



**AO6404**

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

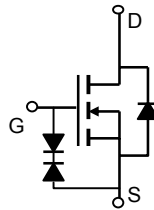
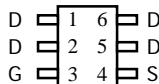
**General Description**

The AO6404 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V while retaining a 12V  $V_{GS(MAX)}$  rating. It is ESD protected.  
Standard Product AO6404 is Pb-free (meets ROHS & Sony 259 specifications). AO6404L is a Green Product ordering option. AO6404 and AO6404L are electrically identical.

**Features**

- $V_{DS}$  (V) = 20V
- $I_D$  = 8.6A ( $V_{GS}$  = 10V)
- $R_{DS(ON)} < 17m\Omega$  ( $V_{GS}$  = 10V)
- $R_{DS(ON)} < 18m\Omega$  ( $V_{GS}$  = 4.5V)
- $R_{DS(ON)} < 24m\Omega$  ( $V_{GS}$  = 2.5V)
- $R_{DS(ON)} < 33m\Omega$  ( $V_{GS}$  = 1.8V)
- ESD Rating: 2000V HBM

**TSOP-6  
Top View**



**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	$V_{GS}$	$\pm 12$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ\text{C}$	8.6	A
	$T_A=70^\circ\text{C}$	6.8	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	
Power Dissipation <sup>A</sup>	$T_A=25^\circ\text{C}$	2	W
	$T_A=70^\circ\text{C}$	1.28	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

**Thermal Characteristics**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	45	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	70	
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	33	50	$^\circ\text{C/W}$

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	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=16\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			10 25	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 10\text{V}$			10	$\mu\text{A}$
$BV_{GSO}$	Gate-Source Breakdown Voltage	$V_{DS}=0\text{V}$ , $I_G=\pm 250\mu\text{A}$	$\pm 12$			V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	0.5	0.75	1	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}$ , $V_{DS}=5\text{V}$	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=8.5\text{A}$ $T_J=125^\circ\text{C}$		13.4 16	17 20	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}$ , $I_D=5\text{A}$		14.8	18	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}$ , $I_D=4\text{A}$		18.8	24	$\text{m}\Omega$
		$V_{GS}=1.8\text{V}$ , $I_D=3\text{A}$		25.5	33	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=8\text{A}$		36		S
$V_{SD}$	Diode Forward Voltage	$I_S=1\text{A}$ , $V_{GS}=0\text{V}$		0.73	1	V
$I_S$	Maximum Body-Diode Continuous Current				2.9	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=10\text{V}$ , $f=1\text{MHz}$		1810		pF
$C_{oss}$	Output Capacitance			232		pF
$C_{riss}$	Reverse Transfer Capacitance			200		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		1.6		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=4.5\text{V}$ , $V_{DS}=10\text{V}$ , $I_D=8.5\text{A}$		17.9		nC
$Q_{gs}$	Gate Source Charge			1.5		nC
$Q_{gd}$	Gate Drain Charge			4.7		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=10\text{V}$ , $V_{DS}=10\text{V}$ , $R_L=1.2\Omega$ , $R_{GEN}=3\Omega$		2.5		ns
$t_r$	Turn-On Rise Time			7.2		ns
$t_{D(off)}$	Turn-Off Delay Time			49		ns
$t_f$	Turn-Off Fall Time			10.8		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		22		ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		9.8		nC

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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

