

Constant current LED driver for high-power LED



RoHS

## FEATURES

- Output current: Max 1200 mA
- Efficiency up to 97%
- Ultra wide range of voltage (input and output)
- Constant current mode, high power output
- PWM dimming & Analogue dimming
- Switching-on/off control function, continuous short circuit protection
- Built-in EMI filter circuit, meet EN55015 standards

KC24H series is step-down constant current sources for driving high-power LED featured in high efficiency and wide range of input voltage, high operating temperature, and act in PWM dimming, analogue dimming and remote turn-off. The product can be widely applied to fields such as landscape lighting, specially-controlled lighting, backlight, business lighting, street lamp lighting, domestic lighting and automobile lighting.

## Selection Guide

Approval	Part No.	Input		Output		Efficiency (% Typ), @Full Load	Max. Capacitive Load(μF)
		Input Voltage (VDC)	Input Current (mA) @Vin=24V Vo=17V	Output Voltage (VDC)	Output Current (mA)		
		Nominal (range)					
RoHS	KC24H-1000(X1/X2/X3)	24	740	3.3-36	1000	97	1000
	KC24H-1200(X1/X2/X3)	(5.5-48)	892		1200		

- Notes:
1. For the product model without a suffix such as KC24H-1000, this product is an 8-pin product without the functions of analogue dimming and PWM dimming.
  2. For the product model with a suffix X1 such as KC24H-1000X1, this product is a 9-pin product only with the function of analogue dimming.
  3. For the product model with a suffix X2 such as KC24H-1000X2, this product is a 9-pin product only with the function of PWM dimming.
  4. For the product model with a suffix X3 such as KC24H-1000X3, this product is a 10-pin product with the functions of analogue dimming and PWM dimming.

## Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range		5.5	24	48	VDC
Input Voltage Limit	≤10 seconds	5	--	55	
Min. Input-output Voltage Drop	Input voltage range	2	--	4	
Input Filter		Pi filter			

## Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Power	Io=1000mA	3.3	--	36	W
	Io=1200mA	3.96	--	43.2	
Output Current Accuracy		--	±3	±5	%
Output Current Stability		--	±0.5	±1	
Temperature Drift Coefficient	Vin=48V,Vo=10LEDs	--	--	±0.05	%/°C
Ripple & Noise*	20MHz bandwidth	--	70	200	mVp-p
Over temperature Protection		Self-recovery after cooling			
Short Circuit Protection		Continuous, Automatic 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	Derating if the temperature ≥71°C (see Fig. 1)	-40	--	85	°C
Storage Temperature		-55	--	125	

Storage Humidity		--	--	95	%RH
Lead Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	265	°C
Switching Frequency		--	370	--	KHz
MTBF	MIL-HDBK-217F@25°C	650	--	--	K hours

### PWM Dimming and Remote on/off Control

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Analogue Dimming	Input Voltage Range	V <sub>in</sub> =5.5-48V	0	--	15	V
	Output Current Range	V <sub>in</sub> =5.5-48V	0	--	100	%
	Control Voltage Range	Full on	0.2V±50mV			
		Full off	4.5V±200mV			
Driving Current	V <sub>c</sub> =5V	--	--	0.6	mA	
Remote Turn-off	ON	V <sub>in</sub> =5.5-48V	Open or 2.8V<V <sub>c</sub> <6V			
	OFF	V <sub>in</sub> =5.5-48V	V <sub>c</sub> <0.6V			
PWM Dimming	PWM dimming Pin suspended voltage	V <sub>in</sub> =24V, 5LED	--	3.3	--	V
	PWM dimming Pin Isink	V <sub>c</sub> =5V	--	--	1	mA
	PWM dimming Pin Isource	V <sub>c</sub> <0.6V	--	1	--	µA
	Turn-off-mode Static Input Current	V <sub>in</sub> =24V, V <sub>c</sub> <0.6V	--	400	--	
	PWM Dimming Frequency*		--	--	200	Hz

Note: \*Refer to "Digital Dimming Control" on page four.

