

Constant current great power buck LED driver



RoHS

### FEATURES

- High efficiency up to 95%
- Ultra wide input voltage range (5.5-46 VDC)
- Drive current: 300/350/500/600/700mA
- Output power: 10/12/18/21/25W
- Low ripple & noise(<100mV)
- Support large capacitive load(1000  $\mu$ F)
- Analogue dimming + PWM dimming
- Continuous short circuit protection
- Meets EN62368

KC24H-R series is a step-down constant current source designed for high-power LED drivers. It features with high efficiency, wide input voltage range, high temperature, PWM dimming, analog dimming and remote shutdown. Can be widely used in backlight and 12V, 24V, 36V automotive lighting, landscape lighting, special control lighting, commercial lighting, street lighting, home lighting and other lighting systems.

### Selection Guide

Model	Input		Output		Full Load Efficiency (%) Min./Typ.	Capacitive Load(uF) Max.
	Input Voltage (VDC)	Input Current (mA) (Typ.) (5LEDs)	Voltage (VDC)	Current(mA)		
	Nominal (range)					
KC24H-300R(X1/X2/X3)	24 (5.5-46)	237	3.3-36	0-300	95	1000
KC24H-350R(X1/X2/X3)		276		0-350		
KC24H-500R(X1/X2/X3)		395		0-500		
KC24H-600R(X1/X2/X3)		474		0-600		
KC24H-700R(X1/X2/X3)		553		0-700		

Notes:

1. For the product model without a suffix such as KC24H-300R, this product is a 4-pin product without the functions of analogue dimming and PWM dimming.
2. For the product model with a suffix X1 such as KC24H-300RX1, this product is a 5-pin product only with the function of analogue dimming.
3. For the product model with a suffix X2 such as KC24H-300R X2, this product is a 5-pin product only with the function of PWM dimming.
4. For the product model with a suffix X3 such as KC24H-300R X3, this product is a 6-pin product with the functions of analogue dimming and PWM dimming.

### Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Limit	$\leq 10$ seconds	5	--	55	VDC
Recommended Input Voltage		5.5	24	46	
Min. Input-output Voltage Drop	$V_{in}=5.5V-46V, 1-10LEDs$	2	--	4	
Internal Power Dissipation	$V_{in}=24V, 5LEDs$	--	--	0.7	W
Reverse Polarity Input		Forbid			
Input Filter		Capacitance Filter			

### Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Power	Io: 300mA	--	--	10.8	W
	Io: 350mA	--	--	12.6	
	Io: 500mA	--	--	18	
	Io: 600mA	--	--	21.6	
	Io: 700mA	--	--	25.2	
Output Current Accuracy	Io: 300mA-600mA	--	$\pm 3$	$\pm 5$	%
	Io: 700mA	--	$\pm 5$	$\pm 7$	
Output Current Stability	$V_{in}=46V, V_o=3.3V-36V$	--	$\pm 3$	$\pm 5$	
Temperature Drift Coefficient	-40 $^{\circ}C$ to +71 $^{\circ}C$	--	--	$\pm 0.015$	%/ $^{\circ}C$
Ripple & Noise*	20MHz bandwidth( $V_{in}=46V, 1-10 LEDs$ )	--	--	100	mVp-p

Over-temperature Protection		Self-recovery after cooling
Output Short Circuit Protection		Continuous, self-recovery
Note: *Ripple and noise tested with "parallel cable" method, please see DC-DC Converter Application Notes for specific operation methods.		

## General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Operating Temperature	300mA / 350mA	-40	--	85	°C
	500mA/ 600mA/ 700mA	-40	--	71	
Storage Temperature		-55	--	125	
Operating Humidity		--	--	95	%
Storage Humidity		--	--	95	
Case Temperature Rise	Ta=25°C	--	--	65	°C
Lead Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	265	
Switching Frequency*		550	645	750	kHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours
Thermal Impedance		--	60	--	°C/W

Note:\* The working frequency will be 100-400kHz when with high input voltage and the output are connected to 1LED.

