ALPHA & OMEGA SEMICONDUCTOR

AO4704

N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

General Description

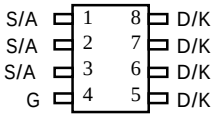
The AO4704 uses advanced trench technology to provide excellent $R_{DS(ON)}$, shoot-through immunity and body diode characteristics.This device is suitable for use as a synchronous switch in PWM applications. The co-packaged Schottky Diode boosts efficiency further. *AO4704 is Pb-free (meets ROHS & Sony 259 specifications). AO4704L is a Green Product ordering option. AO4704 and AO4704L are electrically identical.*

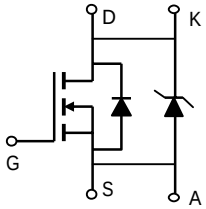
Features

V_{DS} (V) = 30V
I_D = 13 A (V_{GS} = 10V)
$R_{DS(ON)}$ < 11.5mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 13mΩ (V_{GS} = 4.5V)

SCHOTTKY
VDS (V) = 30V, IF = 3A, VF<0.5V@1A

SOIC-8





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	13		A
	T_A=70°C		10.4		
Pulsed Drain Current[B]		I_{DM}	40		
Schottky reverse voltage		V_{KA}		30	V
Continuous Forward Current[A]	T_A=25°C	I_F		4.4	A
	T_A=70°C			3.2	
Pulsed Diode Forward Current[B]		I_{FM}		30	
Power Dissipation	T_A=25°C	P_D	3.1	3.1	W
	T_A=70°C		2	2	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	28	40	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		54	75	°C/W
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	21	30	°C/W

Thermal Characteristics: Schottky					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	36	40	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		67	75	°C/W
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	25	30	°C/W

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 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 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.

F. The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

Rev5: August 2005

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. (Set by Schottky leakage)	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	
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	0.6	1.1	2	V
$I_{D(ON)}$	On state drain current	V_{GS}=4.5V, V_{DS}=5V	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, ID=13A		9.1	11.5	mΩ
		T_J=125°C		13.3	16.5	
		V_{GS}=4.5V, I_D=12.2A		10.5	13	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=13A	30	37		S
V_{SD}	Diode + Schottky Forward Voltage	I_S=1A,V_{GS}=0V		0.45	0.5	V
I_S	Maximum Body-Diode + Schottky Continuous Current				5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		3656	4050	pF
C_{oss}	Output Capacitance (FET+Schottky)			322		pF
C_{rss}	Reverse Transfer Capacitance			168		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		0.86	1.1	Ω
SWITCHING PARAMETERS						
Q_g(4.5V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=13A		30.5	36	nC
Q_{gs}	Gate Source Charge			4.6		nC
Q_{gd}	Gate Drain Charge			8.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=1.1Ω, R_{GEN}=0Ω		6.2	9	ns
t_r	Turn-On Rise Time			4.8	7	ns
$t_{D(off)}$	Turn-Off DelayTime			55	75	ns
t_f	Turn-Off Fall Time			7.3	11	ns
t_{rr}	Body Diode+Schottky Reverse Recovery Time	I_F=13A, dI/dt=100A/µs		20.3	25	ns
Q_{rr}	Body Diode+Schottky Reverse Recovery Charge	I_F=13A, dI/dt=100A/µs		8.4	12.5	nC

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 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 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.

