480W non-isolated, ultra-wide input, buck-boost single output

Patent Protection RoHS

FEATURES

- Ultra-wide input voltage range: 14.5 - 90VDC
- Output voltage range: 20 - 55VDC
- Support wide range adjustable voltage output
- High efficiency up to 97.5%
- No-load input current as low as 5 mA
- Protections: input under-voltage, input over-voltage, short-circuit, output over-current, output over-voltage, over-temperature
- Operating ambient temperature range: -40℃ to 105℃
- Industry standard 1/8-Brick package and pin-out

The KUBXX48EB(F)-10A series are high efficiency switching regulators. It features ultra-wide input range of 14.5-90VDC, adjustable output voltage range of 20-55VDC, efficiency up to 97.5%, operating temperature of -40℃ to +105℃, input over-voltage and under-voltage protection, output short-circuit and output over-voltage, over-current, over-temperature protection, remote control, output voltage regulation and remote compensation and other functions. It is widely used in robotics, communications, battery management, DC-DC distributed power supply and other occasions.

Selection Guide

Certification	Part No.①	Input			Output			Full Load Efficiency (%)④	Capacitive Load (μF)
		Nominal (Range) (VDC)	Max.③ (VDC)	Current (A) Max.	Voltage (Range) (VDC)	Current (A) Max.	Power(W) Max.	Min./Typ.	Max.
--	KUB6048EB-10A	60 (14.5-90)②	90	10	48 (20-55)	10	480	95/97.5	220
	KUB6048EBF-10A								
	KUB4848EB-10A	48 (14.5-75)②	75					95/97.0	
	KUB4848EBF-10A								

Note:
① "F" means heat sink package;
② After the product is started at 18VDC input voltage, it can be reduced to 14.5VDC input voltage to work, but it is not guaranteed to meet the specifications of this datasheet in the 14.5-18VDC input voltage range. This datasheet is for 18-90VDC(KUB6048EB(F)-10A), 18-75VDC(KUB4848EB(F)-10A) input voltage specifications;
③ The input voltage should not exceed this value, otherwise permanent and unrecoverable damage may be caused;
④ The above efficiency values are measured at nominal input voltage, nominal output voltage and output maximum load;
⑤ KUB6048EB(F)-10A and KUB4848EB(F)-10A products in the nominal input voltage range and output voltage range (20-55VDC) can work properly, but the input and output currents cannot exceed 10A and the output power cannot exceed 480W. For details, see the product characteristic curve.

Typical input-output Efficiency

Input	Output			KUB6048EB(F))-10A Full Load Efficiency (%) Typ.	KUB4848EB(F))-10A Full Load Efficiency (%) Typ.
Voltage(VDC)	Voltage(VDC)	Current(A)	Power(W) Max.		
24	24	10	240	96.5	95.5
	36	6.67	240	96.5	95.0
	48	5	240	95.5	94.0
36	24	10	240	96.0	95.0
	36	10	360	96.5	95.5
	48	7.5	360	97.0	96.5

Typical input-output Efficiency

Input	Output			KUB6048EB(F))-10A Full Load Efficiency (%) Typ.	KUB4848EB(F))-10A Full Load Efficiency (%) Typ.
Voltage(VDC)	Voltage(VDC)	Current(A)	Power(W) Max.		
48	24	10	240	95.5	93.5
	36	10	360	96.5	95.0
	48	10	480	97.5	97.0
60	24	10	240	94.5	93.5
	36	10	360	96.5	94.5
	48	10	480	97.5	96.5
72	24	10	240	94.0	92.5
	36	10	360	95.5	93.5
	48	10	480	96.0	95.0

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load / no-load)	KUB6048EB(F)-10A, 60Vin, 48Vo	--	8205/5	8422/--	mA
	KUB4848EB(F)-10A, 48Vin, 48Vo	--	10270/5	10530/--	
Reflected Ripple Current	Nominal input voltage	--	100	500	
Surge Voltage (1sec. max.)	KUB6048EB(F)-10A	--	--	95	VDC
	KUB4848EB(F)-10A	--	--	80	
Start-up Voltage		--	17	18	
Under-voltage Protection		12	14.5	--	
Over-voltage Protection	KUB6048EB(F)-10A	--	94	100	
	KUB4848EB(F)-10A	--	80	85	
Input Filter		Capacitance filter			
Hot Plug		Unavailable			
Input Reverse Polarity Protection		Unavailable			
Ctrl	Module on	Ctrl pin open or pulled GND or pulled low (TTL 0-0.6 VDC)			
	Module off	Ctrl pin pulled TTL to high(2-5 VDC)			
	Input current when off	--	0.5	2	mA