### Physical Specifications

Casing Material	Black flame-retardant and heat-resistant plastic (UL94-V0)
Package Dimensions	31.70*20.30*12.65 mm
Weight	13.00g(Typ.)
Cooling Method	Free air convection

### EMC Specifications

EMI	Conducted Disturbance	CISPR22/EN55022	CLASS B	EN55015 power port	
	Radiated Emission	CISPR22/EN55022	CLASS B		
EMS	Electrostatic Discharge	IEC/EN 61000-4-2	Contact ±4KV		perf. Criteria B
	Radiation Immunity	IEC/EN 61000-4-3	10V/m		perf. Criteria A
	EFT	IEC/EN 61000-4-4	±2KV (see Fig. 5 for recommended circuit)		perf. Criteria B
	Surge Immunity	IEC/EN 61000-4-5	±2KV (see Fig. 5 for recommended circuit)		perf. Criteria B
	Conducted Disturbance Immunity	IEC/EN 61000-4-6	3Vr.m.s		perf. Criteria A
	Immunities of voltage dip, drop and short interruption	IEC/EN 61000-4-29	0%-70%		perf. Criteria B

### Product Characteristic Curve

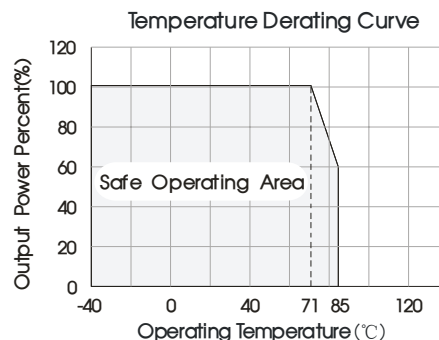
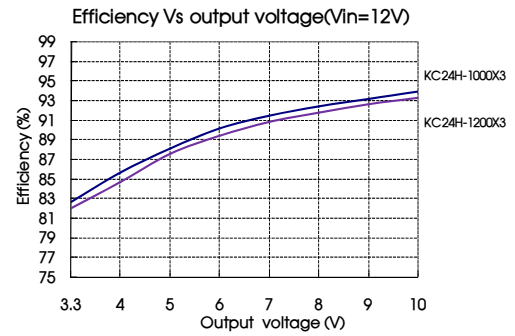
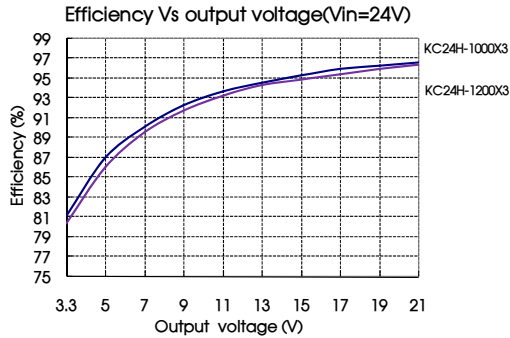
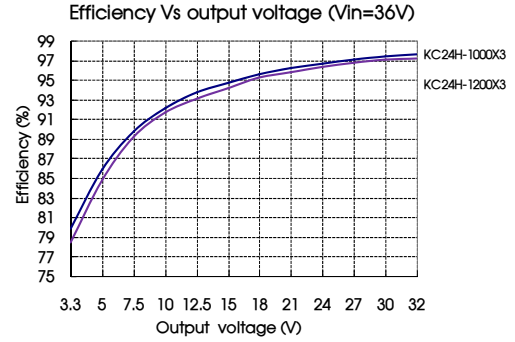
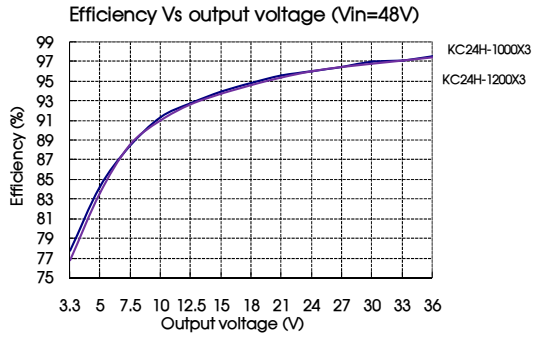


