# Non-isolated Buck-Boost Converter
KUB4836EB(F)-10A(-RS)

MORNSUN®

Non-isolated Buck-Boost DC-DC converter
Ultra-wide input and regulated single output

FEATURES

- Input voltage range: 9 - 60V
- Output voltage range: 0 - 60V
- Output current range: 0 - 10A
- Both output voltage and current are adjustable
- High efficiency up to 95%
- Input under-voltage protection, output short-circuit protection, over-temperature protection
- Operating ambient temperature range: -40℃ to +105℃
- Industry standard 1/8-Brick package and pin-out

3 years Warranty
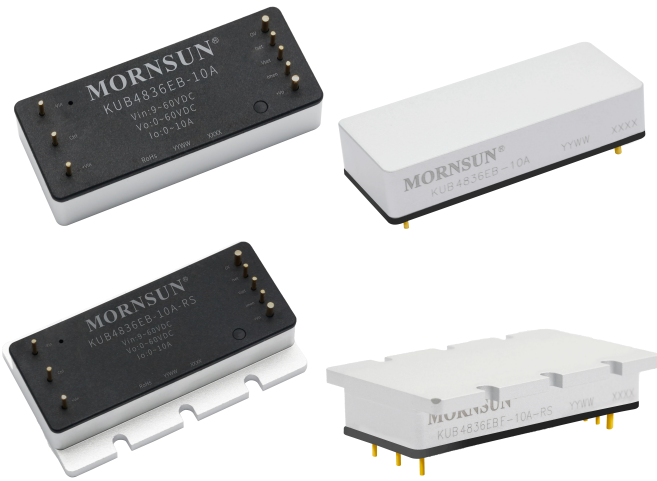
Patent Protection   RoHS

The products with ultra-wide voltage input range of 9-60V, an adjustable output voltage range of 0-60V, and an adjustable output current range of 0-10A. They feature efficiency up to 95%, operating ambient temperature of -40℃ to +105℃, input under-voltage, output short circuit, over-temperature protection, remote On/Off control, output voltage adjustment and output current adjustment. They are widely used in applications such as intelligent robotic, communication, battery powered systems and DC-DC distributed power supply .

Selection Guide

Certification	Part No.[①]	Input			Output			Full Load Efficiency[③] (%) Min./Typ.
		Nominal (Range) (VDC)	Max.[②] (VDC)	Current Limit (A) Typ.	Nominal (Range) (VDC)	Current Limit (A) Typ.	Current Setting Range (A)	
--	KUB4836EB(F)-10A	48 (9-60)	65	12.5	36 (0-60)	12.5	0-10	93/95
	KUB4836EB(F)-10A-RS	48 (9-60)	65	12.5	36 (0-60)	12.5	0-10	93/95

Note:
①Use "F" suffix for heat sink mounting;
②Exceeding the maximum input voltage may cause permanent damage;
③Efficiency is measured at nominal input voltage, nominal output voltage and max. output load.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load/no-load)	Nominal input voltage, nominal output voltage	--	7895/25	8065/50	mA
Surge Voltage (1sec. max.)		-0.7	--	65	VDC
Start-up Voltage		--	--	9	VDC
Input Under-voltage Protection		6	7	--	VDC
Start-up Time	Nominal input voltage, constant resistance load	--	--	100	ms
Input Filter		C filter			
Hot Plug		Unavailable			
Input Reverse Polarity Protection		Unavailable			
Ctrl[①]	Module on	Ctrl pin connected to -Vin or low level (0-0.8VDC)			
	Module off	Ctrl open circuit or connected to TTL high level (1.8-5.0VDC)			
	Input current when off	--	5	15	mA
Input Current Limit	Input voltage range	11	12.5	14	A

Note: ①The Ctrl pin voltage is referenced to input -Vin. When Pin of Vset and Iset are floating, there will be voltage and current output after power on. Please put the Ctrl pin in a high impedance state or connect to a high level before the product is powered on.

