ALPHA & OMEGA SEMICONDUCTOR

AO4435
30V P-Channel MOSFET

General Description

The AO4435 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications.
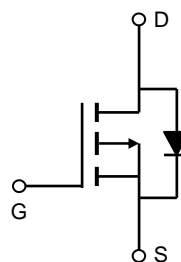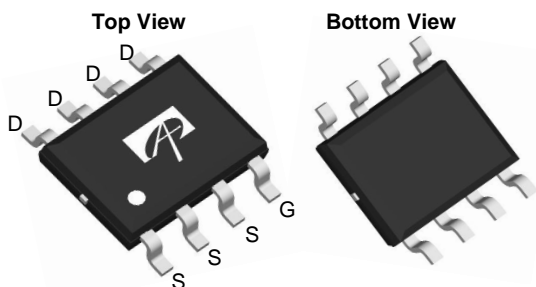
-RoHS Compliant
-AO4435 is Halogen Free

Product Summary

V_{DS} = -30V
I_D = -10.5A   (V_{GS} = -20V)
$R_{DS(ON)}$ < 14mΩ (V_{GS} = -20V)
$R_{DS(ON)}$ < 18mΩ (V_{GS} = -10V)
$R_{DS(ON)}$ < 36mΩ (V_{GS} = -5V)

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8

Top View   Bottom View

Absolute Maximum Ratings T_A=25℃ unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-30	V
Gate-Source Voltage		V_{GS}	±25	V
Continuous Drain Current [A]	T_A=25℃	I_D	-10.5	A
	T_A=70℃		-8	
Pulsed Drain Current [B]		I_{DM}	-80	
Power Dissipation [A]	T_A=25℃	P_D	3.1	W
	T_A=70℃		2.0	
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	℃

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	32	40	℃/W
Maximum Junction-to-Ambient [A]	Steady State		60	75	℃/W
Maximum Junction-to-Lead [C]	Steady State	$R_{\theta JL}$	17	24	℃/W

AO4435

Electrical Characteristics (T_J=25℃ 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	V_{DS} = -30V, V_{GS} = 0V				-1	µA
			T_J = 55℃			-5	
I_{GSS}	Gate-Body leakage current	V_{DS} = 0V, V_{GS} = ±25V				±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS} I_D = -250µA		-1.7	-2.3	-3	V
$I_{D(ON)}$	On state drain current	V_{GS} = -10V, V_{DS} = -5V		-80			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = -20V, I_D = -11A			11	14	mΩ
			T_J=125℃		15	19	
		V_{GS} = -10V, I_D = -10A			15	18	
		V_{GS} = -5V, I_D = -5A			27	36	
g_{FS}	Forward Transconductance	V_{DS} = -5V, I_D = -10A			22		S
V_{SD}	Diode Forward Voltage	I_S = -1A, V_{GS} = 0V			-0.74	-1	V
I_S	Maximum Body-Diode Continuous Current					-3.5	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz			1130	1400	pF
C_{oss}	Output Capacitance				240		pF
C_{rss}	Reverse Transfer Capacitance				155		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1	5.8	8	Ω
SWITCHING PARAMETERS							
$Q_{g(10V)}$	Total Gate Charge	V_{GS}=-10V, V_{DS}=-15V, I_D=-10A			18	24	nC
$Q_{g(4.5V)}$	Total Gate Charge				9.5		
Q_{gs}	Gate Source Charge				5.5		nC
Q_{gd}	Gate Drain Charge				3.3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=1.5Ω, R_{GEN}=3Ω			8.7		ns
t_r	Turn-On Rise Time				8.5		ns
$t_{D(off)}$	Turn-Off DelayTime				18		ns
t_f	Turn-Off Fall Time				7		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-10A, dI/dt=100A/µs			25	30	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-10A, dI/dt=100A/µs			12		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A = 25℃. 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 impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300µs 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℃. The SOA curve provides a single pulse rating.