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	Input voltage range 0% -100% load	--	±1	±3	%
Linear Regulation	Full load, input voltage range	--	±0.02	±1	
Load Regulation	Nominal input voltage, 0% -100% load	--	±0.5	±1	
Transient Recovery Time	Nominal input voltage, 25% load step change	--	100	500	μs
Transient Response Deviation		--	±2	±5	%
Temperature Coefficient	Operating temperature -40℃ to +105℃	--	--	±0.03	%/℃
Ripple & Noise*	20MHz bandwidth, nominal input voltage, full load	--	240	300	mVp-p
Over-temperature Protection	Maximum surface temperature of the product	--	120	--	℃
Over-voltage Protection	Input voltage range, output power range	--	--	65	VDC

Over-current Protection	Normal temperature, Input voltage range	--	150	--	%Io
Short-circuit Protection	Input voltage range	Hiccup, continuous, self-recovery			
Trim	Adjustable range of output voltage	20	--	55	VDC
Note: * The "parallel cable" method is used for ripple and noise test and parallel 22uF/100V capacitor, please refer to DC-DC Converter Application Notes for specific information; In other working conditions, the maximum value of the output ripple & noise is 1000mVp-p.					

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input/Output - Shell, Electric Strength Test for 1 minute with a leakage current of 1mA max.	1500	--	--	VDC
Sense	See part of Remote Sense Application	--	--	105	%Vo
Operating Temperature	See Fig. 1	-40	--	+105	℃
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Pin Soldering Resistance Temperature	Wave-soldering, 10 second	--	--	+260	℃
	Soldering spot is 1.5mm away from case for 10 seconds	--	--	+300	
Pollution Degree		PD 3			
Vibration		10-150Hz, 5g, 0.75mm, 90 Min. along X, Y and Z			
Switching Frequency	Full load, nominal input voltage	--	800	--	kHz
Operating altitude		Altitude: ≤2000m, Atmospheric pressure: 80-110KPa			
MTBF	MIL-HDBK-217F@25℃	500	--	--	k hours

Mechanical Specifications

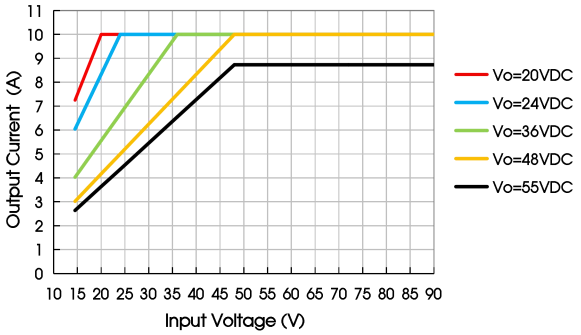
Case Material	Aluminum alloy	
Dimensions	KUBXX48EB-10A	60.80 x 25.00 x 12.70 mm
	KUBXX48EBF-10A	60.80 x 36.83 x 12.70 mm
Weight	KUBXX48EB-10A	48 g(Typ.)
	KUBXX48EBF-10A	53 g(Typ.)
Cooling Method	Free air convection or forced convection	

Electromagnetic Compatibility (EMC)

