STA516B

60 V 6 A quad power half bridge

Features

- Minimum input output pulse width distortion
- 200 mΩ R_{dsON} complementary DMOS output stage
- CMOS compatible logic inputs
- Thermal protection
- Thermal warning output
- Under voltage protection

Power SO36 slug up

Description

STA516B is a monolithic quad half bridge stage in Multipower BCD Technology. The device can be used as dual bridge or reconfigured, by connecting CONFIG pin to Vdd pin, as single bridge with double current capability, and as half bridge (Binary mode) with half current capability.

The device is particularly designed to make the output stage of a stereo all-digital high efficiency (DDX™) amplifier capable to deliver 160 + 160 W @ THD = 10 % at V_{cc} 50 V output power on 8 Ω load and 320 W @ THD = 10 % at V_{cc} 50V on 4 Ω load in single BTL configuration.

The input pins have threshold proportional to V_L pin voltage.

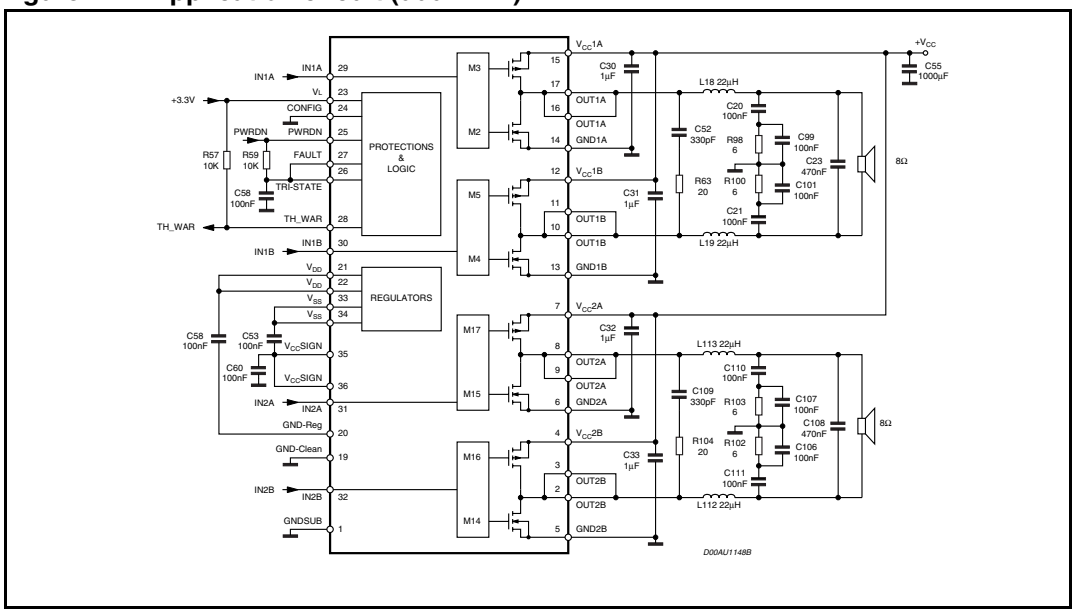
Table 1. Device summary

Part number	Package	Packaging
STA516B	Power SO36 slug up	Tube
STA516B13TR	Power SO36 slug up	Tape and reel

Contents

1 Introduction

Figure 1. Application circuit (dual BTL)