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Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	Constant voltage model, Input voltage range, nominal output voltage, 0-100% load	--	±1	±3	%
Current Accuracy	Constant current model, nominal Input voltage, nominal output voltage, 100% load	--	±5	±8	
Output Voltage Adjustment	Vset setup	See Vset function for output voltage adjustment			
	Adjustable range of output voltage	3.3[2]	--	60	VDC
Output Current Adjustment	Iset setup	See Iset function for output current adjustment			
	Adjustable range of output current	0	--	10	A
Temperature Coefficient	Constant voltage model, nominal input voltage, nominal output voltage,100% load	--	--	±0.03	%/℃
Ripple & Noise[1]	20MHz bandwidth, constant voltage model nominal input voltage, nominal output voltage,	--	100	300	mVp-p
Over-temperature Protection[3]	Max. Case Temperature	--	120	--	℃
Output Current Limit	Input voltage range	10.5	12.5	14.5	A
Short-circuit Protection	Input voltage range	Constant current output, continuous, self-recovery			

Note:
①The "Tip and barrel" method is used for ripple and noise test, please refer to Fig. 6. and DC-DC Converter Application Notes for specific information;
②The product can work in constant current mode when the output voltage at 0-3.3V;
③Over-temperature protection is in the form of product output shutdown.

General Specificationsc

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input/output-case. Electric Strength Test for 1 minute with a leakage current of 1mA max	1500	--	--	VDC
Operating Temperature	See temperature derating curves	-40	--	+105	℃
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Pin Soldering Resistance Temperature	Wave-soldering, 10 seconds	--	--	+260	℃
	Soldering spot is 1.5mm away from case for 10 seconds	--	--	+300	
Pollution Level		PD 3			
Shock And Vibration		IEC/EN61373 - Category 1, Grade B			
Switching Frequency		--	160	--	KHz
Altitude		Altitude：≤2000m, atmospheric pressure: 80～110KPa			
MTBF	MIL-HDBK-217F@25℃	500	--	--	K hours
Safety		Design refer to UL/EN62368 standards			

Mechanical Specifications

| Case Material	Aluminum alloy	
Dimension	KUB4836EB-10A(-RS)	60.80 x 25.00 x 12.70 mm
	KUB4836EBF-10A(-RS)	60.80 x 36.83 x 12.70 mm
Weight	KUB4836EB-10A(-RS)	53.0g(Typ.)
	KUB4836EBF-10A(-RS)	58.2g(Typ.)
Cooling Method	Free air convection (20LFM)	

Electromagnetic Compatibility (EMC)

| Emissions	CE	CISPR32/EN55032 CLASS A (see Fig. 7 for recommended circuit)	
	RE	CISPR32/EN55032 CLASS A (see Fig. 7 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2 Contact ±6KV/Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3 10V/m	perf.Criteria A
	EFT	IEC/EN61000-4-4 ±2KV (see Fig. 7 for recommended circuit)	perf.Criteria A

Immunity	Surge	IEC/EN61000-4-5	line to line ±2KV (see Fig. 7 for recommended circuit)	perf.Criteria B
	CS	IEC/EN61000-4-6	10 Vr.m.s	perf.Criteria A

