



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AO7404**

**N-Channel Enhancement Mode Field Effect Transistor**

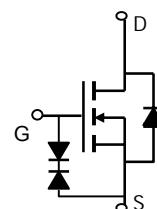
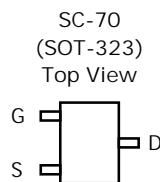


### General Description

The AO7404 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V, in the small SOT323 footprint. It can be used for a wide variety of applications, including load switching, low current inverters and low current DC-DC converters. It is ESD protected to 1KV HBM. *Standard Product AO7404 is Pb-free (meets ROHS & Sony 259 specifications). AO7404L is a Green Product ordering option. AO7404 and AO7404L are electrically identical.*

### Features

$V_{DS}$  (V) = 20V  
 $I_D$  = 1 A ( $V_{GS}$  = 4.5V)  
 $R_{DS(ON)} < 225\text{m}\Omega$  ( $V_{GS}$  = 4.5V)  
 $R_{DS(ON)} < 290\text{m}\Omega$  ( $V_{GS}$  = 2.5V)  
 $R_{DS(ON)} < 425\text{m}\Omega$  ( $V_{GS}$  = 1.8V)



### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Continuous Drain Current <sup>A</sup>	$I_D$	1	A
$T_A=70^\circ\text{C}$		0.75	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	5	
Power Dissipation <sup>A</sup>	$P_D$	0.35	W
$T_A=70^\circ\text{C}$		0.22	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	300	360	°C/W
Steady-State		340	425	°C/W
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	280	320	°C/W

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =16V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C		1		μA
				5		
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V			25	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	0.4	0.55	0.8	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	5			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =4.5V, I <sub>D</sub> =1A T <sub>J</sub> =125°C		186	225	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.85A		262	315	
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =0.7A		241	290	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =1A		2.6		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.69	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				0.4	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =10V, f=1MHz		101		pF
C <sub>oss</sub>	Output Capacitance			17		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			14		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		3		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, I <sub>D</sub> =1A		1.57		nC
Q <sub>gs</sub>	Gate Source Charge			0.13		nC
Q <sub>gd</sub>	Gate Drain Charge			0.36		nC
t <sub>D(on)</sub>	Turn-On Delay Time	V <sub>GS</sub> =5V, V <sub>DS</sub> =10V, R <sub>L</sub> =10Ω, R <sub>GEN</sub> =6Ω		3.2		ns
t <sub>r</sub>	Turn-On Rise Time			4		ns
t <sub>D(off)</sub>	Turn-Off Delay Time			15.5		ns
t <sub>f</sub>	Turn-Off Fall Time			2.4		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =1A, dI/dt=100A/μs		6.7		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =1A, dI/dt=100A/μs		1.6		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the  $\Delta T \leq 10$ s thermal resistance rating.

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

C. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D. The static characteristics in Figures 1 to 6, 12, 14 are obtained using 80μs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