2 Pin lists

Table 2. Pin function

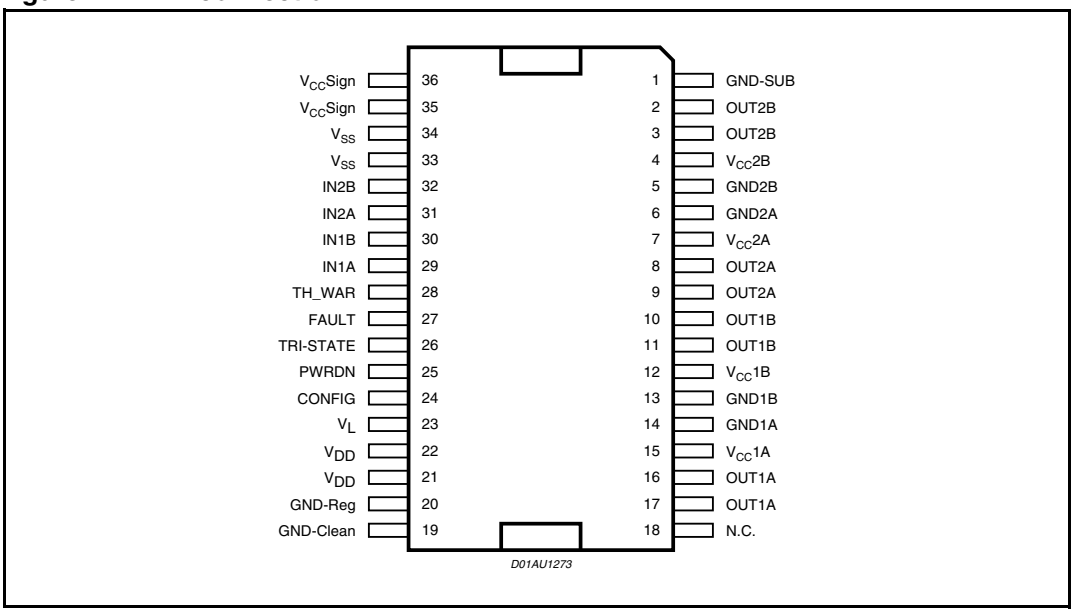
Number	Pin	Description
1	GND-SUB	Substrate ground
2, 3	OUT2B	Output half bridge 2B
4	Vcc2B	Positive supply
5	GND2B	Negative supply
6	GND2A	Negative supply
7	Vcc2A	Positive supply
8, 9	OUT2A	Output half bridge 2A
10, 11	OUT1B	Output half bridge 1B
12	Vcc1B	Positive supply
13	GND1B	Negative supply
14	GND1A	Negative supply
15	Vcc1A	Positive supply
16, 17	OUT1A	Output half bridge 1A
18	NC	Not connected
19	GND-clean	Logical ground
20	GND-Reg	Ground for regulator Vdd
21, 22	Vdd	5 V regulator referred to ground
23	V_L	High logical state setting voltage
24	CONFIG	Configuration pin
25	PWRDN	Stand-by pin
26	TRI-STATE	Hi-Z pin
27	FAULT	Fault pin advisor
28	TH-WAR	Thermal warning advisor
29	IN1A	Input of half bridge 1A
30	IN1B	Input of half bridge 1B
31	IN2A	Input of half bridge 2A
32	IN2B	Input of half bridge 2B
33, 34	Vss	5 V regulator referred to +Vcc
35, 36	Vcc sign	Signal positive supply

Table 3. Functional pin status

Pin name	Logical value	Status
FAULT	0	Fault detected (short circuit or thermal for example)
FAULT (1)	1	Normal operation
TRI-STATE	0	All powers in Hi-Z state
TRI-STATE	1	Normal operation
PWRDN	0	Low absorption
PWRDN	1	Normal operation
THWAR	0	Temperature of the IC =130 °C
THWAR(1)	1	Normal operation
CONFIG	0	Normal operation
CONFIG(2)	1	OUT1A=OUT1B; OUT2A=OUT2B (IF IN1A = IN1B; IN2A = IN2B)

1. The pin is open collector. To have the high logic value, it needs to be pulled up by a resistor.
2. To put CONFIG = 1 means connect Pin 24 (CONFIG) to Pins 21, 22 (Vdd)

Figure 2. Pin connection



3 Electrical characteristics

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	DC supply voltage (Pins 4,7,12,15)	60	V
V_{max}	Maximum voltage on pins 23 to 32	5.5	V
T_{op}	Operating temperature range	0 to 70	°C
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

Table 5. Thermal data

Symbol	Parameter	Min.	Typ.	Max.	Unit
$T_{j\text{-}case}$	Thermal resistance junction to case (thermal pad)		1	2.5	°C/W
T_{jSD}	Thermal shut-down junction temperature		150		°C
T_{warn}	Thermal warning temperature		130		°C
t_{hSD}	Thermal shut-down hysteresis		25		°C