Typical Performance Curves

Efficiency VS Output voltage（Vin=9V）
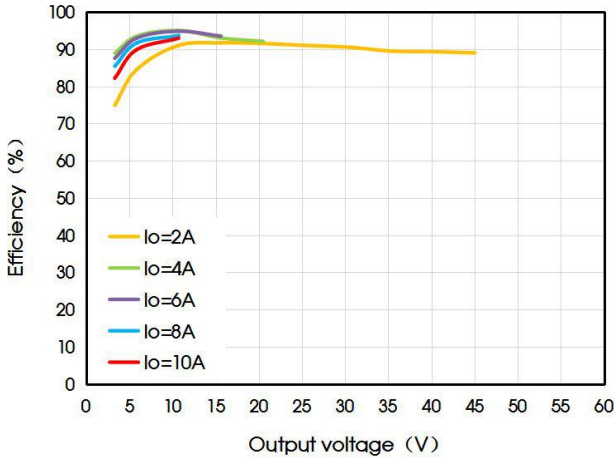
Efficiency VS Output voltage（Vin=24V）
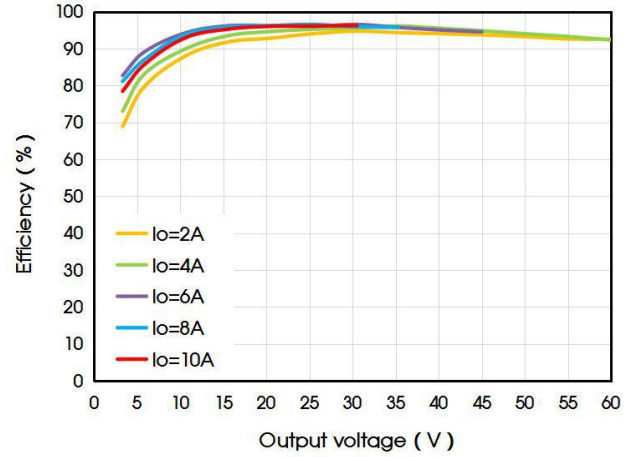
Efficiency VS Output voltage（Vin=48V）
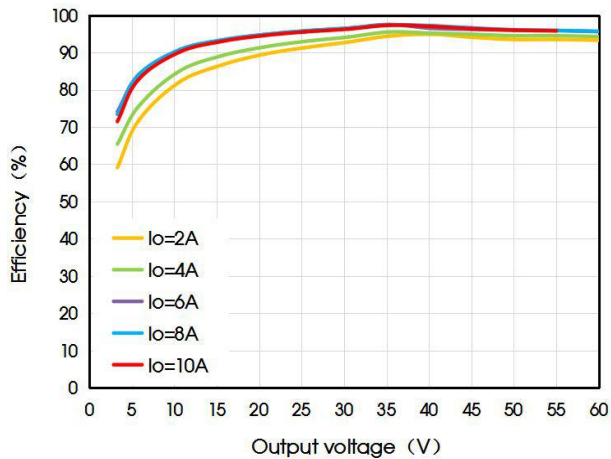
Efficiency VS Output voltage（Vin=60V）
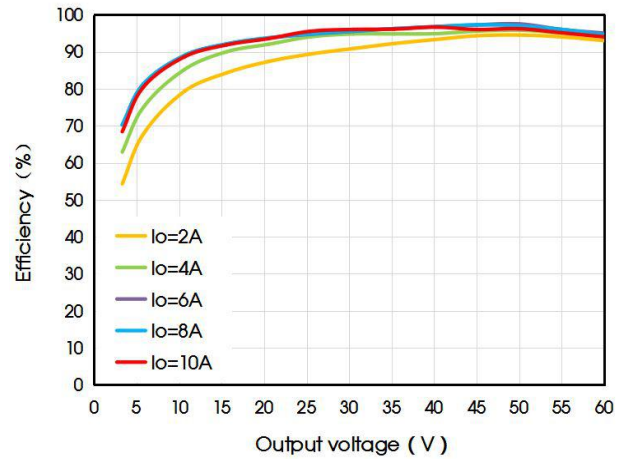
KUB4836EB-10A (-RS) Temperayure Derating Curves (20LFM)

KUB4836EBF-10A (-RS) Temperayure Derating Curves (20LFM)

Vset Function for Output Voltage Adjustment

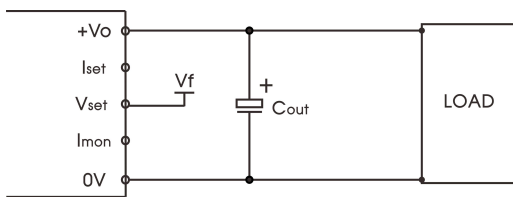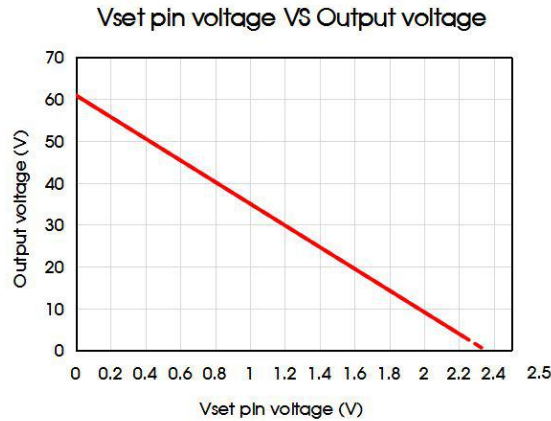1. KUB4836EB(F)-10A: The Vset pin is connected to the external voltage Vf for adjustment:

Vset pin voltage VS Output voltage

Calculation formula of output voltage adjustment:

$$V_O = 60.9 - 25.9V_f$$

Notes:

1. Adjustable range of output voltage: 3.3-60V;
2. Vf is the externally supplied voltage which range from 0V to 2.5V. The Vf voltage is referenced to output 0V;
3. Vset pin must not be opened.