Rev 3 : Aug 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

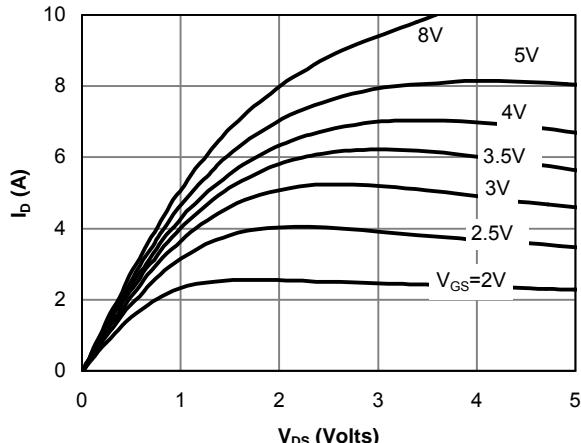


Fig 1: On-Region Characteristics

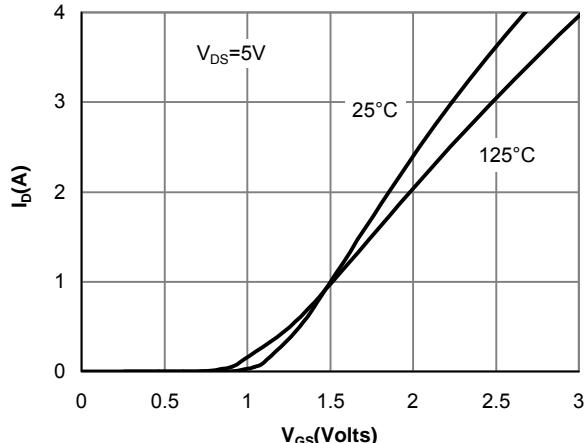


Figure 2: Transfer Characteristics

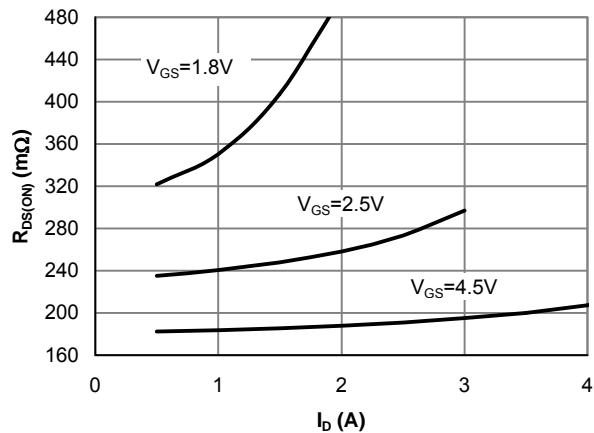


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

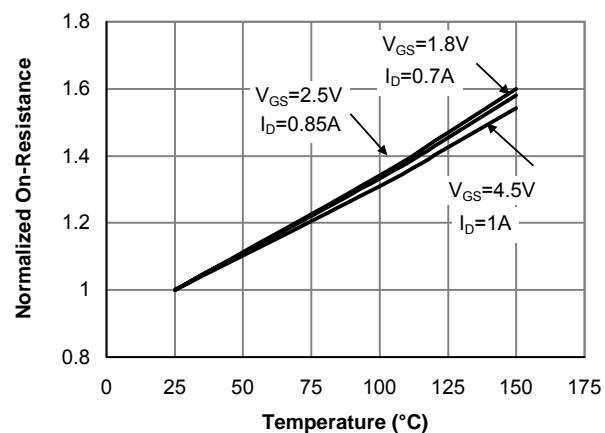


Figure 4: On-Resistance vs. Junction Temperature

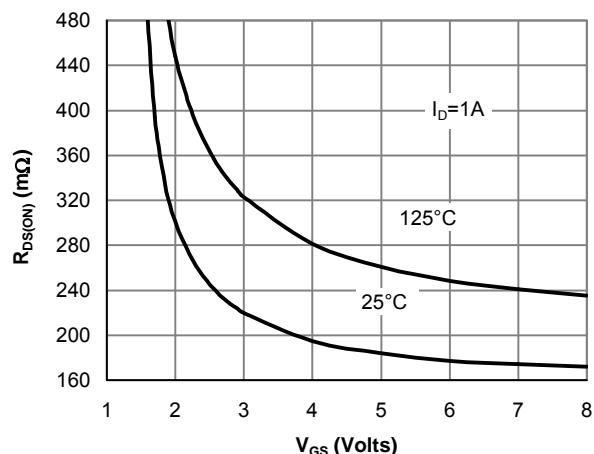


Figure 5: On-Resistance vs. Gate-Source Voltage

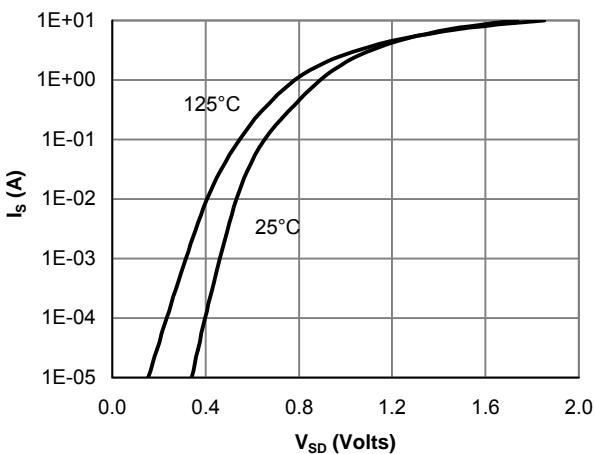