## PWM Dimming and Remote on/off Control

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Analogue Dimming	Input Voltage Range	Vin=5.5V-46V			
	Output Current Range	0-15V			
	Control Voltage Range	0%-100%			
		Full on			
	Driving Current	0.2V±50mV			
PWM Dimming& Remote Turn-off	ON	Full off			
	OFF	4.5V±200mV			
	Turn-off-mode Static Input Current	Vc=5V	--	--	0.2 mA
	Isink	Open or 2.8V<Vc<6V			
	Isource	Vc<0.6V			
	PWM Dimming Frequency*	Vin=24V, Vc <0.6V	--	400	-- μA
		Vc=5V, Vin=24V, 5LEDs	--	--	1 mA
		Vc<0.6V, Vin=24V, 5LEDs	--	1	-- μA
			--	--	200 Hz

Note: \*Refer to "PWM Dimming Control" on page five.

## Physical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant (UL94 V-0)
Dimensions	22.80 x 10.20 x 9.50 mm
Weight	4.3g(Typ.)
Cooling Method	Free air convection

## EMC Specifications

EMI	CE	EN55015 power port/CISPR22 CLASS B (see Fig. 5 for recommended circuit)			
	RE	EN55015 /CISPR22 CLASS B (see Fig. 5 for recommended circuit)			
EMS	ESD	KC24H-xxxR(X1)	IEC/EN 61000-4-2	Contact ±6kV	perf. Criteria B
		KC24H-xxxRX2/X3	IEC/EN 61000-4-2	Contact ±2kV(see Fig. 5 for recommended circuit)	perf. Criteria B
	RS		IEC/EN 61000-4-3	10V/m	perf. Criteria A
	EFT		IEC/EN 61000-4-4	±1kV (see Fig. 5 for recommended circuit)	perf. Criteria B
	Surge		IEC/EN 61000-4-5	line to line ±1kV (see Fig. 5 for recommended circuit)	perf. Criteria B
	CS		IEC/EN 61000-4-6	3Vrms	perf. Criteria A