Fig. 1



## Design Reference

### 1. Input/output relationship

KC24H-1000(X1/X2/X3)			
Input voltage (VDC)	Output voltage range (VDC)	Constant output current (mA)	Output power (W, Max.)
48	3.3-36.0	1000	36
36	3.3-32.0	1000	32
24	3.3-21.0	1000	21
20	3.3-17.0	1000	17
15	3.3-13.2	1000	13.2
12	3.3-10.0	1000	10
5.5	3.3-4.0	1000	4

KC24H-1200(X1/X2/X3)			
Input voltage (VDC)	Output voltage range (VDC)	Constant output current (mA)	Output power (W, Max.)
48	3.3-36.0	1200	43.2
36	3.3-32.0	1200	38.4
24	3.3-21.0	1200	25.2
20	3.3-17.0	1200	20.4
15	3.3-13.2	1200	15.84
12	3.3-10.0	1200	12
5.5	3.3-4.0	1200	4.8

### 2. Typical application circuit

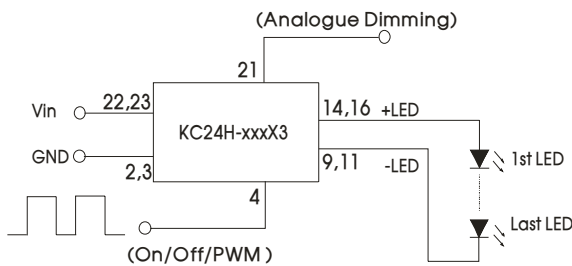


Fig. 2 Application circuits in series

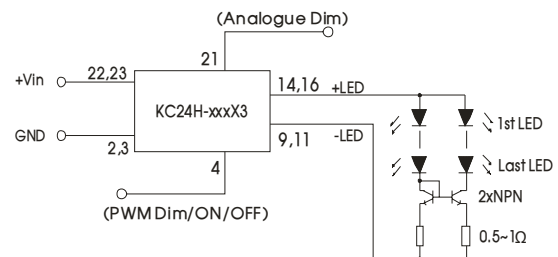


Fig. 3 Application circuits in series and parallel

#### Notes:

- ① If the product is applied to high voltage condition (higher than 40V), the input terminal must be provided with an additional capacitor ( $\geq 47\mu\text{F}/100\text{V}$ ) to prevent voltage spike from damaging the module.
- ② The output cathode cannot be connected with the input grounding, or it will damage the module.
- ③ The "Input/output Relationship" must be complied with during use.
- ④ When the product is at the input high-voltage section and the output is connected to one LED, since the duty ratio is small, the frequency hopping of the product is normal; the output current is constant; and it will not affect the normal use.

### 3. Recommended AC input circuit

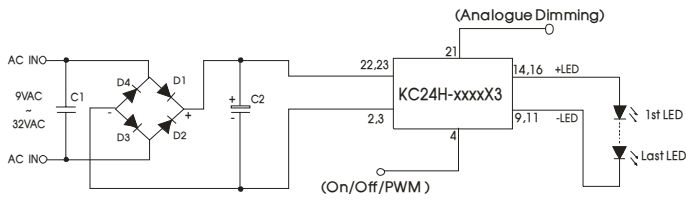


Fig. 4

Components	Specification
C1	Safety-regulated X1 film capacitor, 0.1μF/3000VAC
C2	100μF/100V electrolytic capacitor
D1, D2, D3, D4	Rectifier diode (2A/200V)

### 4. EMC solution-recommended circuit

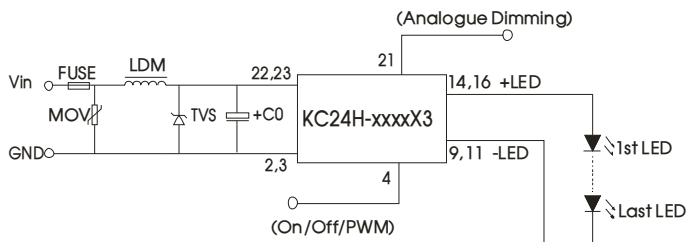


Fig.5 Recommended EMC circuit

Components	Specification
FUSE	Selected based on the actual input current from the customer
MOV	S10K35
TVS	SMC54A
LDM	56μFH
C0	120μF/63V

