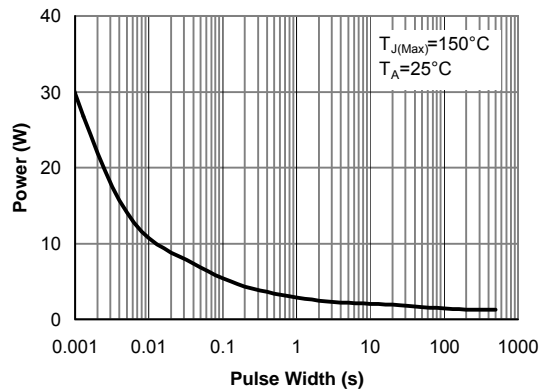


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

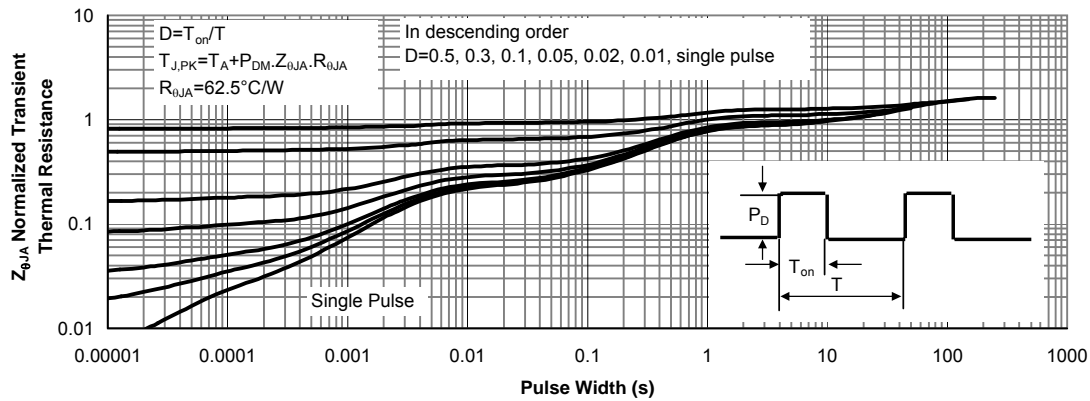


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

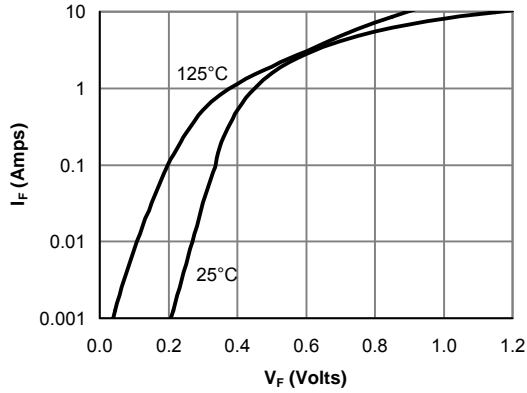


Figure 12: Schottky Forward Characteristics

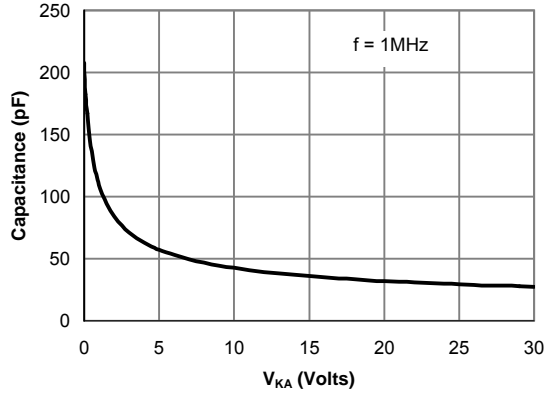


Figure 13: Schottky Capacitance Characteristics

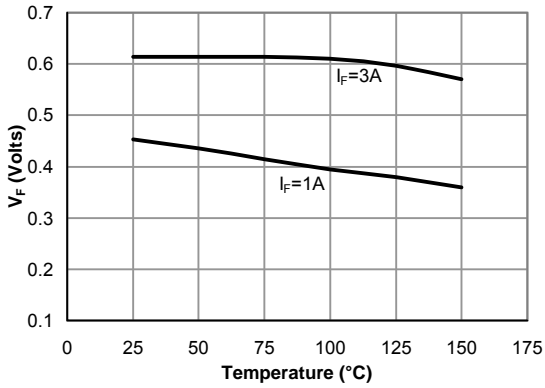


Figure 14: Schottky Forward Drop vs. Junction Temperature

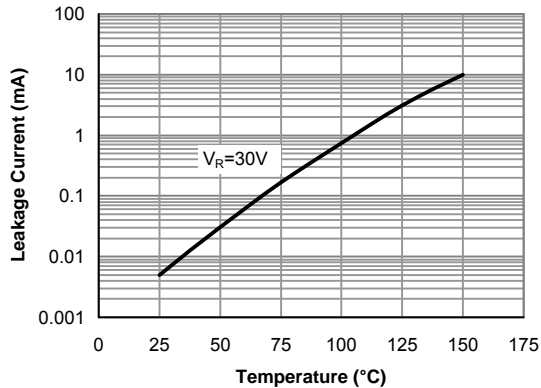


Figure 15: Schottky Leakage current vs. Junction Temperature

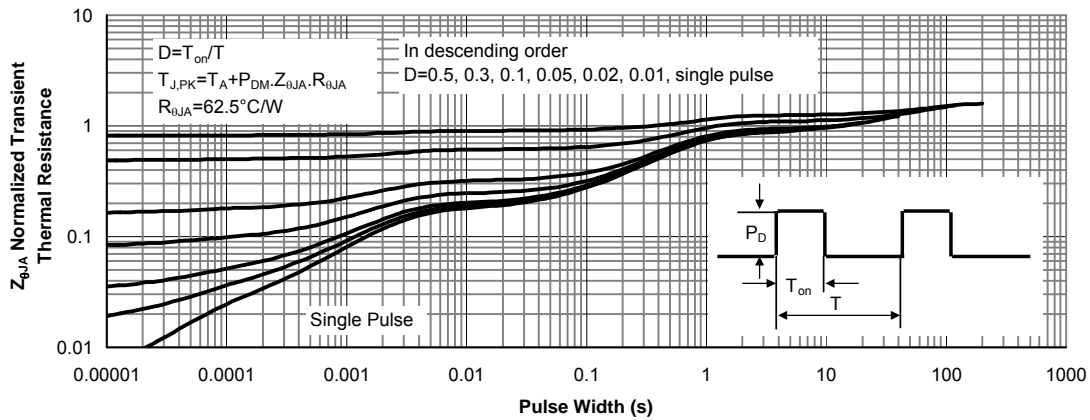


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance