RTKA211605DR0010BU

The RTKA211605DR0010BU board is designed to demonstrate and quickly evaluate the RAA211605, a DC/DC step-down regulator with 450 kHz switching frequency.

The RAA211605 supports a wide input voltage range (from 4.5V to 60V) and adjustable output voltage. It can deliver up to 0.5A continuous output current with premium load regulation and line regulation performance.

The demonstration board implements a complete buck regulator using the RAA211605. The output voltage is set to 3.3V but can be adjusted by changing the resistor values in the feedback network.

Features

- Simple and flexible design
- Wide input voltage range: 4.5V to 60V
- Adjustable output voltage
- Convenient power conversion

Specifications

The following are the design specifications for the RTKA211605DR0010BU:

- Input voltage (V_{IN}): 4.5V to 60V
- Output voltage (V_{OUT}): 3.3V
- Maximum output current: 0.5A

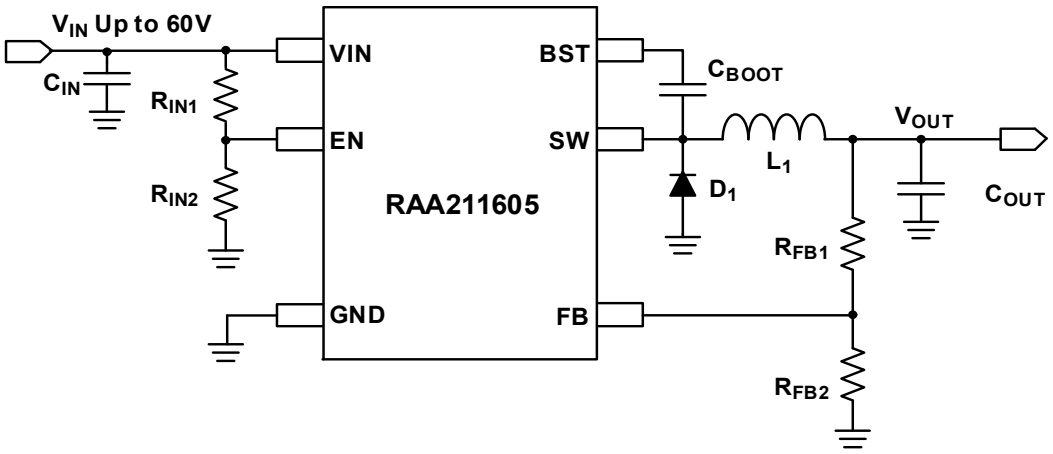


Figure 1. Block Diagram

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1. Functional Description

The RAA211605 is an easy-to-use Buck switching regulator with an integrated 600mΩ high-side MOSFET. The RTKA211605DR0010BU board demonstrates the operations of RAA211605. It allows you to evaluate the performance of the part with different application circuits. It also provides you a reference for board layout.

1.1 Setting the Output Voltage

The output voltage is set to 3.3V by default and can be changed by changing the values of R_3 and R_4 in the feedback resistor network based on Equation 1:

(EQ. 1) $$R_3 = R_4 \bullet \frac{V_{out} - 0.8}{0.8}$$

For applications where the V_{IN} - V_{OUT} is larger than 3V, Renesas recommends using a 20kΩ resistor for R_4 and choose R_3 based on Equation 1. For applications where V_{IN} - V_{OUT} is less than 3V, Renesas recommends using smaller R_3 and R_4 such that there is larger than 50mA load at V_{OUT}.

1.2 Quick Test Setup

1. EN is tied to VIN by default through a 0Ω resistor on R_1, but R_1 and R_2 can also be used to set the input undervoltage lockout level.
2. Connect the power supply to the input terminals VIN(T1) and GND(T2). Connect the load to the output terminals VOUT(T3) and GND(T4). **Important:** Ensure the setup is correctly connected before applying any power or load to the board.
3. Turn on the power supply and the part should start operating.
4. Verify that the output voltage is 3.3V and phase node waveforms can be monitored at J2.