Table 6. Electrical characteristics (VL= 3.3 V; Vcc = 50 V; Tamb = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
R_{dsON}	Power Pchannel/Nchannel MOSFET R_{dsON}	Id=1A		200	240	mΩ
I_{dss}	Power Pchannel/Nchannel leakage Idss				100	µA
g_N	Power Pchannel R_{dsON} matching	Id=1A	95			%
g_P	Power Nchannel R_{dsON} matching	Id=1A	95			%
Dt_s	Low current dead time (static)	see *Figure 4*		10	20	ns
Dt_d	High current dead time (dynamic)	L=22µH, C = 470nF Rl = 8 Ω, Id=4.5A see *Figure 5*			50	ns
$t_{d\ ON}$	Turn-on delay time	Resistive load			100	ns
$t_{d\ OFF}$	Turn-off delay time	Resistive load			100	ns
t_r	Rise time	Resistive load see *Figure 4*			25	ns
t_f	Fall time	Resistive load see *Figure 4*			25	ns
V_{CC}	Supply operating voltage		10		52	V
$V_{IN\text{-}High}$	High level input voltage				V_L/2 +300mV	V
$V_{IN\text{-}Low}$	Low level input voltage		V_L/2 -300mV			V
$I_{IN\text{-}H}$	High level Input current	Pin voltage = V_L		1		µA
$I_{IN\text{-}L}$	Low level input current	Pin voltage = 0.3 V		1		µA

Table 6. Electrical characteristics (continued)
(VL= 3.3 V; Vcc = 50 V; Tamb = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{PWRDN-H}$	High level PWRDN pin input current	V_L= 3.3 V		35		µA
V_{Low}	Low logical state voltage VL (pin PWRDN, TRISTATE)(see *Table 7*)	V_L = 3.3 V	0.8			V
V_{High}	High logical state voltage VH (pin PWRDN, TRISTATE)(see *Table 7*)	V_L = 3.3 V			1.7	V
$I_{VCC-PWRDN}$	Supply current from Vcc in power down	PWRDN = 0			3	mA
I_{FAULT}	Output current pins FAULT -TH-WARN when FAULT CONDITIONS	Vpin = 3.3 V		1		mA
$I_{VCC-hiz}$	Supply current from Vcc in Tristate	Tristate = 0		22		mA
I_{VCC}	Supply current from Vcc in operation both channel switching)	Input pulse width = 50 % duty Switching frequency = 384 Khz; No LC filters		70		mA
I_{OUT-SH}	Over current protection threshold Isc (short circuit current limit) *1*		6	8	10	A
V_{UV}	Under voltage protection threshold			7		V
V_{OV}	Over voltage protection threshold		60		70	V
t_{pw_min}	Output minimum pulse width	No load	25		40	ns

1. See specific application note number: AN1994.

Table 7. VLow, VHigh variation with VL

V_L	VLow min	VHigh max	Unit
2.7	0.7	1.5	V
3.3	0.8	1.7	V
5	0.85	1.85	V

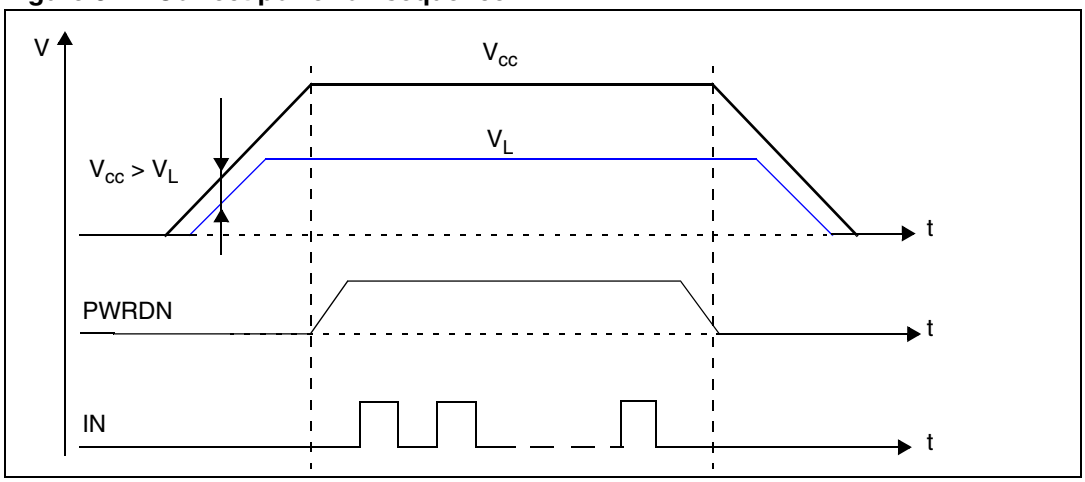
Table 8. Logic truth table (see *Figure 2*)

