



ALPHA & OMEGA
SEMICONDUCTOR

AO6404
20V N-Channel MOSFET

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.
- RoHS and Halogen-Free Compliant

Product Summary

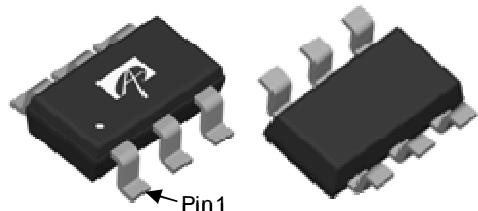
V_{DS} (V) = 20V
 I_D = 8.6A (V_{GS} = 10V)
 $R_{DS(ON)} < 17m\Omega$ (V_{GS} = 10V)
 $R_{DS(ON)} < 18m\Omega$ (V_{GS} = 4.5V)
 $R_{DS(ON)} < 24m\Omega$ (V_{GS} = 2.5V)
 $R_{DS(ON)} < 33m\Omega$ (V_{GS} = 1.8V)

ESD Rating: 2000V HBM

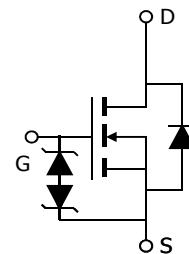
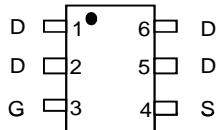
ESD Protected
 100% UIS Tested
 100% R_g Tested



Top View **TSOP6** Bottom View



Top View



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AO6404	TSOP6	Tape & Reel	3000

Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current ^A	I_D	8.6	A
$T_A=70^\circ C$		6.8	
Pulsed Drain Current ^B	I_{DM}	30	
Power Dissipation ^A	P_D	2	W
$T_A=70^\circ C$		1.28	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	45	62.5	°C/W
Maximum Junction-to-Ambient ^A		70	110	°C/W
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	33	50	°C/W

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	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	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	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 10\text{V}$		10		μA
BV_{GSO}	Gate-Source Breakdown Voltage	$V_{DS}=0\text{V}, I_G=\pm 250\mu\text{A}$	± 12			V
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	0.5	0.75	1	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=4.5\text{V}, V_{DS}=5\text{V}$	30			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=8.5\text{A}$ $T_J=125^\circ\text{C}$		13.4	17	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=5\text{A}$		16	20	
		$V_{GS}=2.5\text{V}, I_D=4\text{A}$		18.8	24	
		$V_{GS}=1.8\text{V}, I_D=3\text{A}$		25.5	33	
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
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=10\text{V}, f=1\text{MHz}$		1810	2200	pF
C_{oss}	Output Capacitance			232		pF
C_{rss}	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	2.2	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=4.5\text{V}, V_{DS}=10\text{V}, I_D=8.5\text{A}$		17.9	22	nC
Q_{gs}	Gate Source Charge			1.5		nC
Q_{gd}	Gate Drain Charge			4.7		nC
$t_{\text{D(on)}}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=10\text{V}, R_L=1.2\Omega, R_{\text{GEN}}=3\Omega$		2.5		ns
t_r	Turn-On Rise Time			7.2		ns
$t_{\text{D(off)}}$	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	27	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 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.