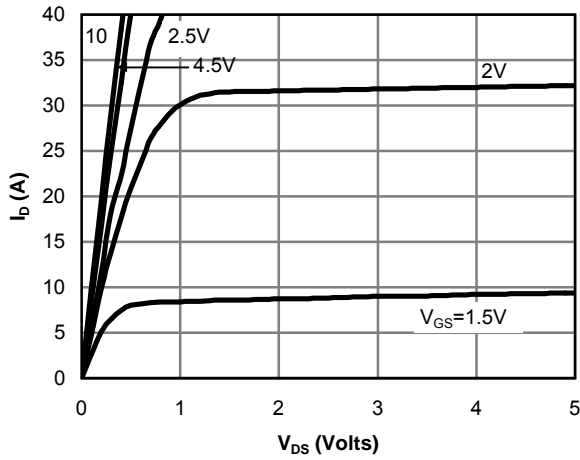


Fig 1: On-Region Characteristics

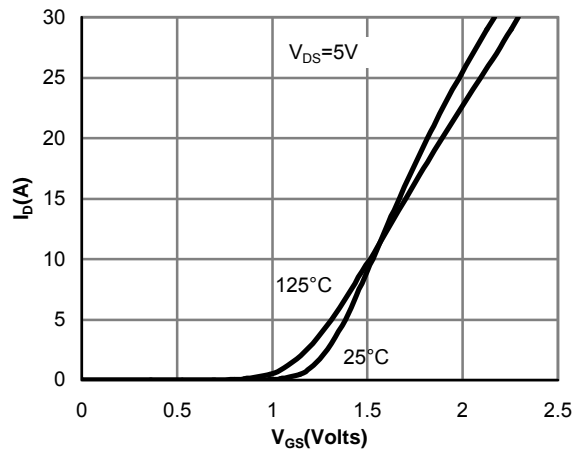


Figure 2: Transfer Characteristics

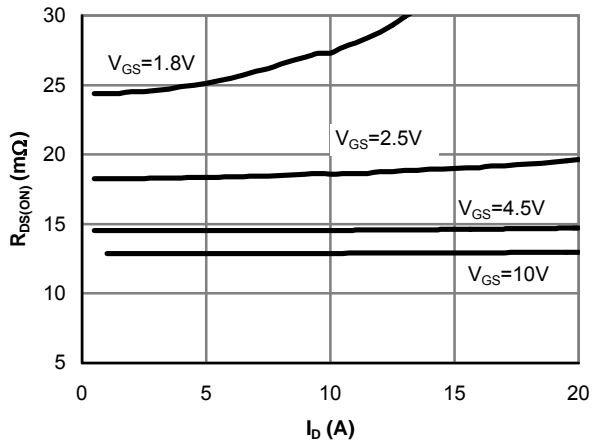


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

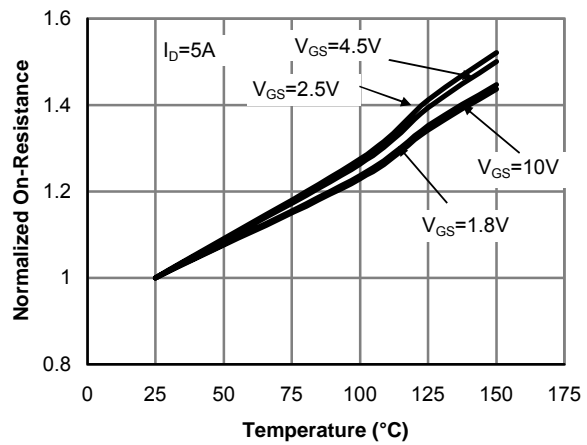


Figure 4: On-Resistance vs. Junction Temperature

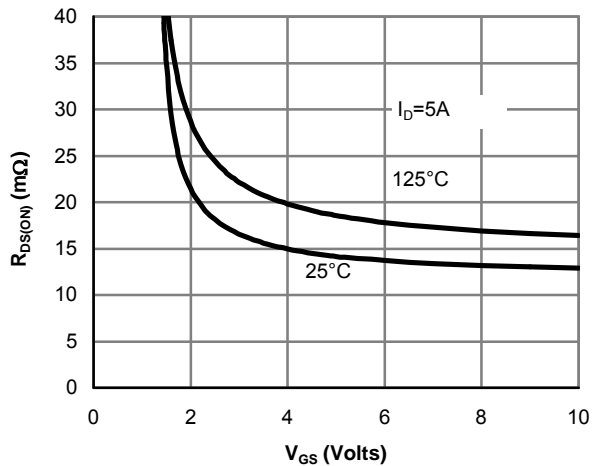


Figure 5: On-Resistance vs. Gate-Source Voltage

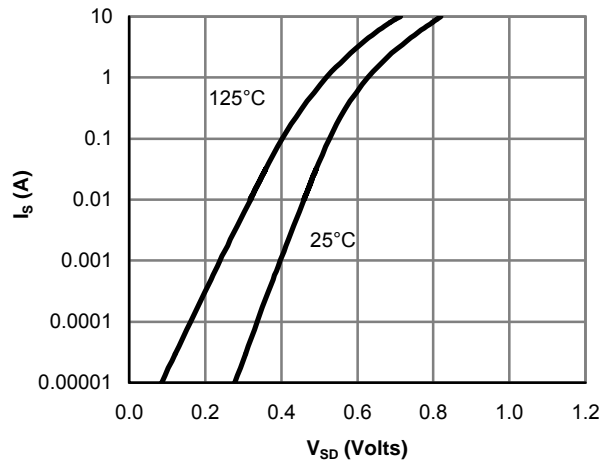