Tristate	INxA	INxB	Q1	Q2	Q3	Q4	Output mode
0	x	x	OFF	OFF	OFF	OFF	Hi-Z
1	0	0	OFF	OFF	ON	ON	DUMP
1	0	1	OFF	ON	ON	OFF	NEGATIVE
1	1	0	ON	OFF	OFF	ON	POSITIVE
1	1	1	ON	ON	OFF	OFF	Not used

4 Power supply and control sequencing

To guarantee correct operation and reliability, a correct turn on/off sequence must be followed. *Figure 3* shows the correct power on sequence.

Figure 3. Correct power-on sequence



Vcc must turn on before V_L in order to prevent uncontrolled current flowing through an internal protection diode connected between V_L (logic supply) and Vcc (high power supply). Failure to do so could result in damage to the device.

PWRDN must be released after V_L is switched on. An input signal can then be sent to the power stage.

5 Test

Figure 4. Test circuit

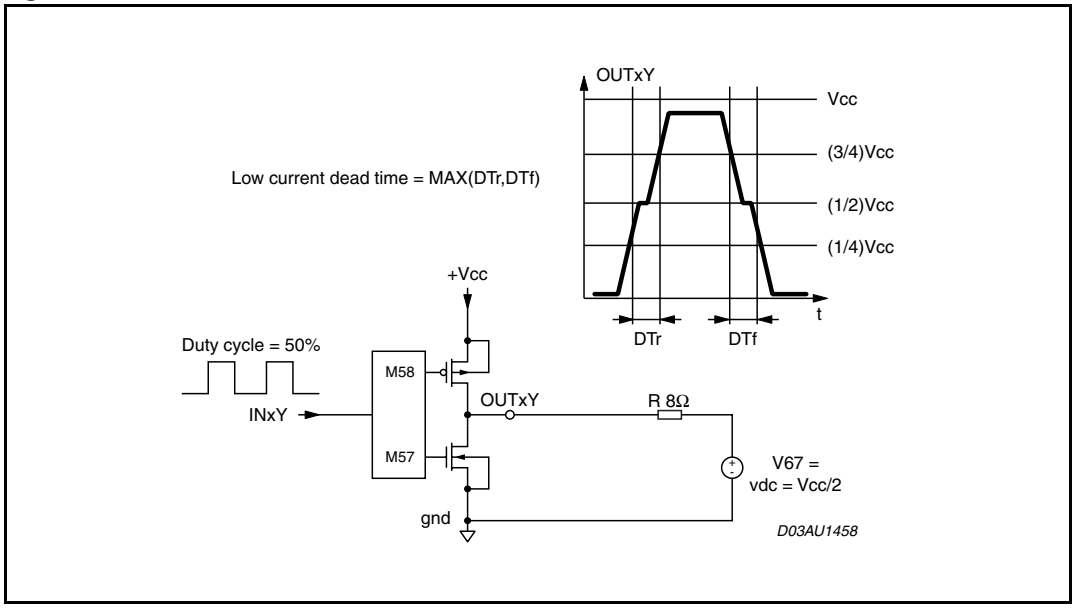


Figure 5. Current dead time test circuit

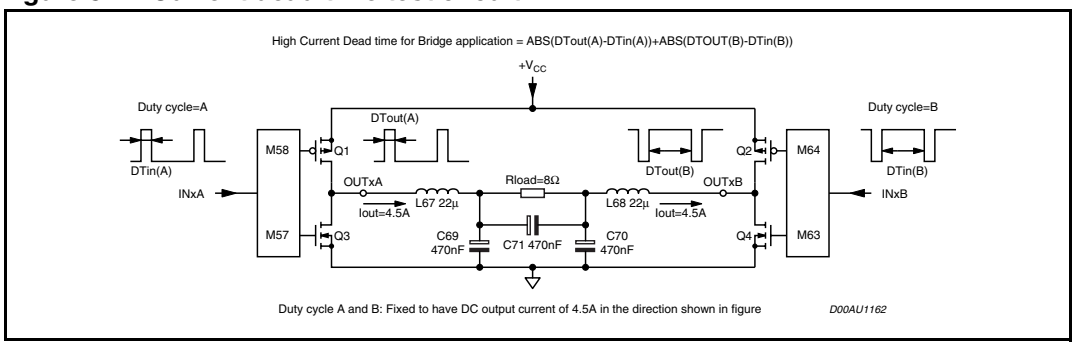


Figure 6. Typical single BTL configuration to obtain 320 W @ THD 10 %, RL = 4 W, VCC = 50 V (a)

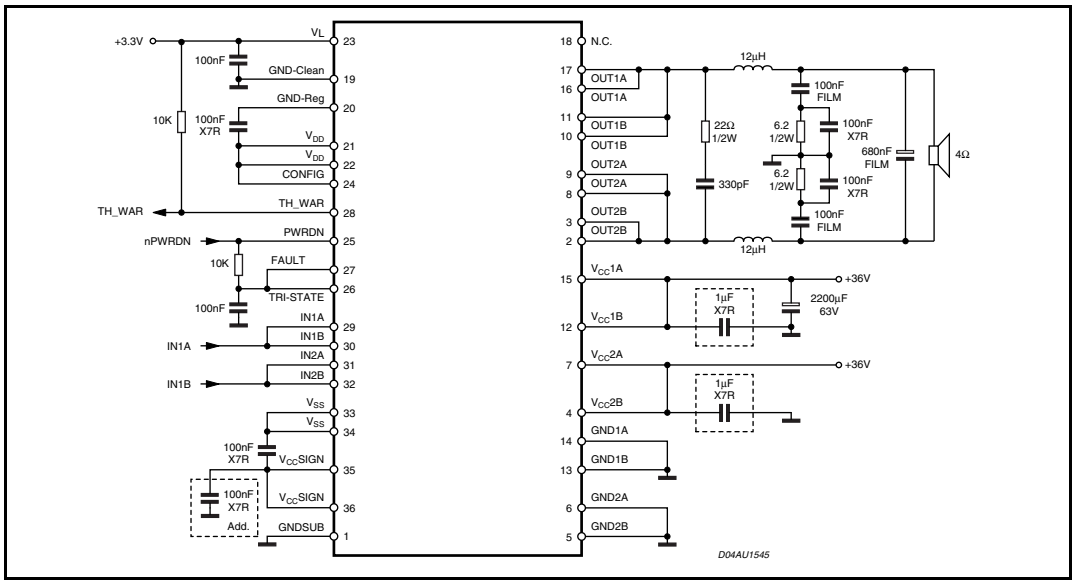
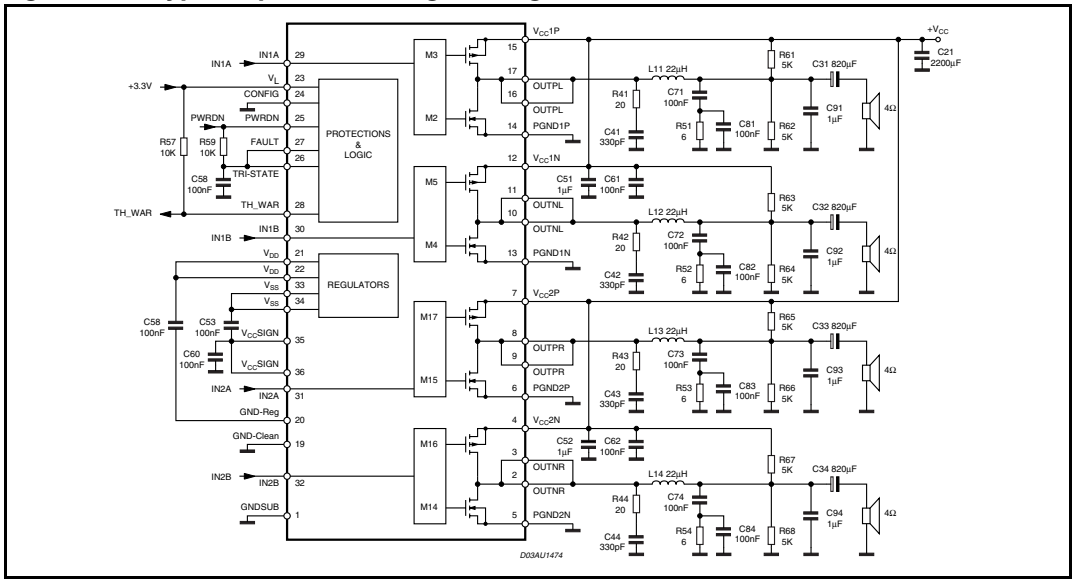