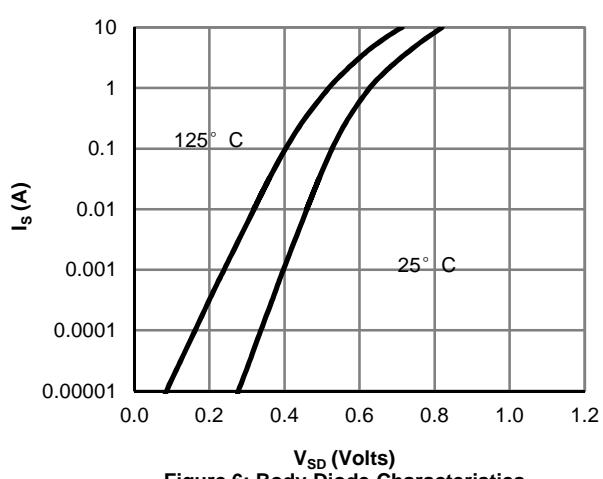
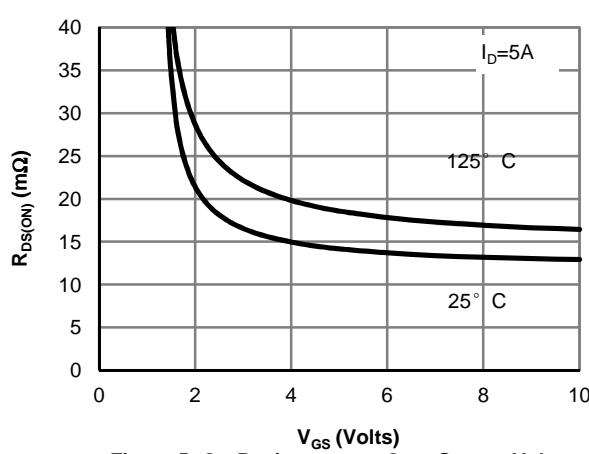
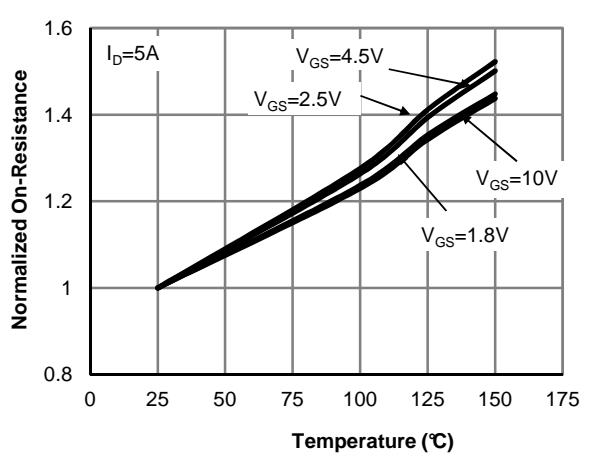
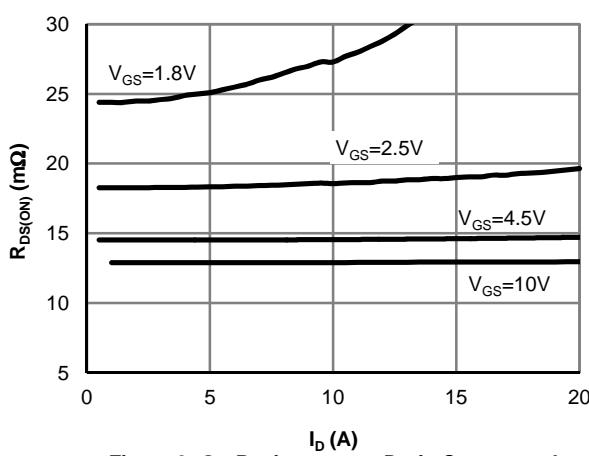
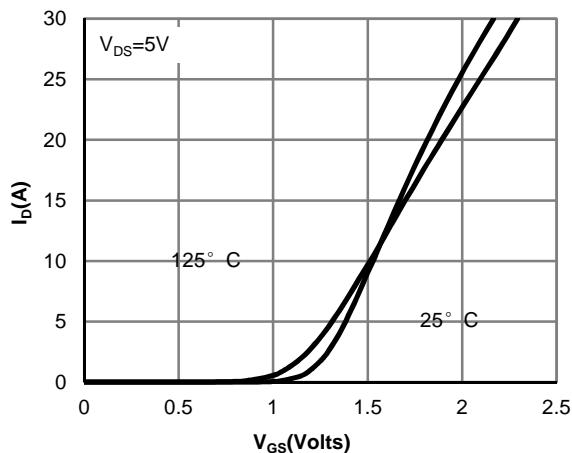
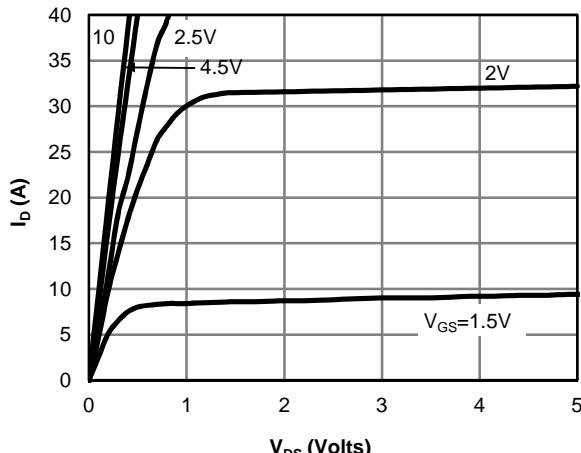
B: Repetitive rating, pulse width limited by junction temperature.