F. The current rating is based on the t ⩽ 10s thermal resistance rating.

G. E_{AR} and I_{AR} ratings are based on low frequency and duty cycles to keep T_j=25C.

Rev7: Nov. 2010

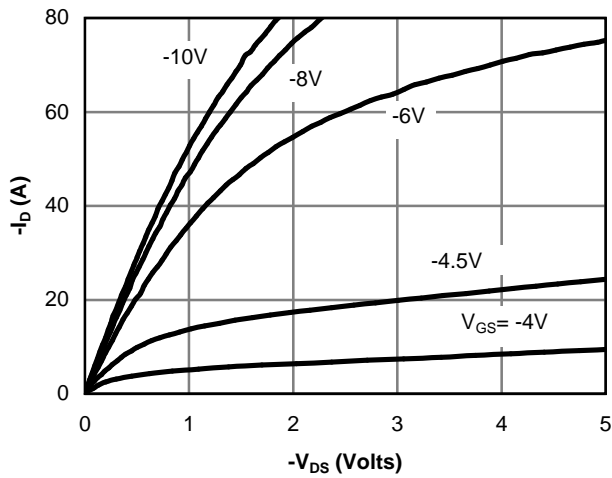## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
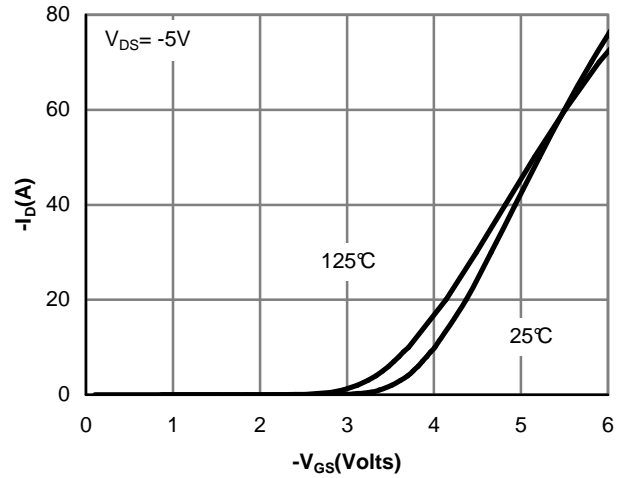
Figure 1: On-Region Characteristics
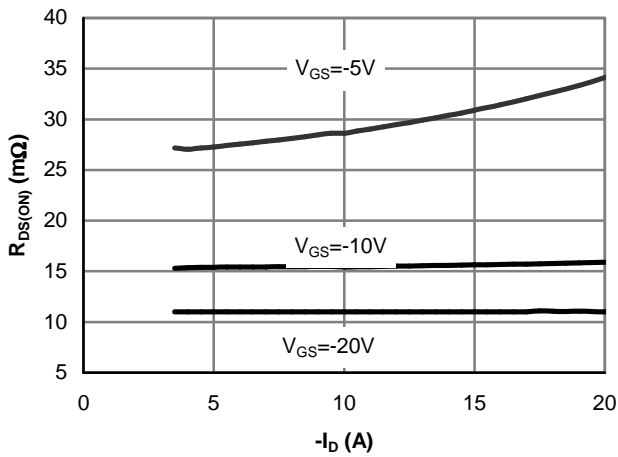
Figure 2: Transfer Characteristics

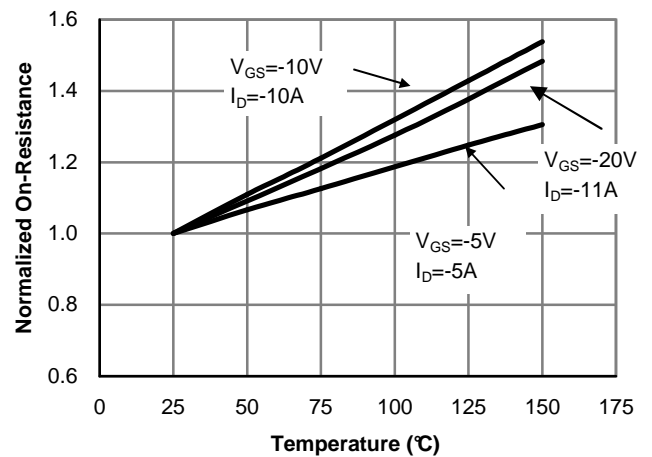**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

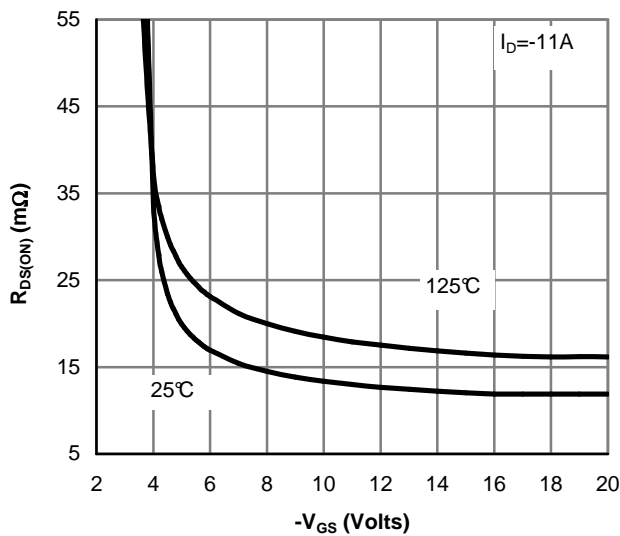**Figure 4: On-Resistance vs. Junction Temperature**