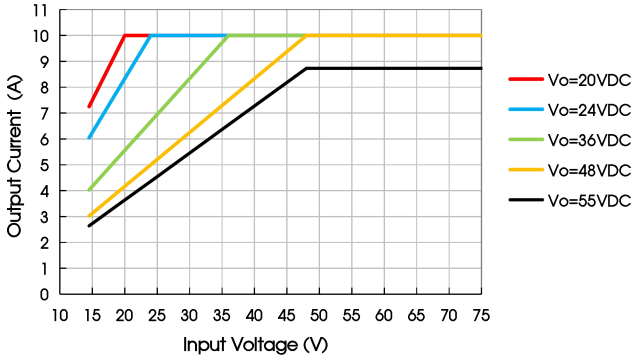
Emissions	CE	CISPR32/EN55032 CLASS A (see Fig. 3 for recommended circuit)	
	RE	CISPR32/EN55032 CLASS A (see Fig. 3 for recommended circuit)	
Immunity	ESD	IEC/EN 61000-4-2 Contact ±6kV	perf. Criteria B
	RS	IEC/EN 61000-4-3 10V/m	perf. Criteria A
	EFT	IEC/EN 61000-4-4 ±2kV (see Fig. 3 for recommended circuit)	perf. Criteria B
	Surge	IEC/EN 61000-4-5 line to line ±2kV (see Fig. 3 for recommended circuit)	perf. Criteria B
	CS	IEC/EN 61000-4-6 10Vr.m.s	perf. Criteria A

Typical Characteristic Curves

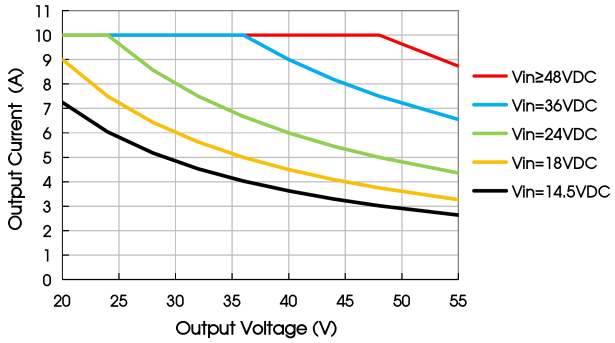
KUB6048EB(F)-10A
Output Current Derating Curves



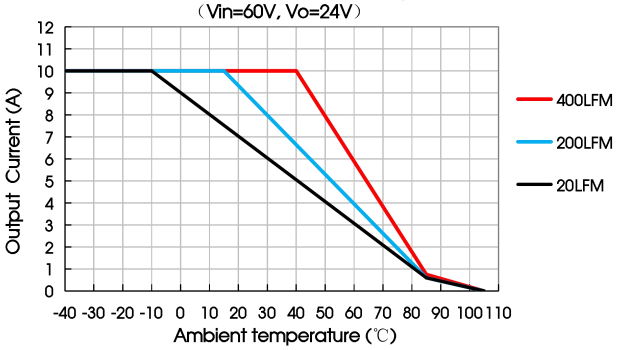
KUB4848EB(F)-10A
Output Current Derating Curves



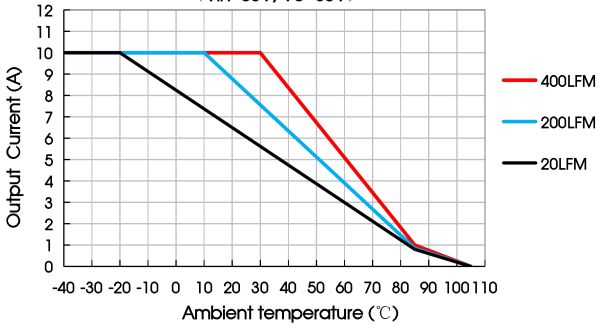
KUBXX48EB(F)-10A
Output Current Derating Curves



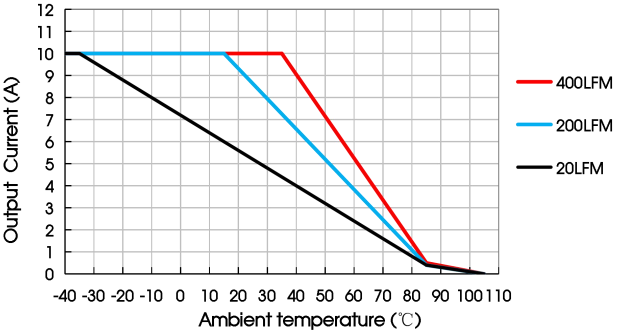
KUB6048EB-10A Temperature Derating Curves
（Vin=60V, Vo=24V）