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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS


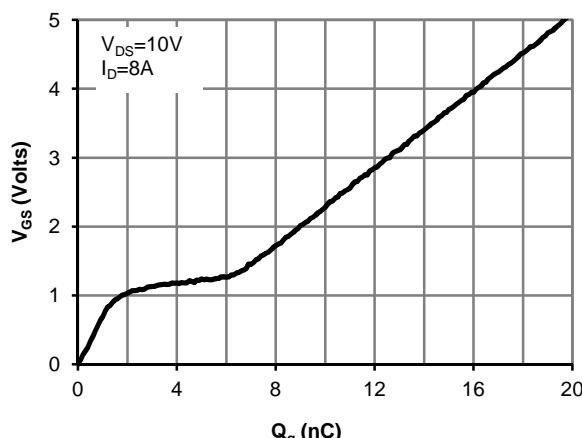
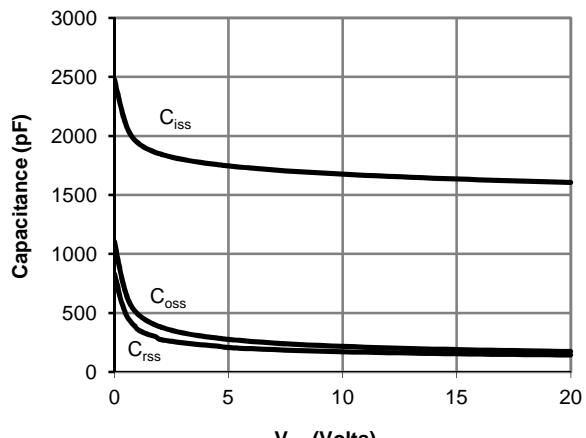
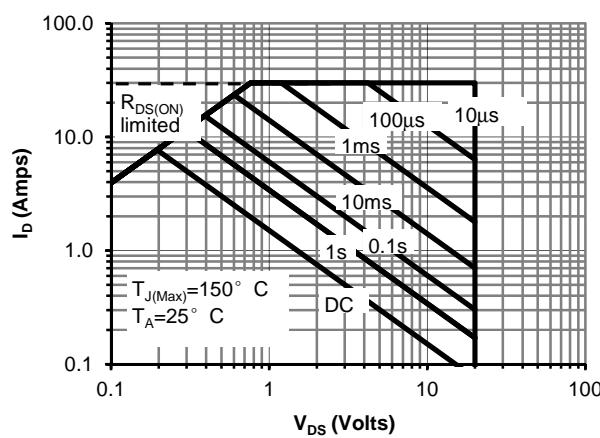
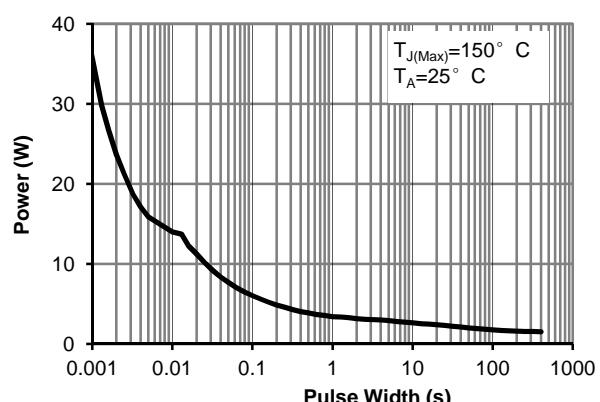
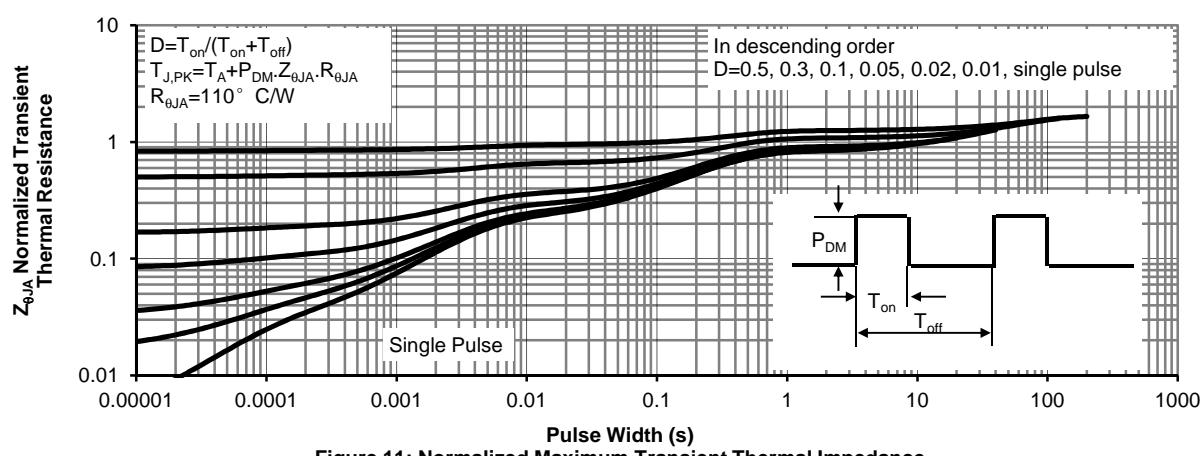
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