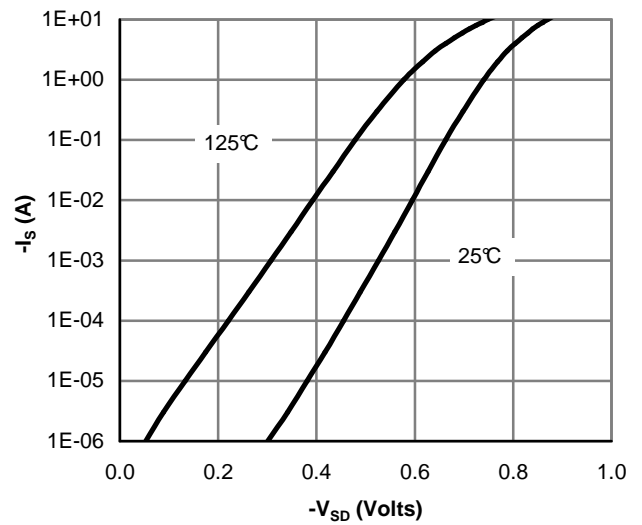**Figure 5: On-Resistance vs. Gate-Source Voltage**

Figure 6: Body-Diode Characteristics

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
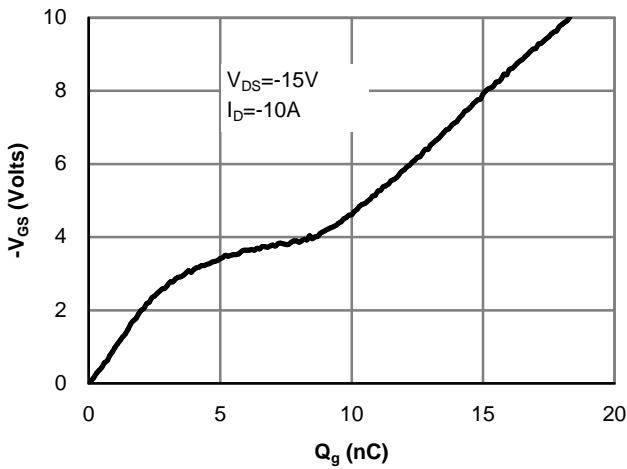
Figure 7: Gate-Charge Characteristics

V_{DS}=-15V
I_D=-10A
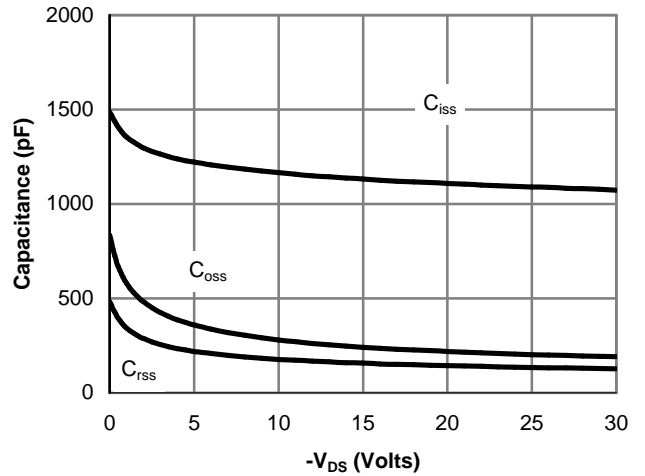
Figure 8: Capacitance Characteristics

C_{iss}

C_{oss}

C_{rss}
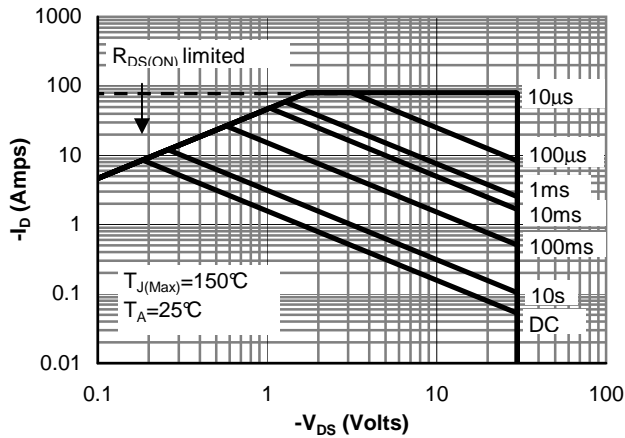
Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