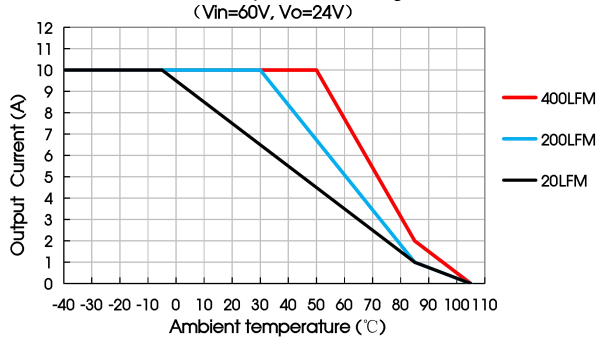
KUB6048EB-10A Temperature Derating Curves
（Vin=60V, Vo=36V）

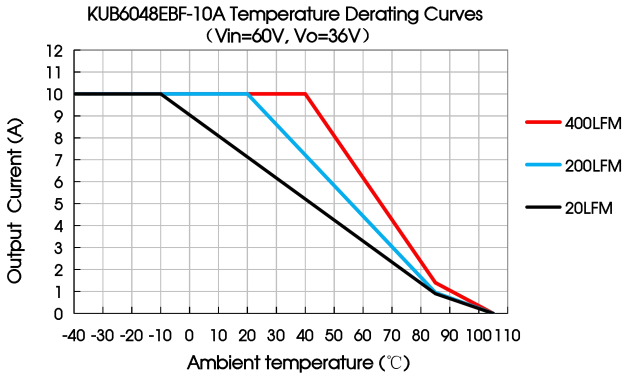


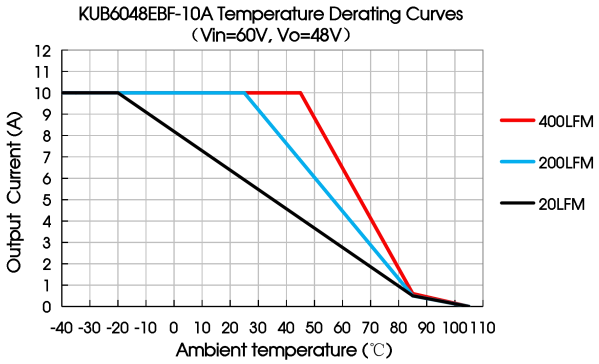
KUB6048EB-10A Temperature Derating Curves
（Vin=60V, Vo=48V）

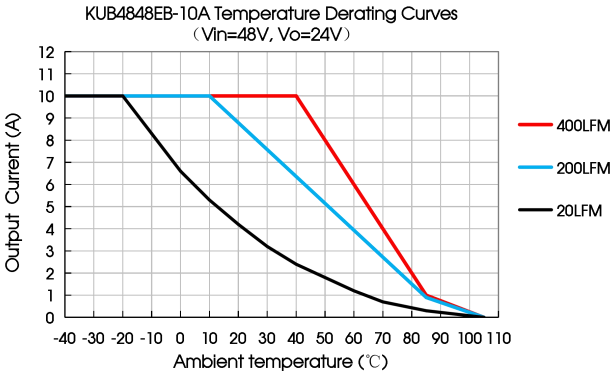


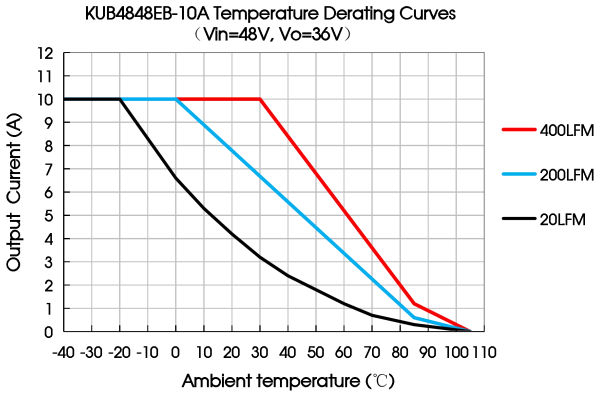
KUB6048EBF-10A Temperature Derating Curves
（Vin=60V, Vo=24V）