Fig. 1

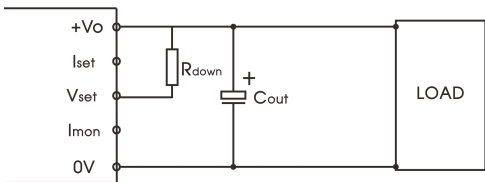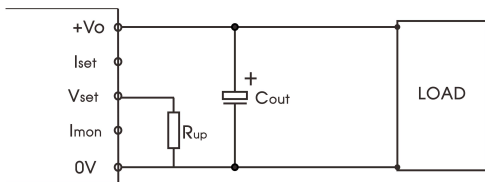2. KUB4836EB(F)-10A-RS: The Vset pin is connected to the external resistance for adjustment:

Calculation formula of output voltage adjustment:

$$up: \quad V_O = 60 - \frac{29.934 R_{up}}{2.87 + R_{up}}$$

$$down: \quad V_O = \frac{30.066 R_{down} + 172.19}{74.046 + R_{down}}$$

Notes:

1. Adjustable range of output voltage: 3.3-60V;
2. When the Vset pin is open, the output voltage of the product is 30V;
3. Rup and Rdown are external resistance, in kΩ.

Fig. 2

Iset Function for Output Current Adjustment

1. KUB4836EB(F)-10A: The Iset pin is connected to the external voltage Vf for adjustment:
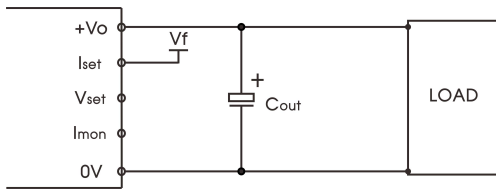
Iset pin voltage VS Output current
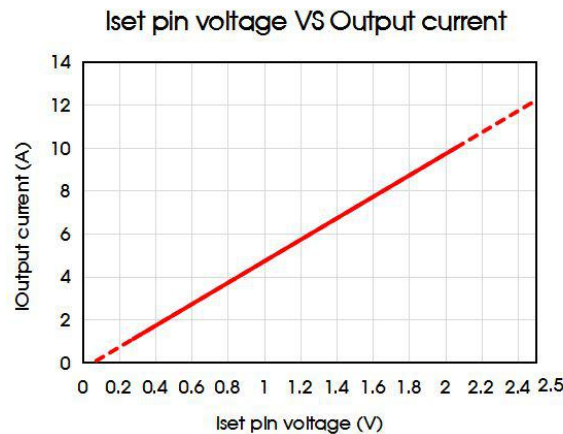
Fig. 3

Calculation formula of output current adjustment:

$$I_o = 5V_f - 0.3$$

Notes:

1. Adjustable range of output current: 0-10A;
2. Vf is the externally supplied voltage which range from 0V to 2.5V. The Vf voltage is referenced to output 0V;
3. Iset pin must not be opened.

2. KUB4836EB(F)-10A-RS: The Iset pin is connected to the external resistance for adjustment:

（1）When the maximum output current is set between 0-10A：

Recommended Parameter Setting：

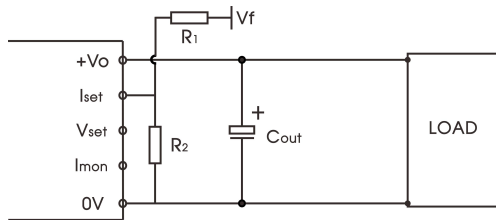1. Vf is 5V；
2. R1 is 10kΩ.

Calculation formula of output current adjustment:

$$I_o = 11.925 - \frac{270.73R_2}{10.59R_2 + 88.79}$$

Fig. 4

Notes:

1. Adjustable range of output current: 0-10A;
2. When using external resistance to adjust Iset current, external auxiliary power supply and regulating resistance are needed. Please ensure that the external resistance meets the power and withstand voltage requirements;
3. R2 is external resistance, in kΩ. When R2 value range is 0-10kΩ, it can meet the requirements of output current regulation range;
4. When the Iset pin is opened, the output current ≤7A.

