

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).

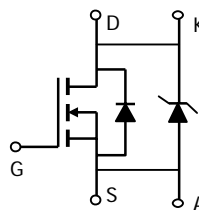
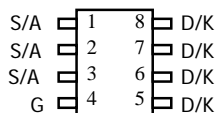
Features

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

SCHOTTKY

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

UIS TESTED!
Rg, Ciss, Coss, Crss Tested

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 ^{AF}	I_D	$T_A=25^\circ C$	13	A
		$T_A=70^\circ C$	10.4	
Pulsed Drain Current ^B	I_{DM}	40		
Schottky reverse voltage	V_{KA}		30	V
Continuous Forward Current ^{AF}	I_F	$T_A=25^\circ C$	4.4	A
		$T_A=70^\circ C$	3.2	
Pulsed Diode Forward Current ^B	I_{FM}		30	
Power Dissipation	P_D	$T_A=25^\circ C$	3.1	W
		$T_A=70^\circ C$	2	
Avalanche Current ^B	I_{AR}	20		A
Repetitive avalanche energy 0.3mH ^B	E_{AR}	60		mJ
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ C$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	t ≤ 10s	R _{θJA}	28	40	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		54	75	°C/W
Maximum Junction-to-Lead ^C	Steady-State	R _{θJL}	21	30	°C/W

Thermal Characteristics: Schottky					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	t ≤ 10s	R _{θJA}	36	40	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		67	75	°C/W
Maximum Junction-to-Lead ^C	Steady-State	R _{θJL}	25	30	°C/W

A: The value of R_{θJA} 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.

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 <300 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 current rating is based on the t ≤ 10s junction to ambient thermal resistance rating.

G: 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.

Rev 6 : Dec 2006

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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, I _D =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	235	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	0.4	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
Q _{rr}	Body Diode+Schottky Reverse Recovery Charge	I _F =13A, dI/dt=100A/μs		8.4	12.5	nC