$R_{DS(ON)}$ limited

10μs
100μs
1ms
10ms
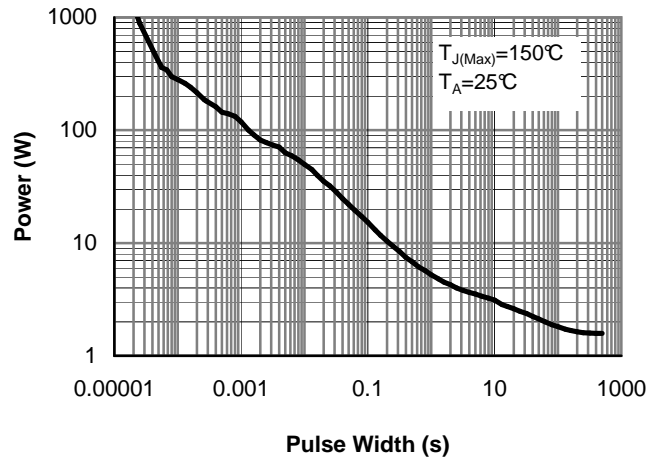100ms
10s
DC

$T_{J(Max)}$=150℃
T_A=25℃

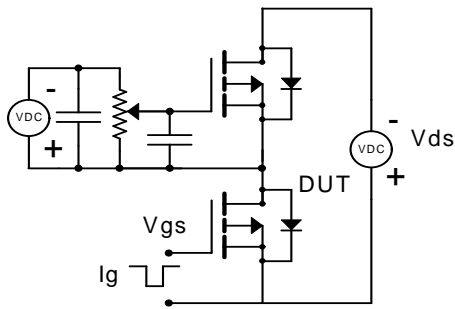**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

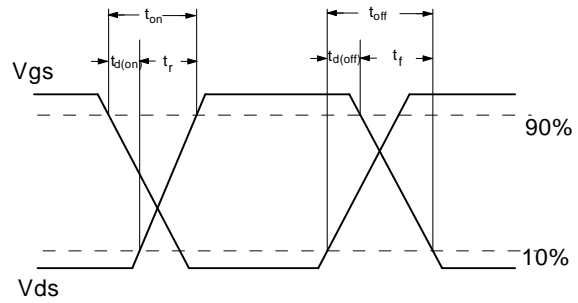$T_{J(Max)}$=150℃
T_A=25℃
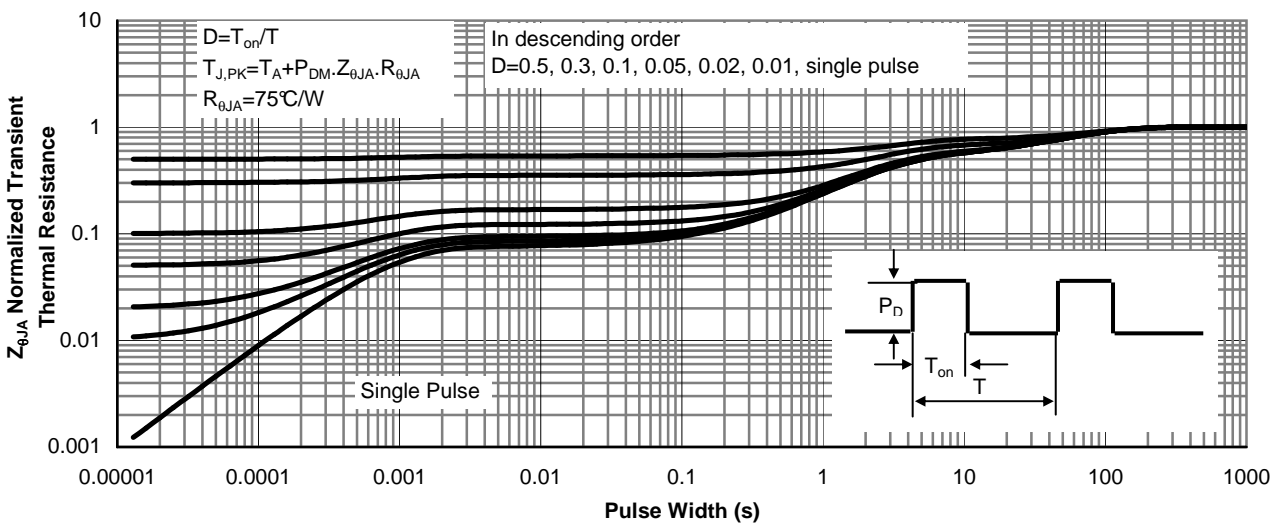
Figure 11: Normalized Maximum Transient Thermal Impedance(Note E)