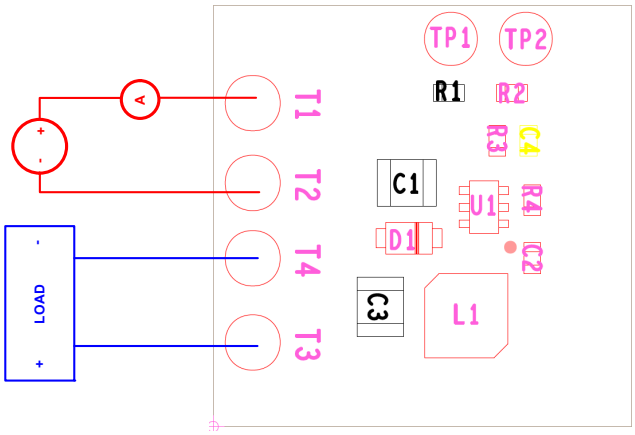


Figure 2. RTKA211605DR0010BU Board Setup

2. Board Design

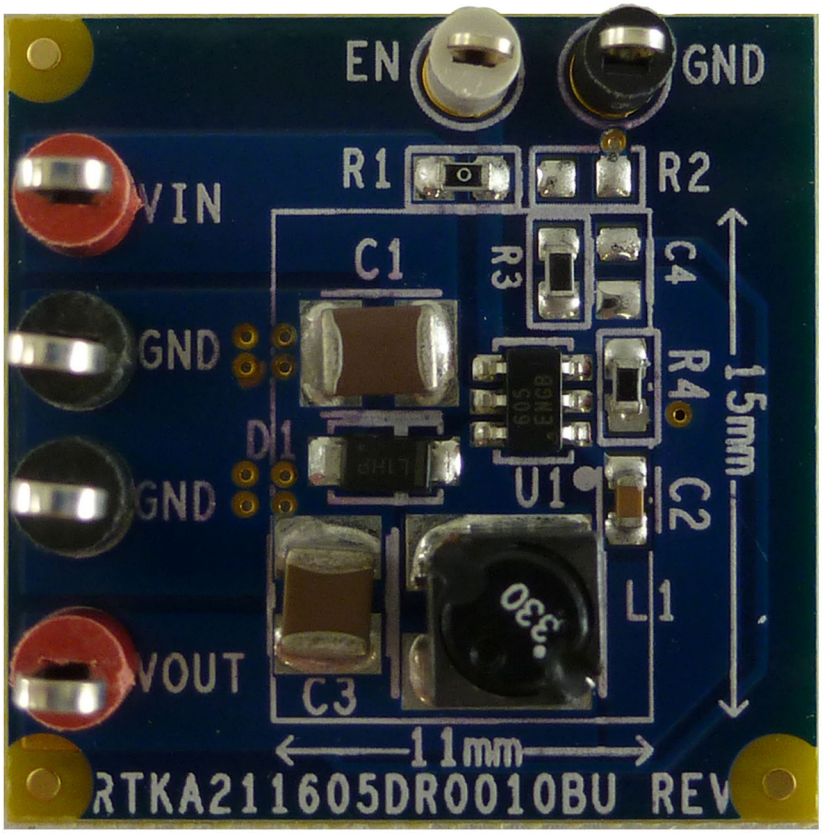


Figure 3. Top View

2.1 Circuit Schematic

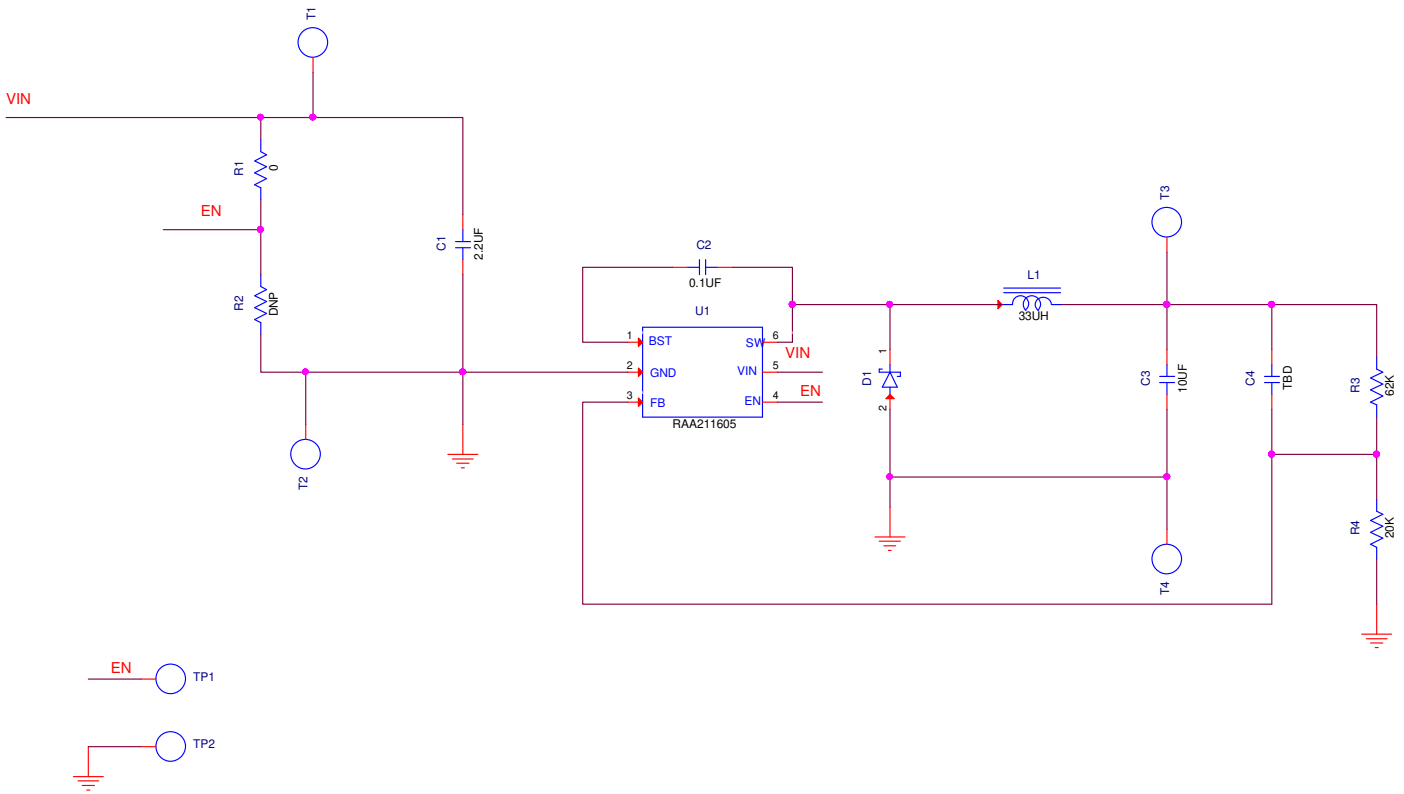


Figure 4. RTKA211605DR0010BU Schematic

2.2 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1		PWB-PCB, RTKA211605DR0010BU, REVA, ROHS	Imagineering Inc	RTKA211605DR0010BURVAPCB
1	C3	CAP, SMD, 1210, 10µF, 16V, 10%, X7R, ROHS	Murata	GRM32DR71C106KA01L
1	C2	CAP, SMD, 0603, 0.1µF, 16V, 10%, X7R, ROHS	Murata	GCM188R71C104KA37D
0	C4	CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS		
1	C1	CAP, SMD, 1210, 2.2µF, 100V, 10%, X7R, ROHS	Murata	GRM32ER72A225KA35L
1	L1	COIL-PWR INDUCTOR, SMD, 4.8mm, 33µH, 20%, 1.2A, ROHS	Wurth Electronics	74408943330