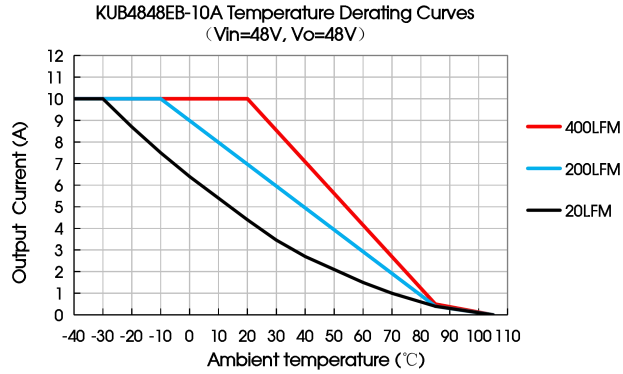


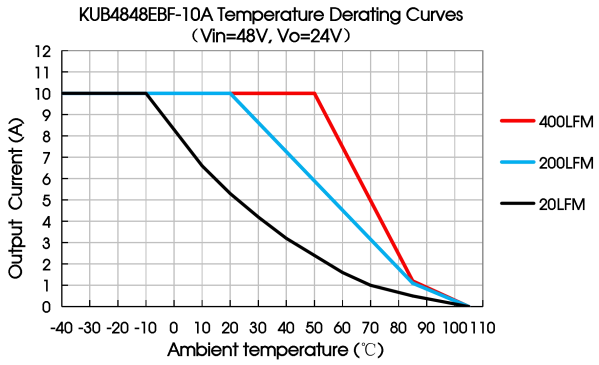


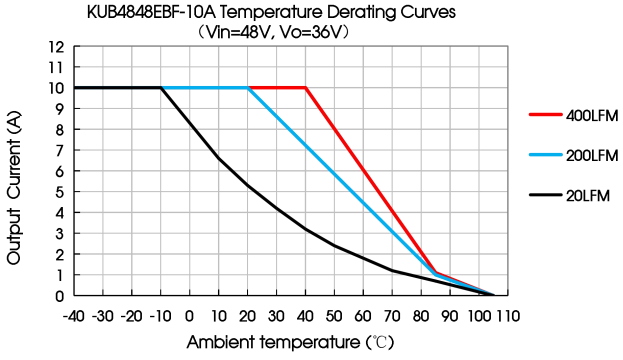












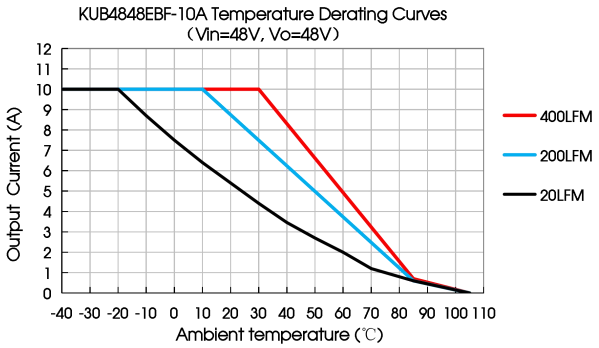
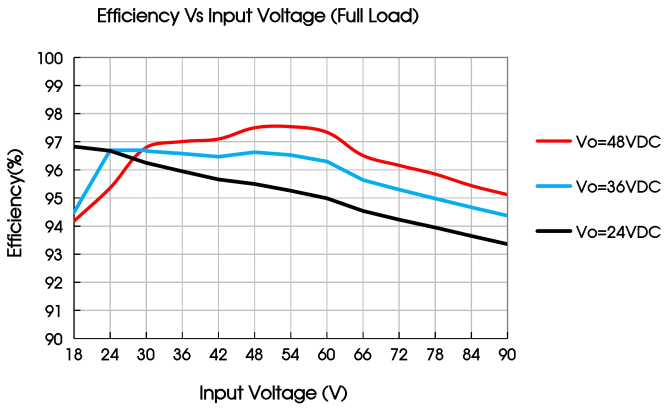
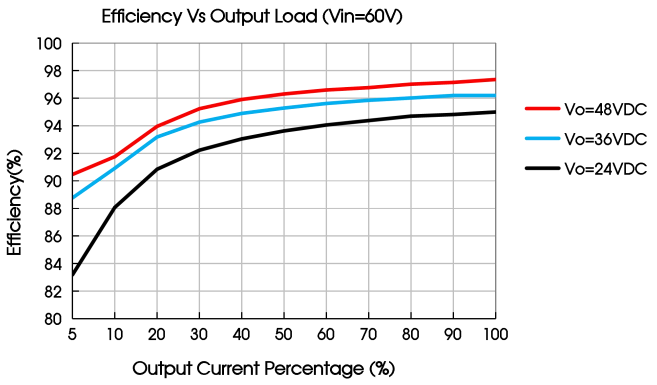