F. The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately

Rev5: August 2005.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

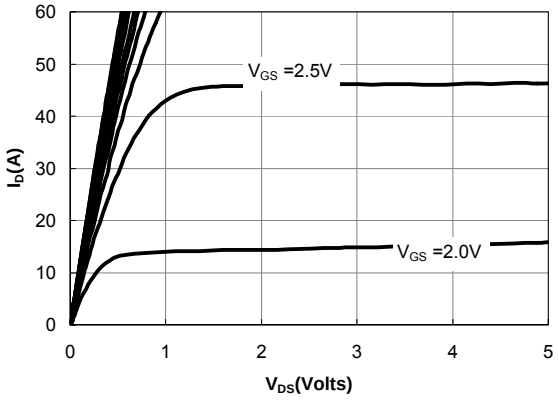


Figure 1: On-Regions CharacteristiCS

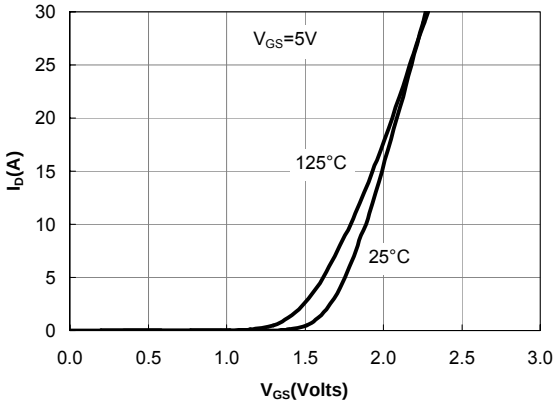


Figure 2: Transfer Characteristics

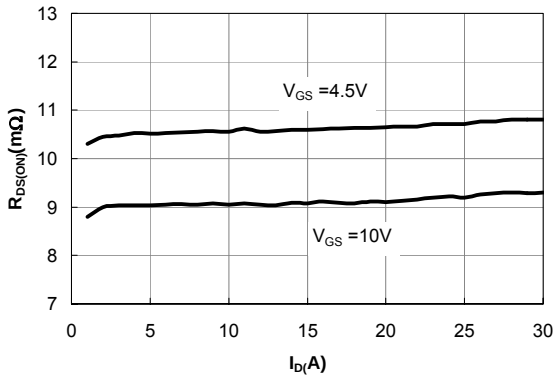


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

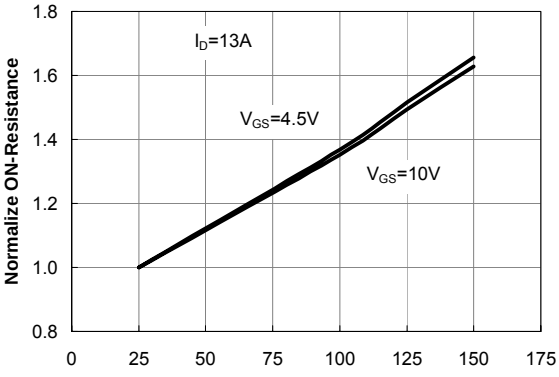


Figure 4: On-Resistance vs. Junction Temperature

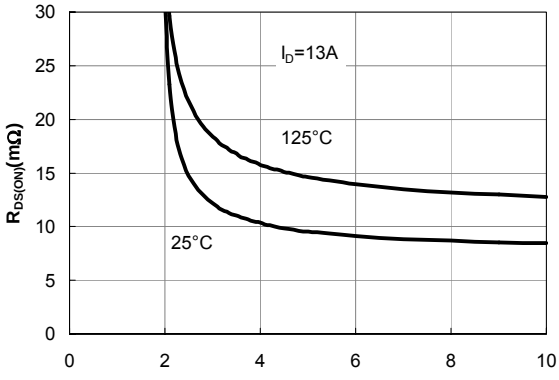


Figure 5: On-Resistance vs. Gate-Source Voltage

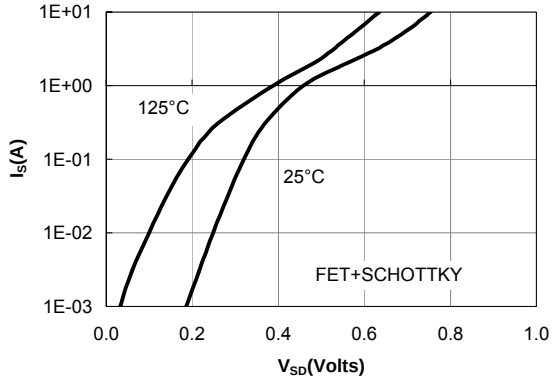


Figure 6: Body-Diode Characteristics (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