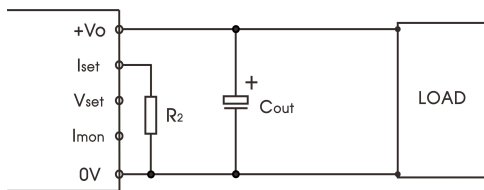（2）When the maximum output current is set between 5-10A：

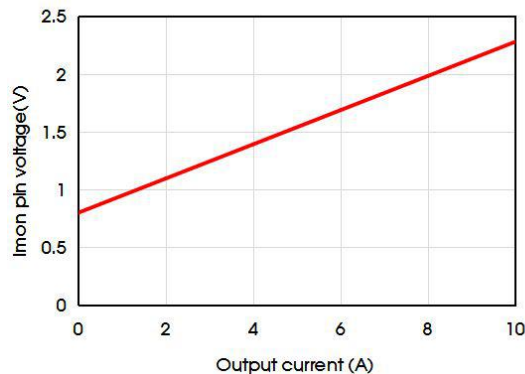Calculation formula of output current adjustment:

$$I_o = \frac{1209}{3R_2 + 155.82} + 4.87$$

Fig. 5

Notes:

1. Adjustable range of output current: 0-10A;
2. R2 is external resistance, in kΩ;
3. When the Iset pin is opened, the output current ≤7A.

The Output Current Detection Imon

Output current VS Imon pin voltage

Calculation formula of the Imon pin voltage and output current:

$$V_{Imon} = \frac{3.64 + 0.676I_o}{4.568}$$

Notes:

1. VImon is the Imon pin voltage, in V. The VImon voltage is referenced to output 0V.
2. Io is the output current, in A.

Design Reference

1. Typical application

(1) During testing and application, please follow the recommended test circuit (Figure 6); Be sure to connect an electrolytic capacitor Cin (≥220μF) at the input to suppress the surge voltage that may be generated at the input terminal, and connect an electrolytic capacitor Cout(≥220μF) at the output, used for output filtering.

(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), it may cause the input voltage of the product to be pulled down. Please pay attention to the fluctuation of the input voltage of the product, and it is recommended to increase the electrolytic capacitor at the input terminal appropriately. The capacitance value of Cin is to ensure the stability of the input terminal voltage and avoid the situation that the input voltage is lower than the undervoltage protection point and the product restarts repeatedly.

(3) If the output terminal of the product is an inductive load (such as a relay, a motor), it is recommended to increase the value of the output capacitor Cout and add a TVS to filter out the voltage spikes.

(4) Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance).

Fig. 6
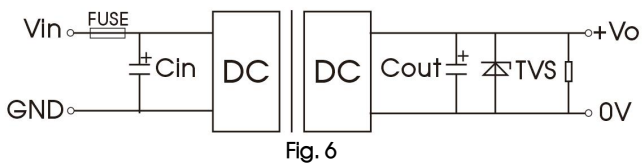
FUSE	Cin	Cout	TVS
20A, slow	220μF/100V	220μF/100V	85V

Note:
①Please pay attention to the ambient temperature of the product when using an external capacitor, increase the electrolytic capacitor values to at least 1.5 times the original parameter if the ambient temperature is low.

2. EMC solution-recommended circuit

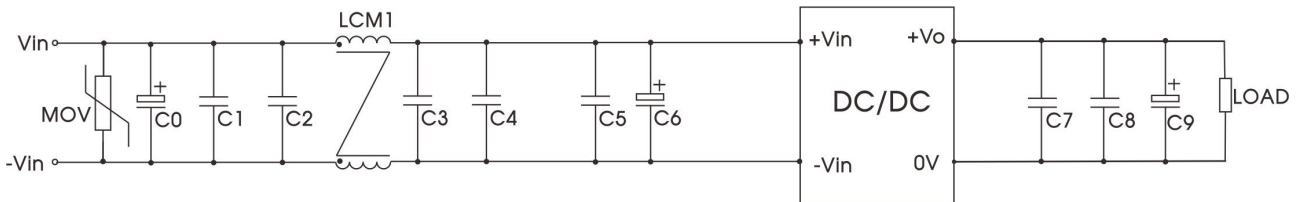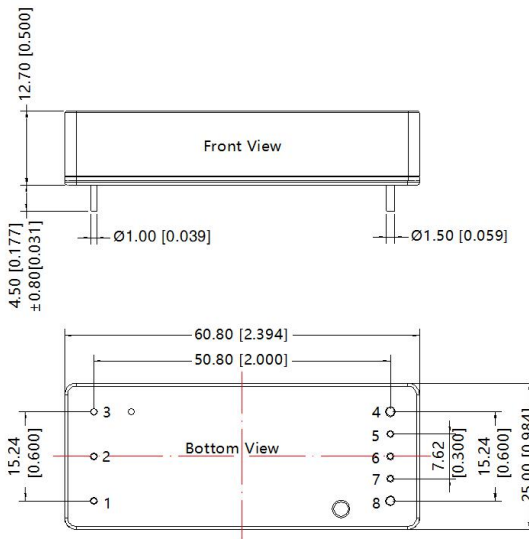We recommended using the circuit shown in Fig.7 during product EMC testing and application.