Product Characteristic Curve

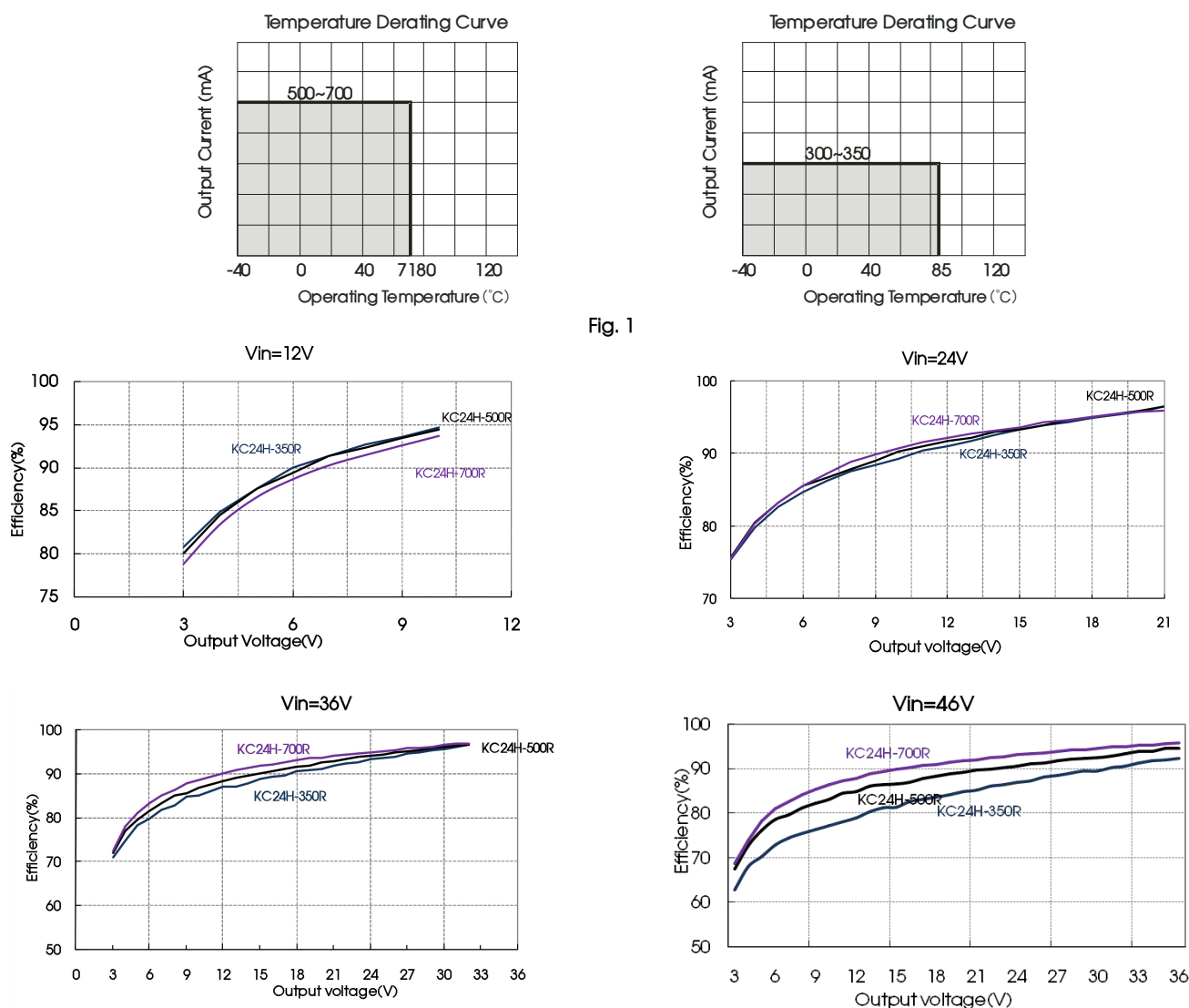


Fig. 1

Design Reference

1. Input/output relationship

Input voltage(VDC)	Output voltage range(VDC)	Constant output current (mA)	Output power (W Max.)	Input voltage(VDC)	Output voltage range(VDC)	Constant output current (mA)	Output power (W Max.)
46	3.3-36.0	300	10.80	46	3.3-36.0	350	12.60
36	3.3-32.0	300	9.60	36	3.3-32.0	350	11.20
24	3.3-21.0	300	6.30	24	3.3-21.0	350	7.35
20	3.3-17.0	300	5.10	20	3.3-17.0	350	5.95
15	3.3-13.2	300	3.96	15	3.3-13.2	350	4.62
12	3.3-10.0	300	3.00	12	3.3-10.0	350	3.50
5.5	3.3-4.0	300	1.20	5.5	3.3-4.0	350	1.40
46	3.3-36.0	500	18.00	46	3.3-36.0	600	21.60
36	3.3-32.0	500	16.00	36	3.3-32.0	600	19.20
24	3.3-21.0	500	10.50	24	3.3-21.0	600	12.60
20	3.3-17.0	500	8.50	20	3.3-17.0	600	10.20
15	3.3-13.2	500	6.60	15	3.3-13.2	600	7.92
12	3.3-10.0	500	5.00	12	3.3-10.0	600	6.00

5.5	3.3-4.0	500	2.00		5.5	3.3-4.0	600	2.40
Input voltage(VDC)	Output voltage range(VDC)	Constant output current (mA)	Output power (W Max.)		Input voltage(VDC)	Output voltage range(VDC)	Constant output current (mA)	Output power (W Max.)
46	3.3-36.0	700	25.20		--	--	--	--
36	3.3-32.0	700	22.40		--	--	--	--
24	3.3-21.0	700	14.70		--	--	--	--
20	3.3-17.0	700	11.90		--	--	--	--
15	3.3-13.2	700	9.24		--	--	--	--
12	3.3-10.0	700	7.00		--	--	--	--
5.5	3.3-4.0	700	2.80		--	--	--	--