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

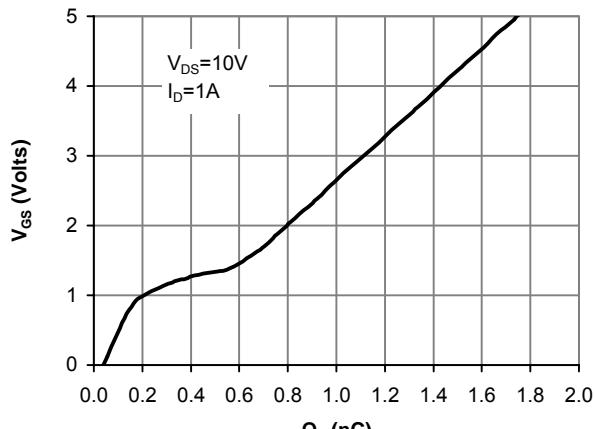


Figure 7: Gate-Charge Characteristics

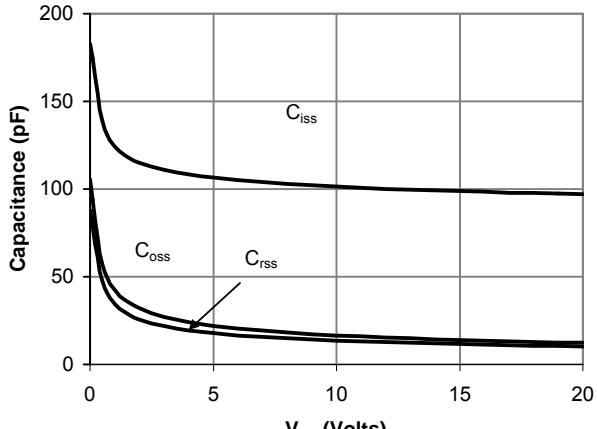


Figure 8: Capacitance Characteristics

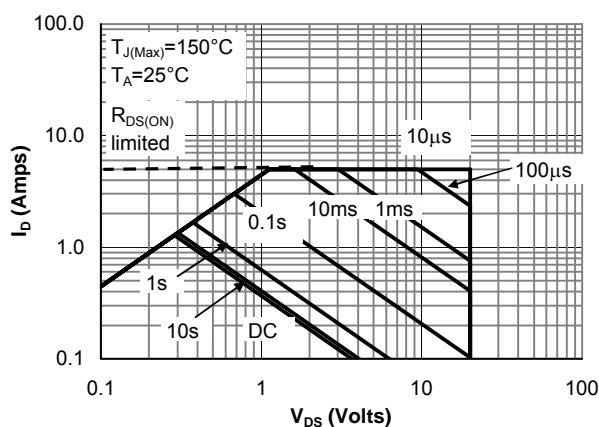


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

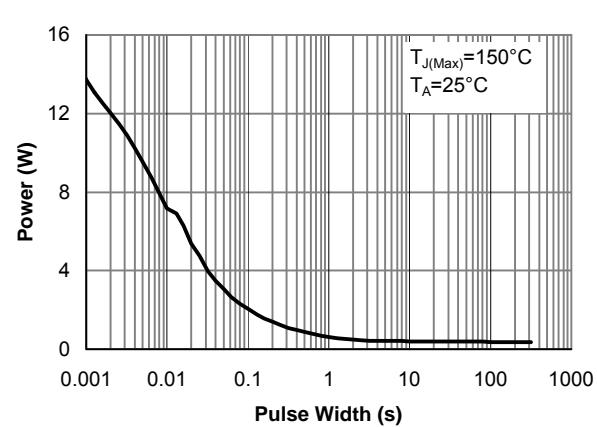


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

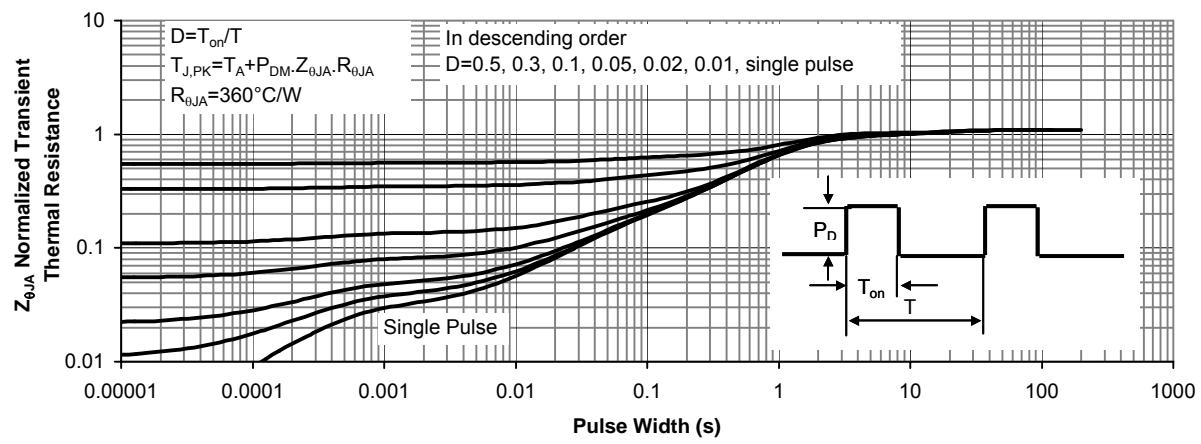


Figure 11: Normalized Maximum Transient Thermal Impedance