### EMC solution-recommended circuit PCB layout

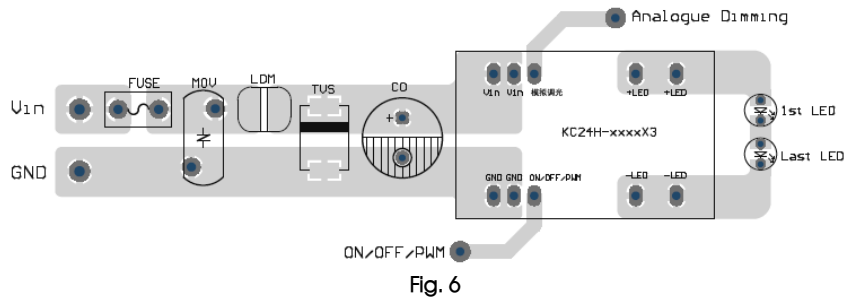
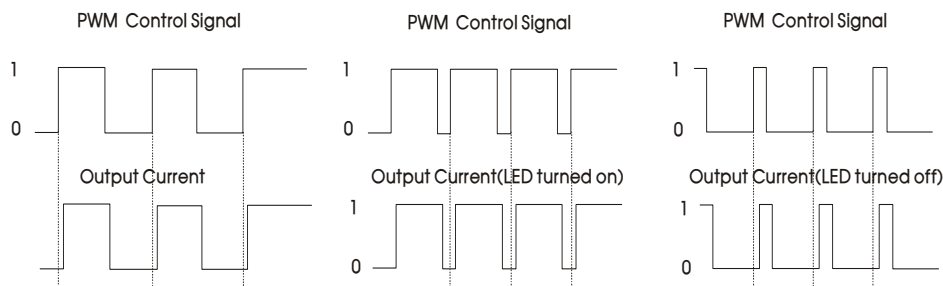


Fig. 6

### 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:

$$I_{o\_set} = \frac{(DT-0.75)}{T} I_{o\_norm}$$

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  $I_{o\_norm}$  represents the rated output value (mA) of the driver.

Note: The above formula is for reference only; and deviation of output current may exist due to various loads. The min. conducted time of PWM signal shall not be less than 0.75ms, or the product will be in abnormal operation; in case of low voice from the driver during PWM dimming, it is normal since the PWM dimming frequency is within the auditory frequency range of human ears (20Hz-20KHz in general). To prevent seeing flash of the LED by human eyes, it is suggested to set the PWM dimming frequency between 100-200Hz.

PWM curve(Vin=24V,5LEDs):

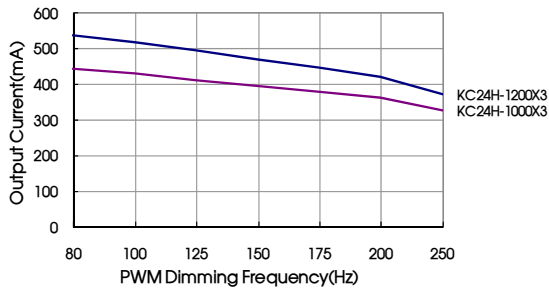


Fig. 7 PWM dimming frequency and output current (D=50%)

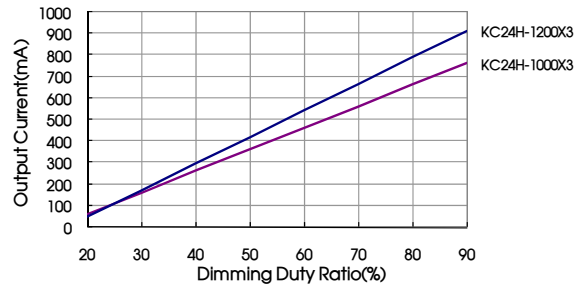


Fig. 8 Dimming duty ratio and output current (f=200Hz)