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

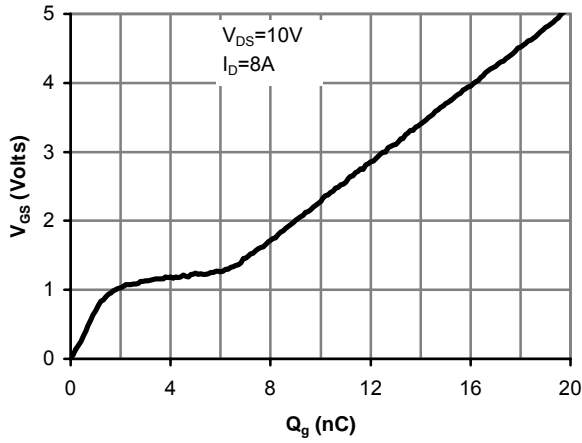


Figure 7: Gate-Charge Characteristics

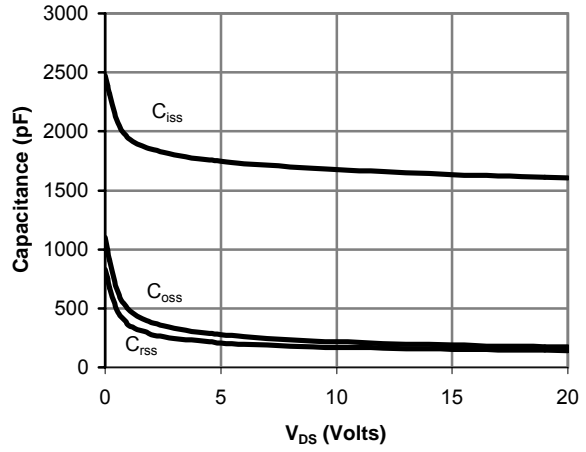


Figure 8: Capacitance Characteristics

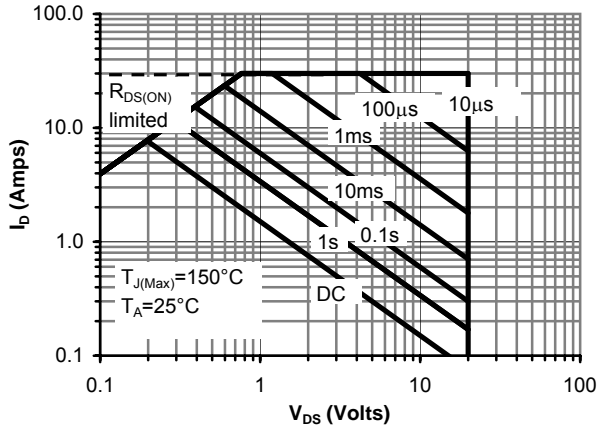


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

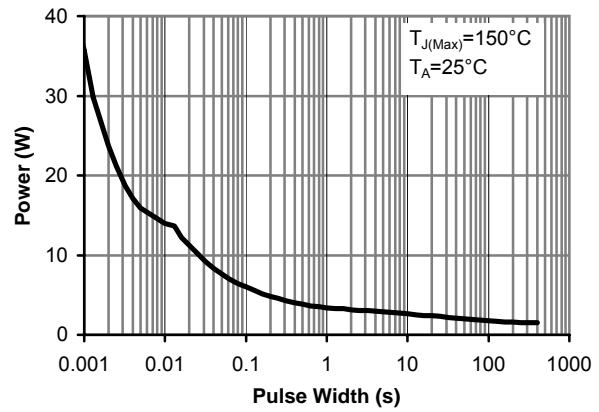


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

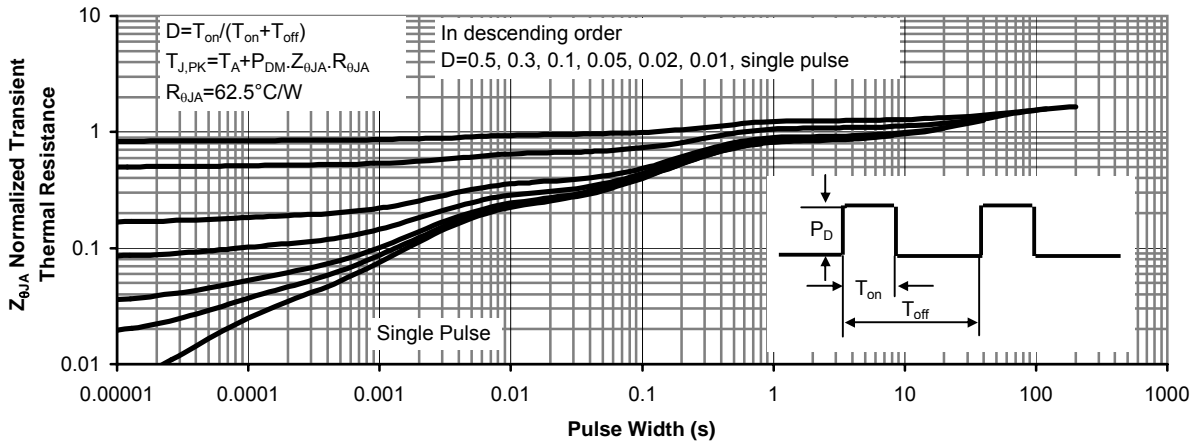


Figure 11: Normalized Maximum Transient Thermal Impedance