1	TP2	CONN-MINI TEST PT, VERTICAL, BLK, ROHS	Keystone	5001
1	TP1	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	Keystone	5002
2	T1, T3	CONN-MULTI-PURPOSE TEST PT, RED, ROHS	Keystone	5010
2	T2, T4	CONN-MULTI-PURPOSE TEST PT, BLK, ROHS	Keystone	5011
1	D1	DIODE-RECTIFIER, SMD, 2P, S0D-123FL, 100V, 1A, ROHS	On Semiconductor	MBR1H100SFT3G
1	U1	IC-60V SYNCHRONOUS BUCK CONVERTER, 6P, TSOT-23, ROHS	Renesas Electronics	RAA2116054GP3#JA0
1	R3	RES-AEC-Q200, SMD, 0603, 62k, 1/10W, 1%, ROHS	Panasonic	ERJ-3EKF6202V
0	R2	RESISTOR, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER		
1	R1	RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS	Venkel	CR0603-10W-000T
1	R4	RES, SMD, 0603, 20k, 1/10W, 1%, TF, ROHS	Venkel	CR0603-10W-2002FT
1	Apply to bottom center PCB	BUMPONS, 0.5x0.5inch, SQUARE, TAPERED, BLK, ROHS	3M	SJ-5008-BLACK