D=T_{on}/T
$T_{J,PK}$=T_A+P_{DM}.$Z_{\theta JA}$.$R_{\theta JA}$
$R_{\theta JA}$=75℃/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
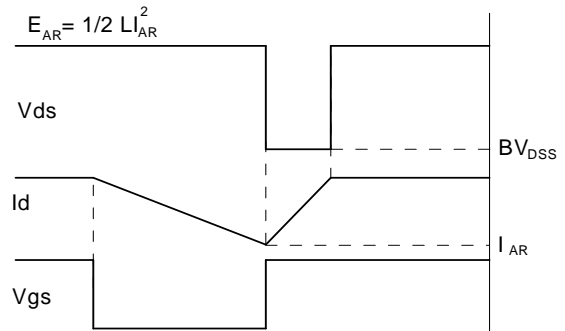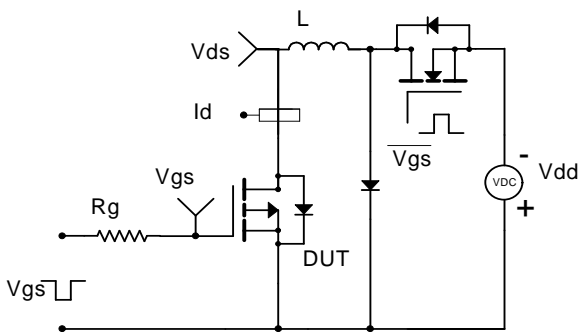
Single Pulse

P_D

T_{on}

T

Gate Charge Test Circuit & Waveform
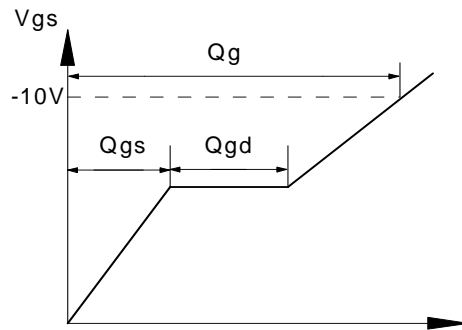
Resistive Switching Test Circuit & Waveforms
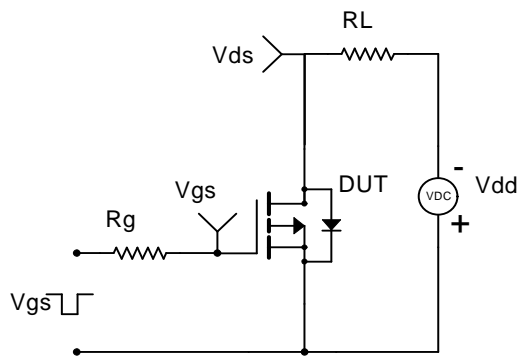
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$$E_{AR} = 1/2 \, LI_{AR}^2$$

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int I \, dt$$
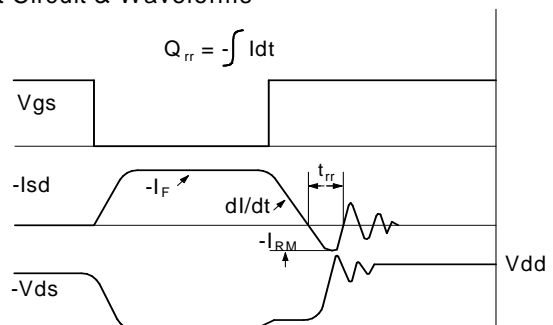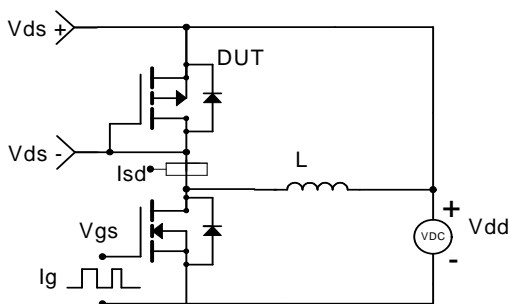
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