6. Analogue dimming and typical application

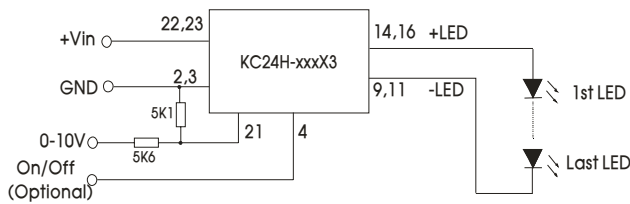


Fig. 9 Analogue dimming circuit

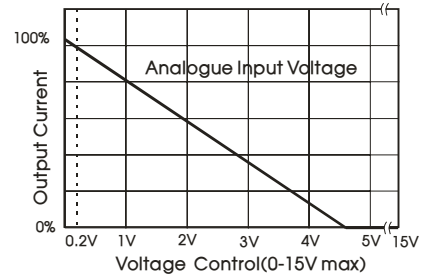
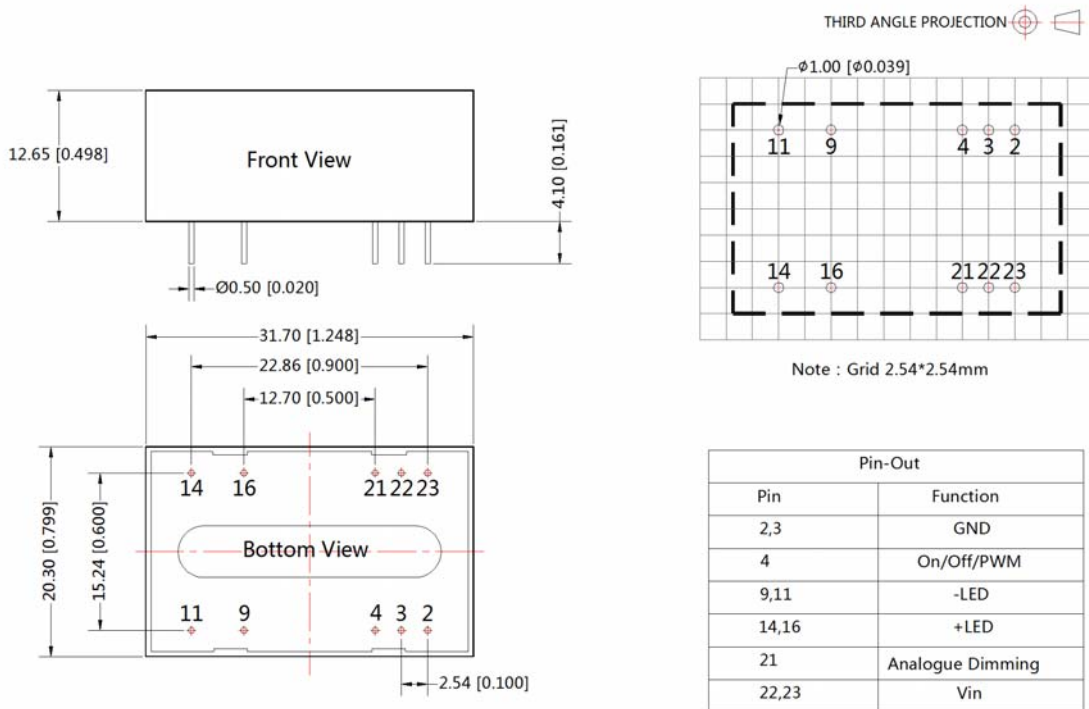


Fig. 10 Analogue input voltage and output current

- The voltage drop of all LEDs in the datasheet is 3.3-3.8V, during actual application, the number of LEDs can be confirmed based on the actual voltage drop and output voltage of LEDs.
- 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



Note:  
Unit :mm[inch]  
Pin diameter tolerances :±0.10[±0.004]  
General tolerances:±0.25[±0.010]

Notes:

1. Packing Information please refer to 'Product Packing Information'. Packing bag number: 58000150;
2. If the product is not operated within the required load range, the product performance can not be guaranteed to comply with all performance indexes in the datasheet;
3. Unless otherwise specified, data in this datasheet should be tested under the conditions of  $T_a=25^{\circ}\text{C}$ , humidity<75% when inputting nominal voltage and outputting 5 LEDs;
4. All index testing methods in this datasheet are based on our Company's corporate standards;
5. The performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact with our technician for specific information;
6. We can provide product customization service;
7. Specifications of this product are subject to changes without prior notice.

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