## 2. Typical application circuit

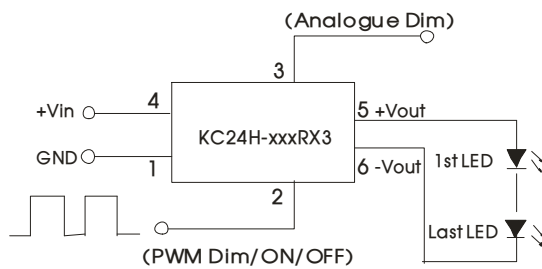


Fig. 2 Application circuits in series

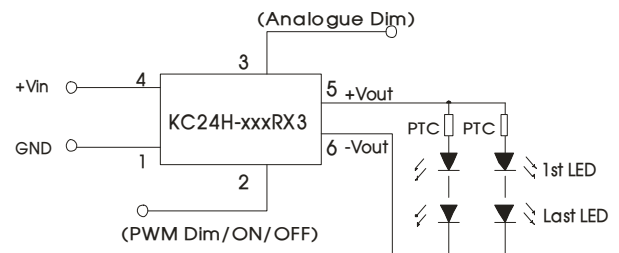


Fig. 3 Application circuits in series and parallel

If it is necessary to protect LED in actual application, you could connect a PTC to the input of every channel or all channels, as shown in Figure 3.

Note: The negative output terminal could not connect GND, or the module may be damaged.

## 3. Recommended AC input circuit

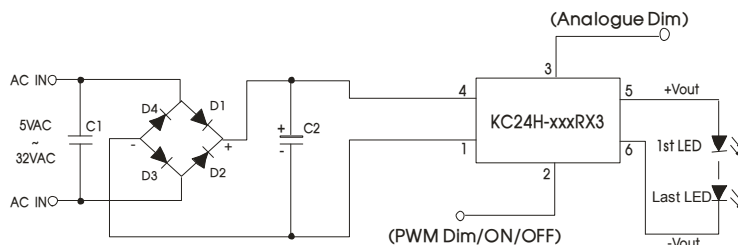


Fig. 4

Components	Specification
C1	X1 Safety capacitor, 0.1μF /300VAC (QIYA)
C2	100μF /63V Electrolytic capacitor, Φ10x16(Flat surface)NCC
D1, D2, D3, D4	Rectifier diode 1N4007 1A/1000V D0-41(PANJIT)

## 4. EMC solution-recommended circuit

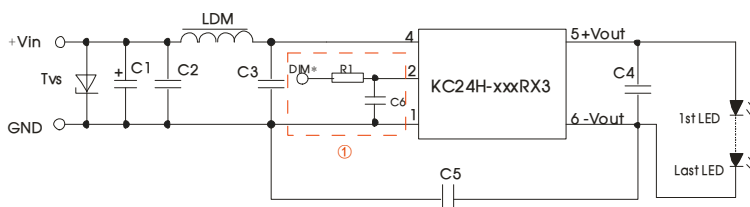
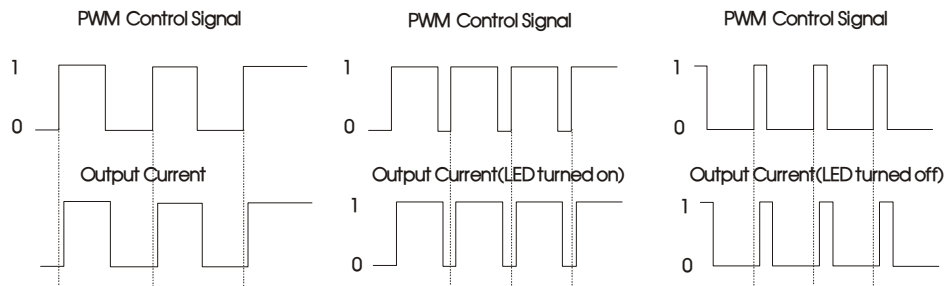


Fig.5 Recommended EMC circuit

Note: Add circuit ① may let the ESD level of PWM-control pin reach to ±6KV.