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

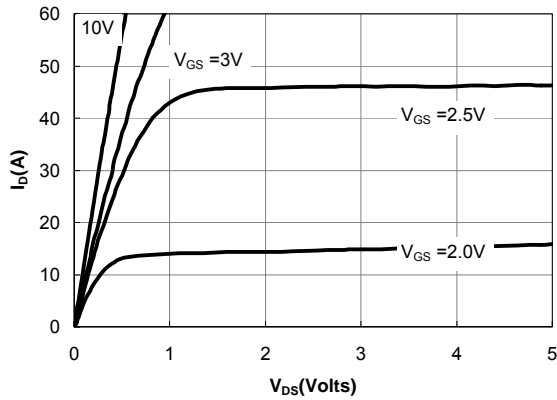


Figure 1: On-Regions Characteristics

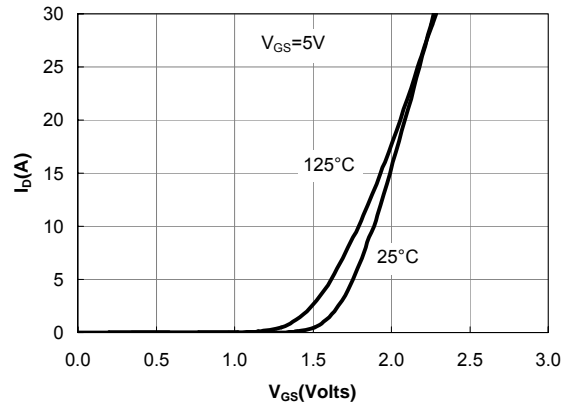


Figure 2: Transfer Characteristics

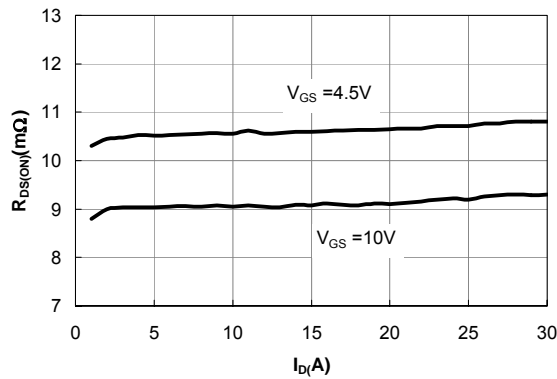


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

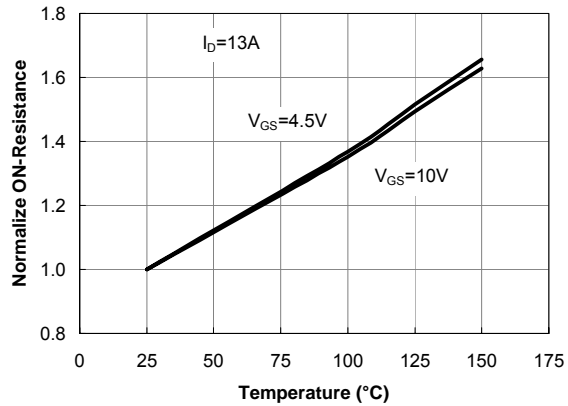


Figure 4: On-Resistance vs. Junction Temperature

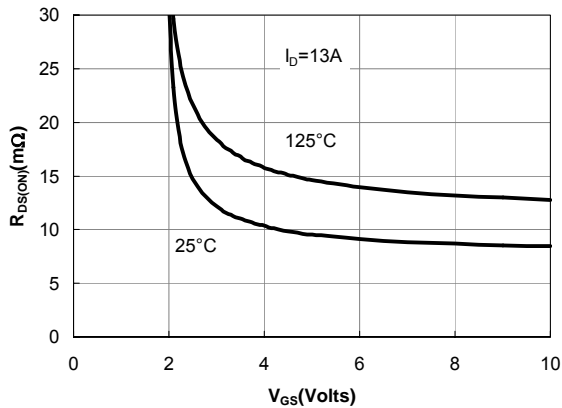


Figure 5: On-Resistance vs. Gate-Source Voltage

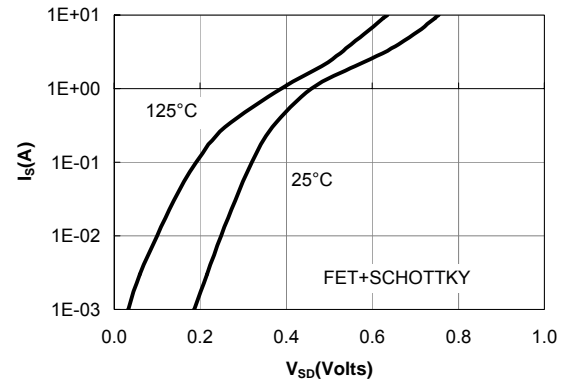


Figure 6: Body-Diode Characteristics (Note F)

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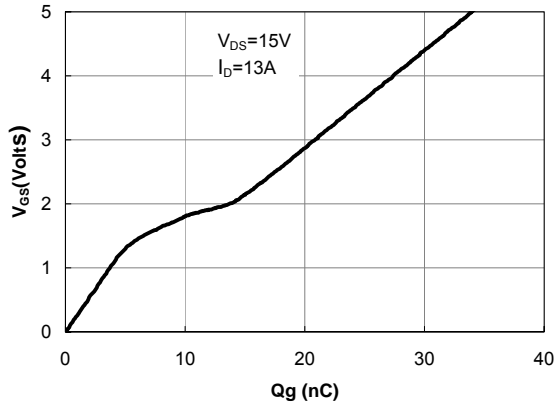