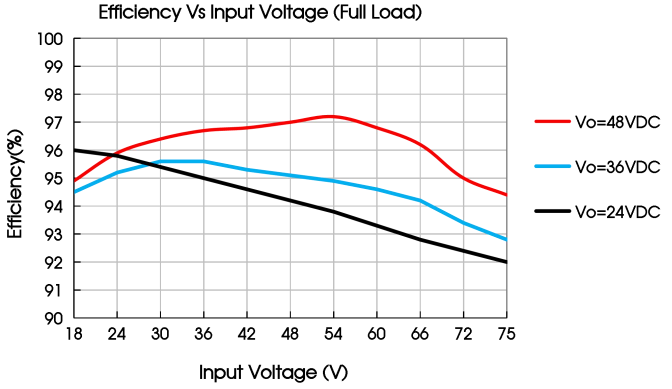
Fig. 1

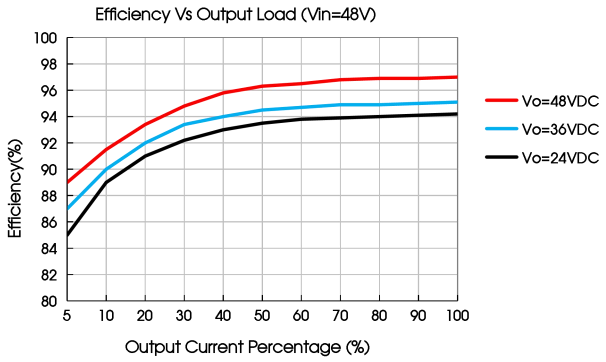
KUB6048EB(F)-10A





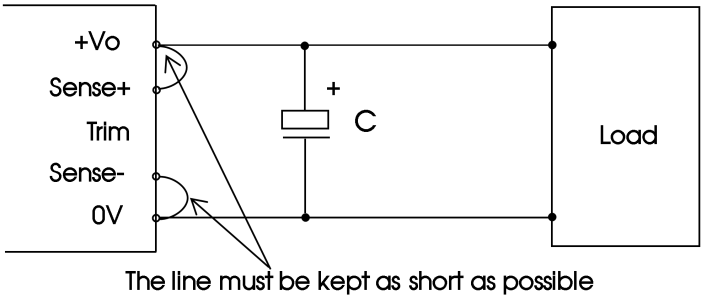
KUB4848EB(F)-10A





Remote Sense Application

1. Remote Sense Connection if not used

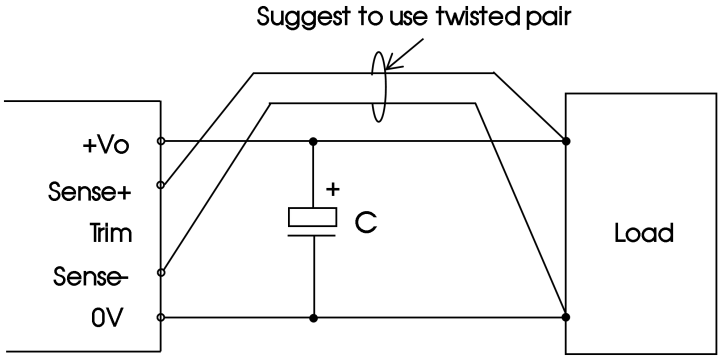


Notes:

(1) If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only;

(2) The connections between sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation



Notes:

(1) Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used;

(2) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wairs are suggested for remote compensation and must be kept as short as possible;

(3) We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range;

(4) Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.

Design Reference

1. Application circuit

(1) During product testing and application, please follow the recommended test circuit (Figure 2); At least one electrolytic capacitor Cin (≥100μF) is guaranteed to be connected externally to suppress the possible input surge voltage;

(2) If the input terminal of the product is connected in parallel with a circuit with large transient energy (such as a parallel motor drive circuit), the input voltage of the product may be pulled down. At this time, pay attention to the fluctuation of the input voltage of the product, and it is recommended to appropriately increase the capacitance of the electrolytic capacitor Cin at the input terminal to ensure the stability of the input terminal voltage and avoid the situation where the input voltage is lower than the under-voltage protection point and cause the product to restart repeatedly;

(3) If the output end of the product is inductive load (such as relay and motor), it is recommended to increase the output capacitance Cout capacitance within the capacitive load specification and add TVS tubes to filter out voltage spikes;

(4) If the input and output ripple needs to be further reduced, Cin and Cout capacity of external capacitors can be appropriately increased or external capacitors with small series equivalent impedance can be selected. Cout capacity of external capacitors cannot be greater than the maximum capacitive load of products.