Figure 7. Typical quad half bridge configuration



For more information, refer to the application note “ST50X and STA51X digital power amplifiers”.

a. A PWM modulator as driver is required. This result was obtained using the STA30X+STA50X demo board.

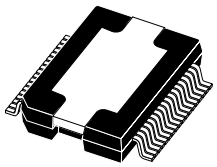
6 Mechanical and package data

Figure 8. Power SO36 (slug up) mechanical data and package dimension

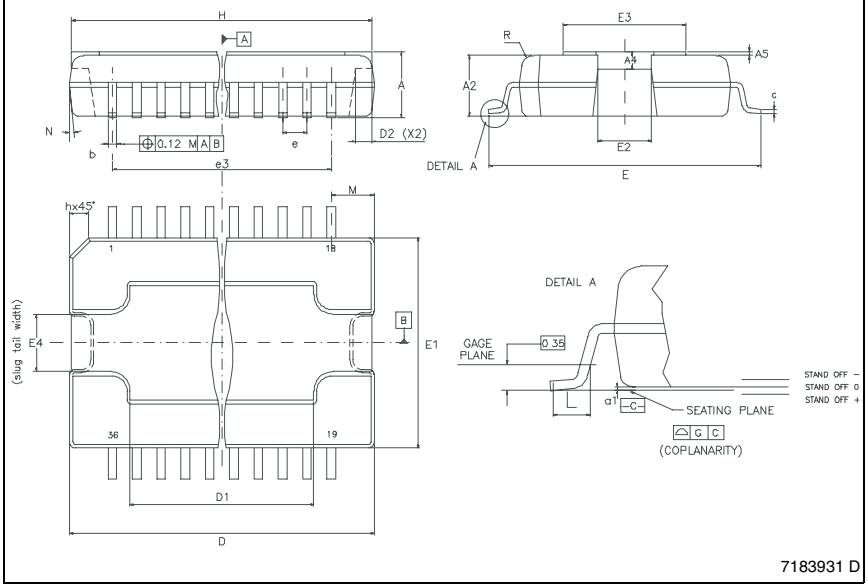
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.25		3.43	0.128		0.135
A2	3.1		3.2	0.122		0.126
A4	0.8		1	0.031		0.039
A5		0.2			0.008	
a1	0.030		-0.040	0.0011		-0.0015
b	0.22		0.38	0.008		0.015
c	0.23		0.32	0.009		0.012
D	15.8		16	0.622		0.630
D1	9.4		9.8	0.37		0.38
D2		1			0.039	
E	13.9		14.5	0.547		0.57
E1	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
E4	2.9		3.2	0.114		1.259
e		0.65			0.026	
e3		11.05			0.435	
G	0		0.075	0		0.003
H	15.5		15.9	0.61		0.625
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N			10°			10°
s			8°			8°

(1) "D and E1" do not include mold flash or protusions.
Mold flash or protusions shall not exceed 0.15mm (0.006")
(2) No intrusion allowed inwards the leads.

OUTLINE AND MECHANICAL DATA



PowerSO36 (SLUG UP)



7 Revision history

Table 9. Document revision history

Date	Revision	Changes
01-Feb-2007	1	Initial release
19-Mar-2007	2	Update to reflect product maturity.

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