2.3 Board Layout

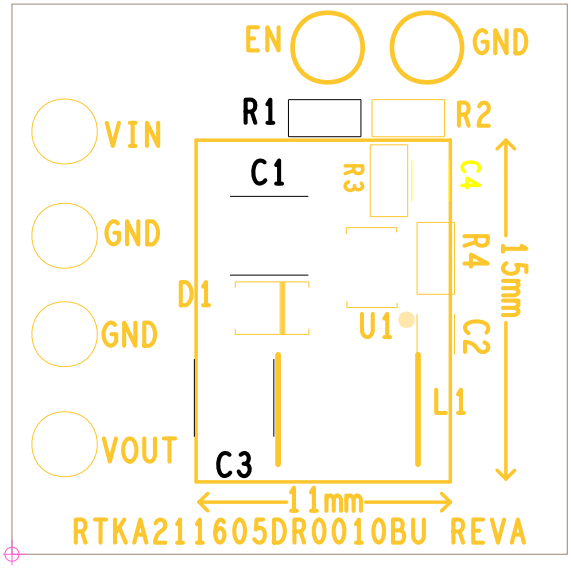


Figure 5. Silkscreen Top

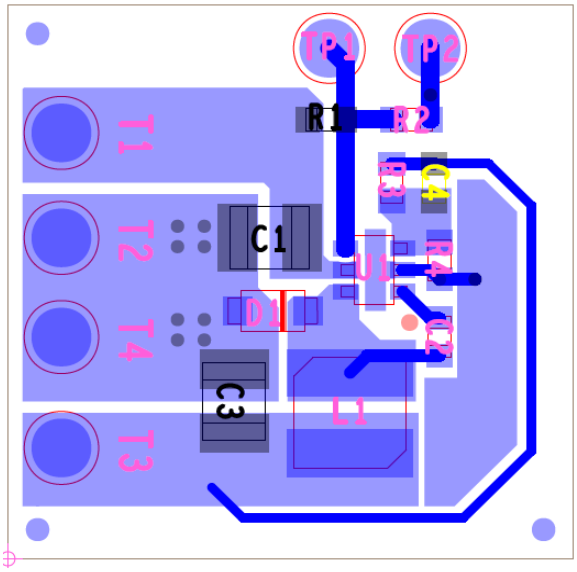


Figure 6. Top Layer

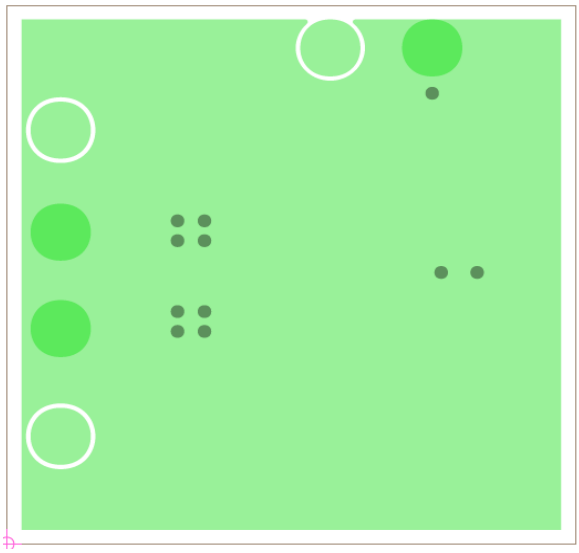


Figure 7. Bottom Layer

3. Typical Performance Curves

V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C, unless otherwise noted.