Figure 7: Gate-Charge Characteristics

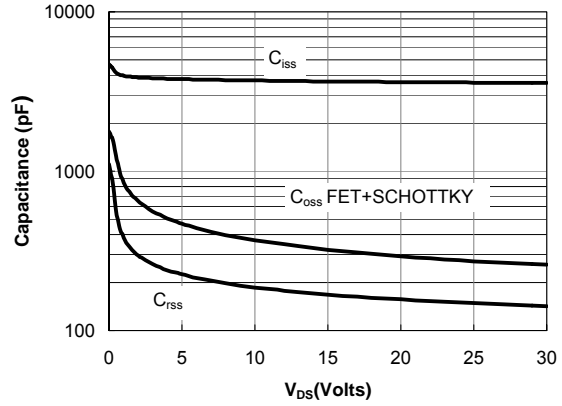


Figure 8: Capacitance Characteristics

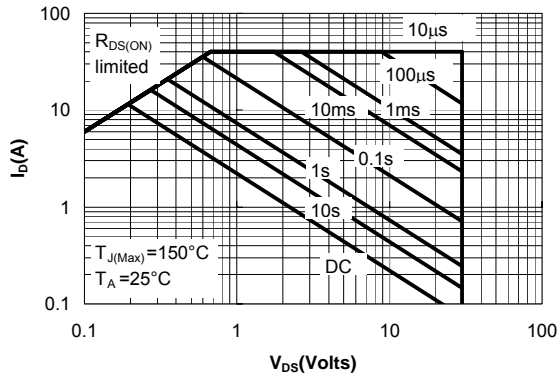


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

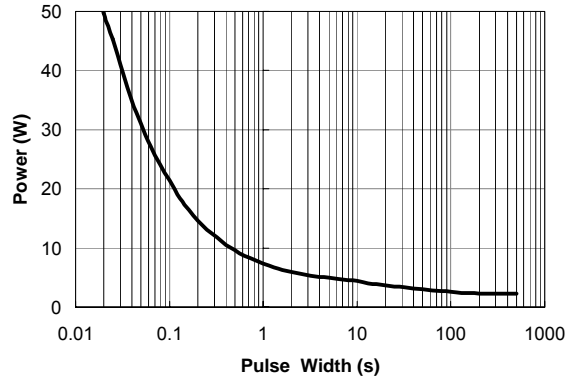


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

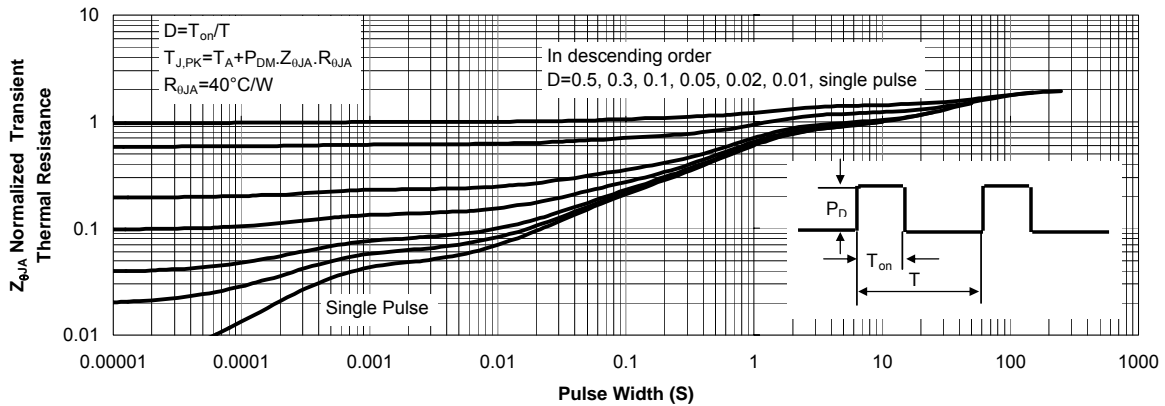


Figure 11: Normalized Maximum Transient Thermal Impedance