Components	Specification
Tvs	SMC51A,1500W (ON)
LDM	CD53-82 μ H (CEA1YA)
C1	470 μ F/100V (NCC)
C2	2.2 μ F/50V 1210 X7R (TORCH)
C3	0.1 μ F/50V 0805 X7R (TORCH)
C4	1 μ F/50V 1210 X7R (TORCH)
C5	1nF/2000V 1210 (TDK)(choose or no)
C6	470pF/100V 0805 (TORCH)
R1	680Ω 0805(can be replaced by inductance or magnetic bead)

## 5. PWM dimming control



For PWM dimming signals with a certain frequency, the output current of the driver is related to the duty ratio of PWM signal. Refer to the formula for the calculation method:

$$I_{o\_set} = \frac{DT - 0.8}{T} = I_{o\_nom}$$

Where,  $I_{o\_set}$  represents required output current (mA);  $D$  represents the duty ratio (%) of PWM signal;  $T$  represents the period (ms) of PWM signal; and  $I_{o\_nom}$  represents the rated output value (mA) of the driver.

Note: The above formula is for reference only, and the output current may vary due to different loads. The minimum on-time of the PWM signal cannot be less than 0.8ms, otherwise the product will not work normally. It is normal to hear a slight sound from the driver during PWM dimming, because the PWM dimming frequency is within the range of human hearing frequency (usually 20Hz-20KHz). In order to prevent human eyes from observing the flicker of the LED, it is recommended to set the PWM dimming frequency at 100-200Hz.

PWM curve ( $V_{in}=24V$ , 5LEDs) :

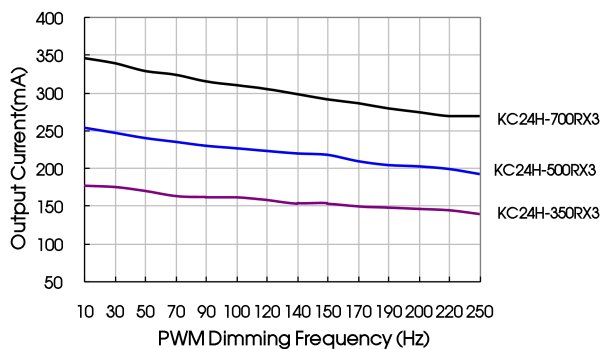


Fig. 6 Output current VS PWM dimming frequency (D=50%)

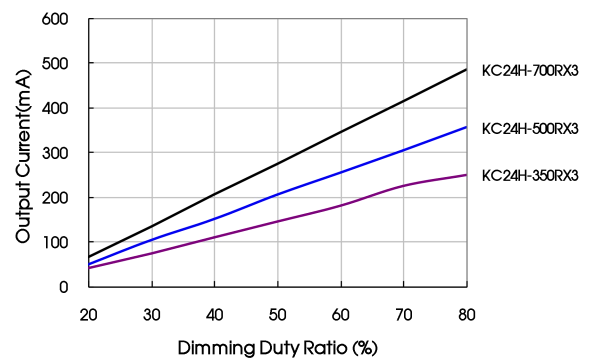


Fig. 7 Output current VS Dimming duty ratio (f=200Hz)