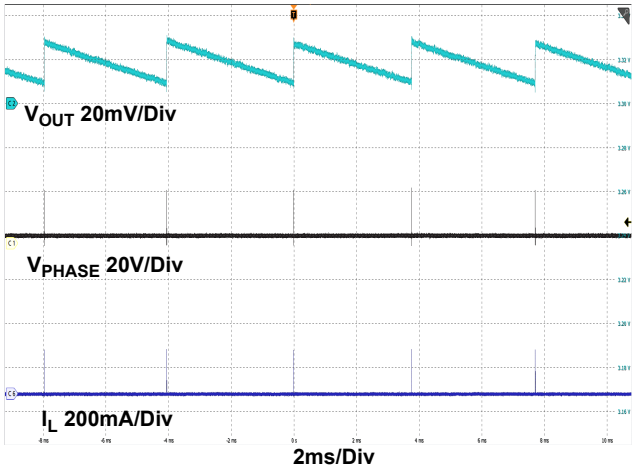


Figure 8. Output Ripple at No Load

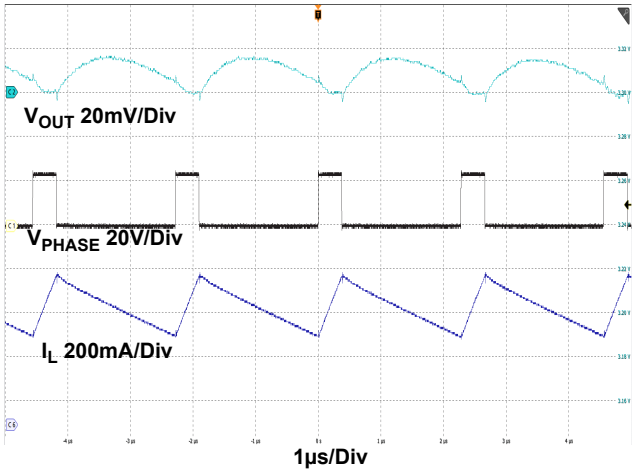


Figure 9. Output Ripple at Full Load

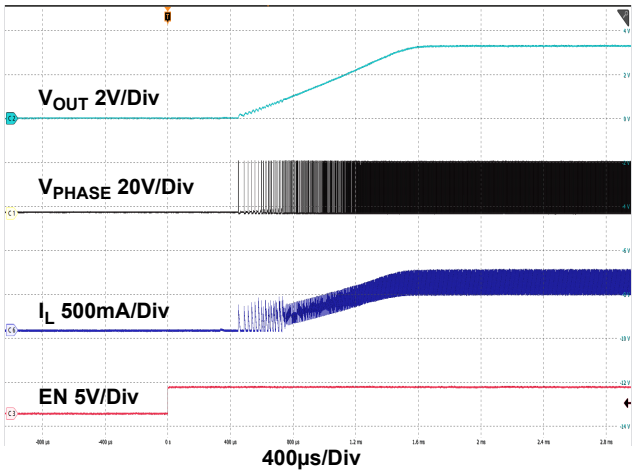


Figure 10. Enable On at Full Load

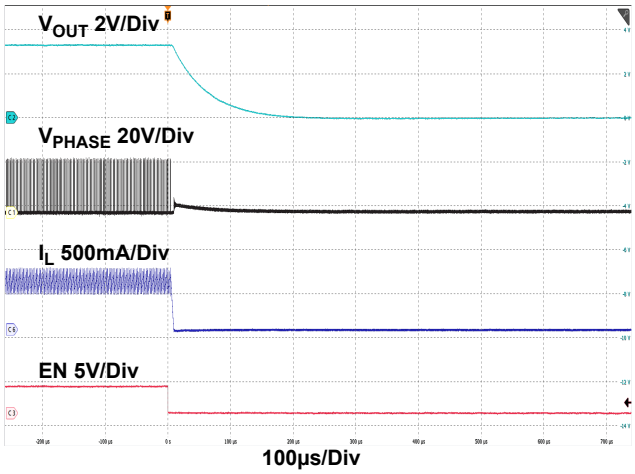


Figure 11. Enable Off at Full Load

V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C, unless otherwise noted. (Cont.)