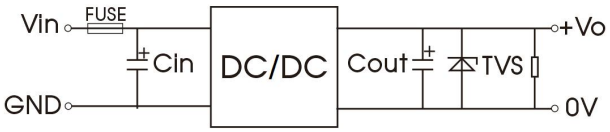


Fig. 2

Fuse	Cin*	Cout	TVS
20A, Slow fuse	100μF/100V	220μF/100V	Based on the output voltage

Note: *During the use of external capacitor, attention should be paid to the external environment temperature of the product. Under low temperature, the electrolytic capacitor capacity value should be increased to 1.5 times of the original parameter at least.

2. EMC compliance circuit

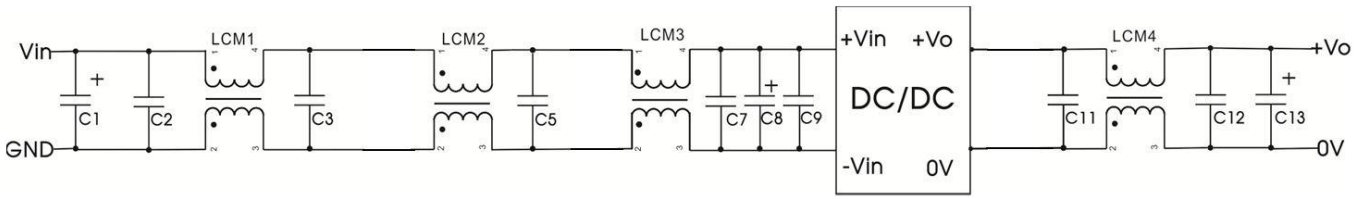
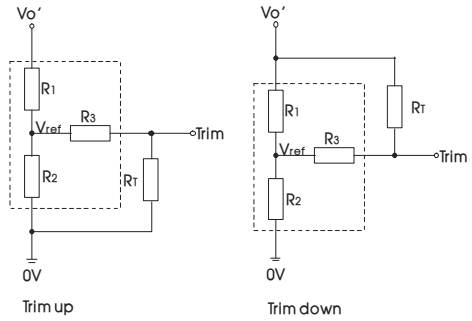


Fig.3 Recommended compliance circuit

C1	C8	C13	C2, C3, C5, C7, C9, C11, C12	LCM1	LCM2	LCM3, LCM4
1000μF/100V	560μF/100V	220μF/100V	4.7μF/100V	FL2D-A2-202 (MORNSUN)	TD3224 (LUCKY TENDA)	FL2D-D0-040 (MORNSUN)

3. Trim Function for Output Voltage Adjustment



Trim resistor connection (dashed line shows internal resistor network)

Trim resistance calculation formula:

$$up:\ R_T=\frac{aR_2}{R_2-a}-R_3 \qquad a=\frac{Vref}{Vo'-Vref}\cdot R_1$$

$$down:\ R_T=\frac{aR_1}{R_1-a}-R_3 \qquad a=\frac{Vo'-Vref}{Vref}\cdot R_2$$

RT: the Trim resistor
A: a user-defined parameter and has no actual meaning
Vo ': the actual up or down voltage required

R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
150	7.5	35.7	2.28

Recommended Trim resistors for typical output voltages

Vo'(V)	20	24	36	48	55
R_T (kΩ)	58.7	100	396.8	/	12.4
Trim	down	down	down	/	up

When trimming is used, if the RT resistor is too small or the Trim and +Vo pins are directly short-circuited, the output voltage is too low after trimming, the product may be irreparably damaged.