## 6. Analogue dimming and typical application

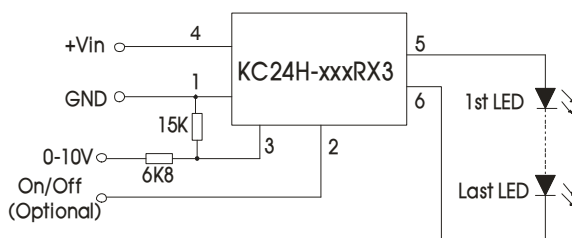


Fig. 8 Analogue dimming circuit

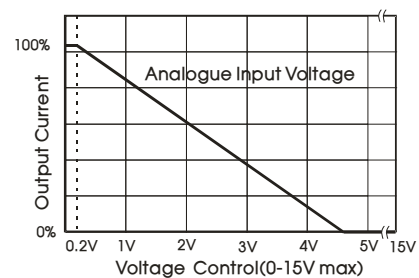
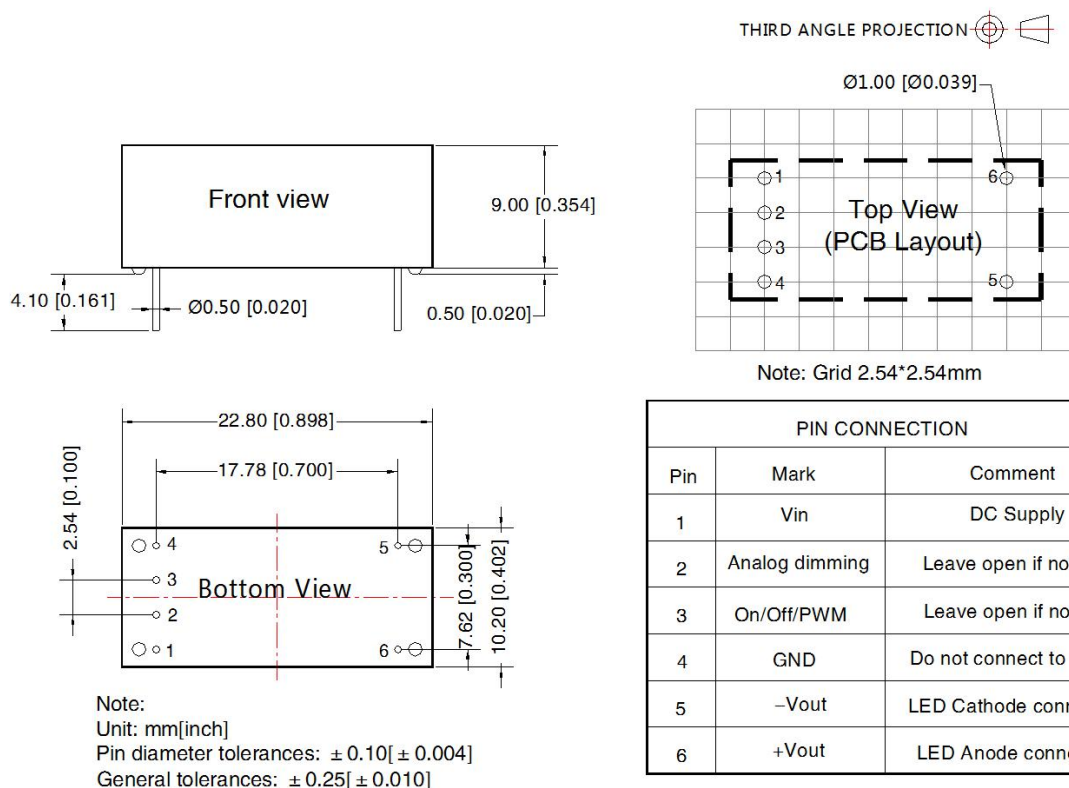


Fig. 9 Analogue input voltage and output current

- The voltage drop of all LEDs in this datasheet is 3.3-3.8V. In actual use, the number of LED lights can be determined according to the actual voltage drop and output voltage of the LED lights.
- This product does not support hot-Plug use.
- For more information Please find the application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

## Dimensions and Recommended Layout



### Notes:

- For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). Packaging bag number: 58210025;
- If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
- The specified maximum capacitive load is tested under full load condition and over the input voltage range; The maximum capacitive load offered were tested at input voltage range and full load;
- Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^{\circ}\text{C}$ , humidity<75%RH with nominal input voltage and rated output load;
- All index testing methods in this datasheet are based on our company corporate standards;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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