Fig. 7

Components	Recommended Component Value
MOV	S14K60 (Varistor)
C0	680μF/100V electrolytic capacitor
C6	470μF/100V electrolytic capacitor
C9	470uF/100V electrolytic capacitor
C1, C2, C3, C4, C5, C7, C8	4.7μF/100V ceramic capacitor
LCM1	T24 x 23.5 x 19/4mH/35mΩ max

### 3. The products do not support parallel connection of their output

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

KUB4836EB-10A(-RS) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Front View

12.70 [0.500]

4.50 [0.177] ±0.80[0.031]

Ø1.00 [0.039]　Ø1.50 [0.059]

60.80 [2.394]
50.80 [2.000]

Bottom View

15.24 [0.600]

7.62 [0.300]　15.24 [0.600]

25.00 [0.984]

6-Ø1.50 [Ø0.06]　2-Ø2.00 [Ø0.08]

Top View
(PCB Layout)

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]
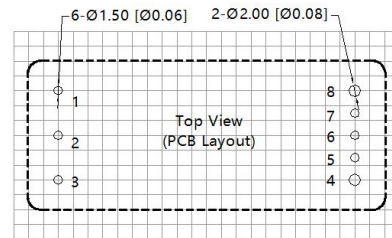
Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Iset
2	Ctrl	6	Vset
3	-Vin	7	Imon
4	0V	8	+Vo

KUB4836EBF-10A(-RS) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Front View

12.70 [0.500]

4.50 [0.177] ±0.80[0.031]

Ø1.00 [0.039]　Ø1.50 [0.059]

60.80 [2.394]
50.80 [2.000]
33.02 [1.300]
3.30 [0.130]

Bottom View

32.26 [1.270]
15.24 [0.600]

7.62 [0.300]　15.24 [0.600]

25.00 [0.984]
36.83 [1.450]

6-Ø1.50 [Ø0.06]　2-Ø2.00 [Ø0.08]

Top View
(PCB Layout)

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]
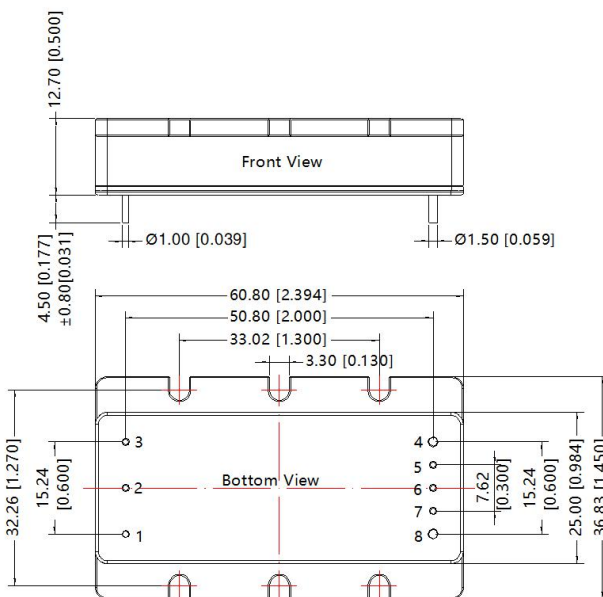Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
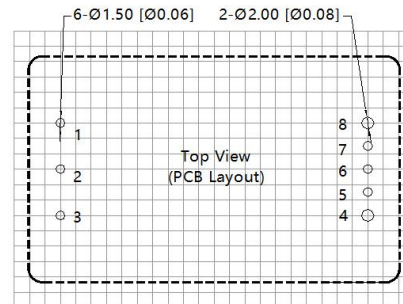
Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Iset
2	Ctrl	6	Vset
3	-Vin	7	Imon
4	0V	8	+Vo

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113;

2. 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;

3. All index testing methods in this datasheet are based on company corporate standards;

4. We can provide product customization service, please contact our technicians directly for specific information;

5. Products are related to laws and regulations: see "Features" and "EMC";

6. 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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