4. The products do not support parallel connection of their output

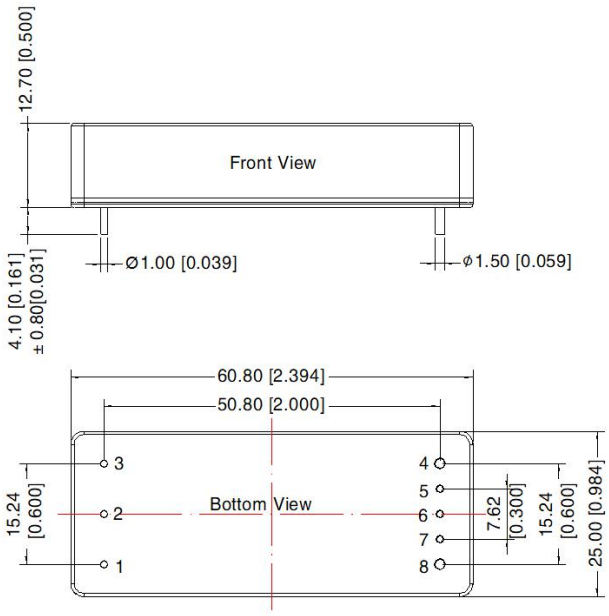
5. Recommended solution for thermal test

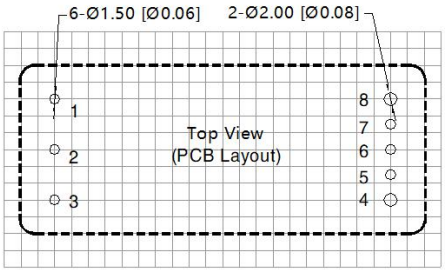
In the application process, the product temperature derating curve can be combined to evaluate the product thermal design; The temperature of point A is used to determine the stable operating range of the product, when it is lower than 110℃, it is the stable operating range.

6. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

KUBXX48EB-10A Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



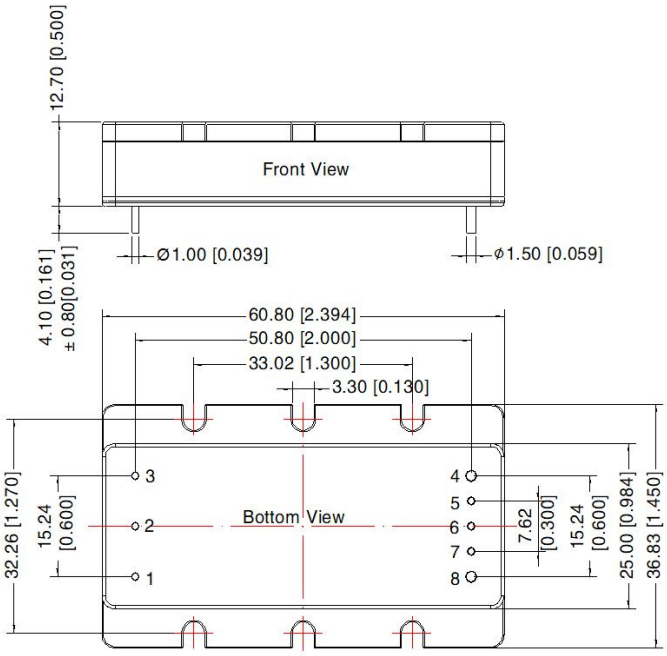


Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
Pin1,2,3,5,6,7 diameter: 1.00[0.039]
Pin4,8 diameter: 1.50[0.059]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]

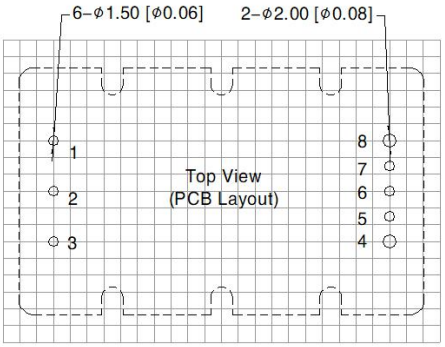
Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

KUBXX48EBF-10A Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin1,2,3,5,6,7 diameter: 1.00[0.039]
Pin4,8 diameter: 1.50[0.059]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]

THIRD ANGLE PROJECTION



Note: Grid 2.54*2.54mm

Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113;
2. The maximum capacitive load offered were tested at nominal input voltage and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

MORNSUN Guangzhou Science & Technology Co., Ltd.
Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com