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

Figure A: Gate Charge Test Circuit & Waveforms

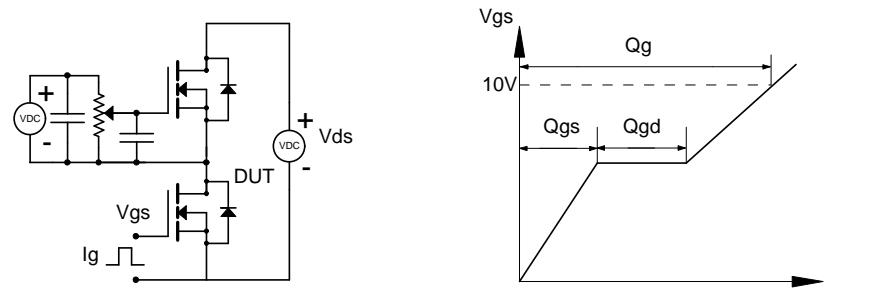


Figure B: Resistive Switching Test Circuit & Waveforms

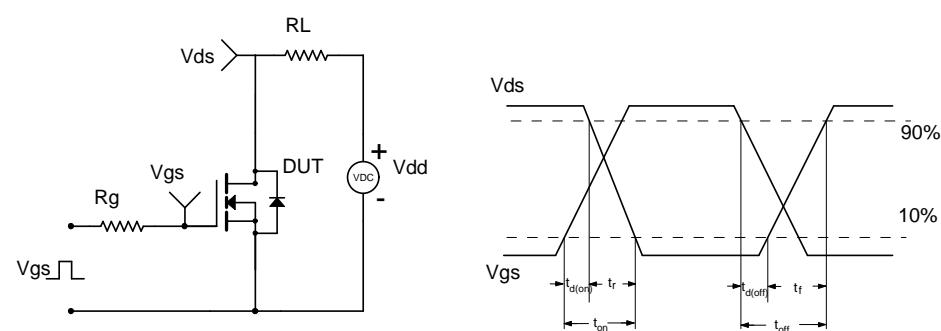


Figure C: Unclamped Inductive Switching (UIS) Test Circuit &

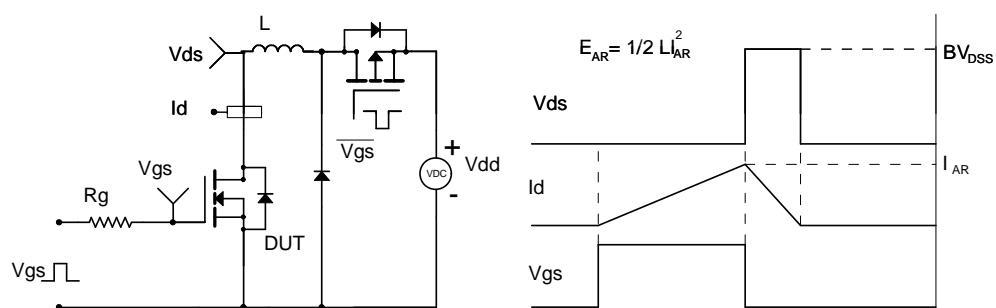


Figure D: Diode Recovery Test Circuit & Waveforms