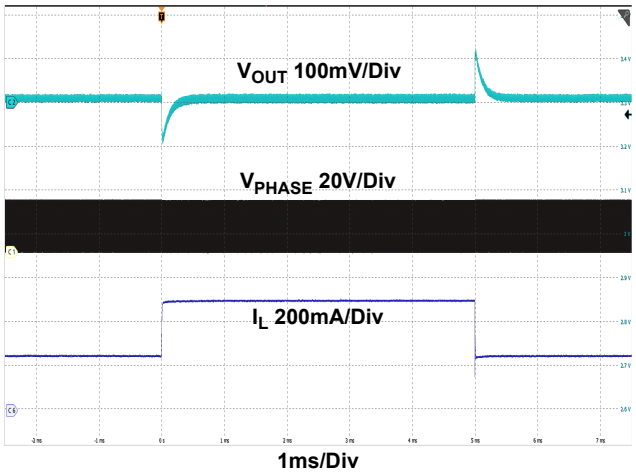


Figure 12. Load Transient between 0.25A and 0.5A

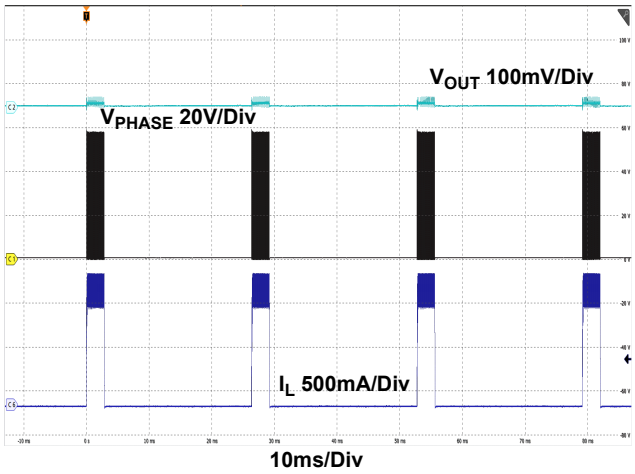


Figure 13. V_{OUT} UVP (V_{IN} = 60V)

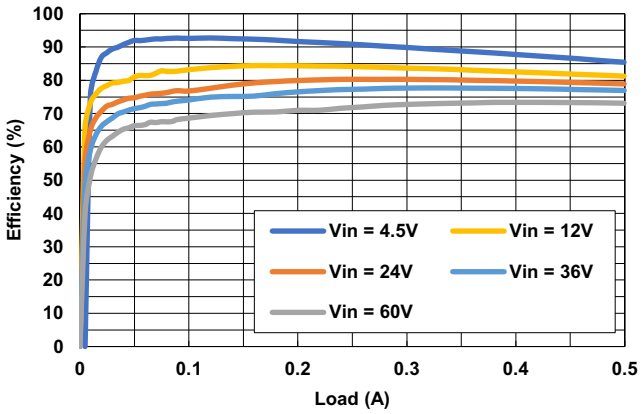


Figure 14. Efficiency vs Load

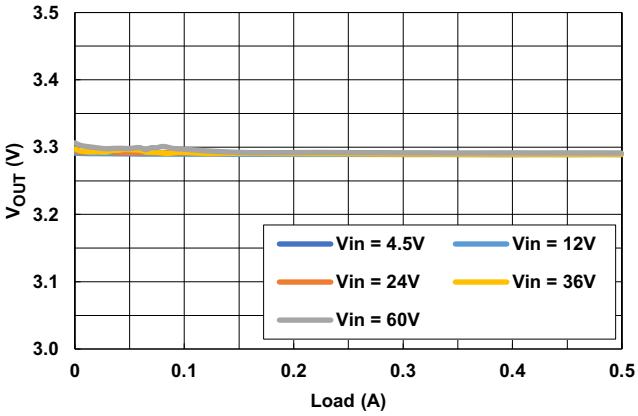


Figure 15. Load Regulation vs Input Voltage

4. Ordering Information

Part Number	Description
RTKA211605DR0010BU	RAA211605 Demonstration Board

5. Revision History

Revision	Date	Description
1.01	May 9, 2022	Updated BOM.
1.00	Jul 13, 2021	Initial release

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