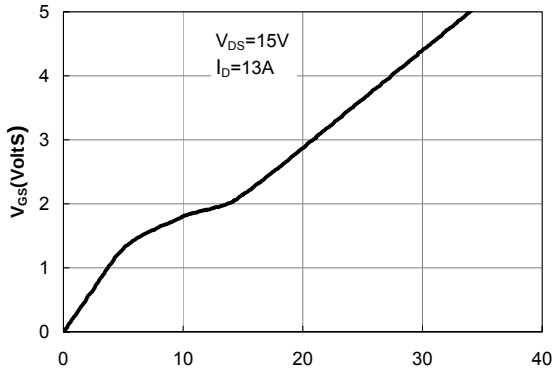


Figure 7: Gate-Charge Characteristics

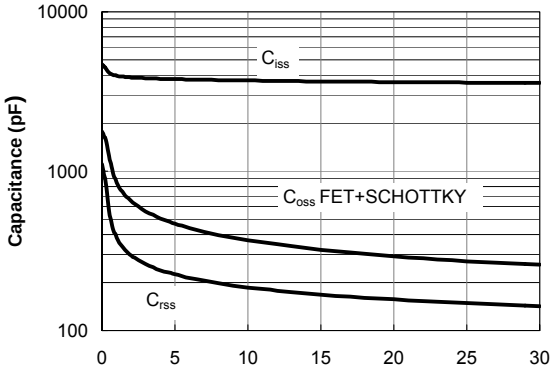


Figure 8: Capacitance Characteristics

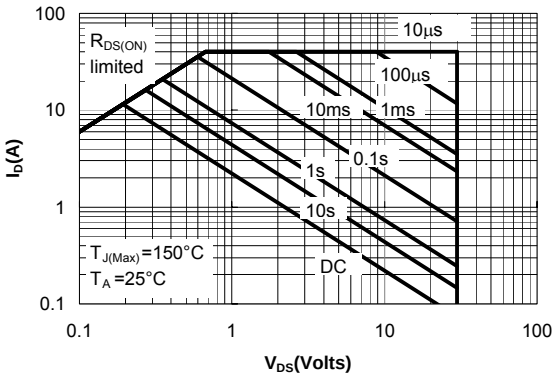


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

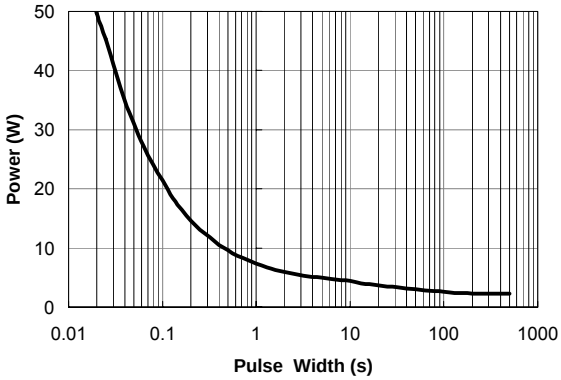


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

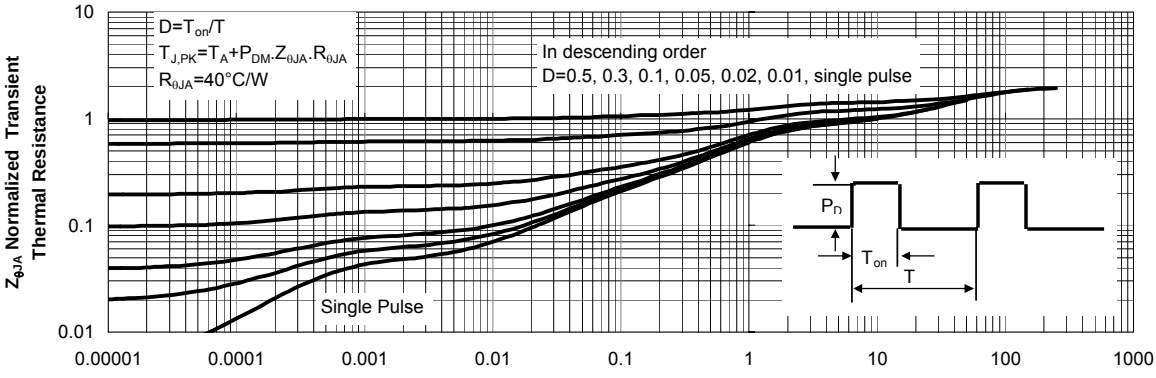


Figure 11: Normalized Maximum Transient Thermal Impedence