

Wide input voltage and isolated single output
DIP package, Super-Capacitor group two-way
balanced, DC-DC converter



RoHS Patent Protection



FEATURES

- Two-way switching power supply
- Wide 2:1 input voltage range
- Efficiency up to 78%
- Forward static operating current is as low as 5uA, Reverse static operating current is as low as 100uA
- I/O isolation test voltage 5k VAC
- Forward constant current output
- Operating ambient temperature range -40°C to +65°C

MBP2403RP-2A/3A a two-way switching power supply, input voltage range 15~30VDC, output voltage range 1.8~4.5VDC. Forward working support charging current constant current 2A/3A, reverse working discharge current nearly 2A/3A, with isolation voltage 5000VAC, used in occasion of voltage balance between battery BMS.

Selection Guide

Part No.		Input Voltage (VDC)		Output Voltage (VDC)	Output Current ^③ (A,Typ.)	Efficiency(%Typ.) @+Vin voltage 24V, +Vo voltage 3.3V
MBP2403RP-2A	Forward ^①	+Vin Voltage 24 (15~30)	Max. ^② 40	+Vo Voltage 3.3 (1.8~4.5)	2	76/73
	Reverse	+Vo Voltage 3.3 (1.8~4.5)	Max. 5.2	+Vin Voltage 24 (15~30)		
MBP2403RP-3A	Forward ^①	+Vin Voltage 24 (15~30)	Max. ^② 40	+Vo Voltage 3.3 (1.8~4.5)	3	76/73
	Reverse	+Vo Voltage 3.3 (1.8~4.5)	Max. 5.2	+Vin Voltage 24 (15~30)		
MBP2403RP-5A	Forward ^①	+Vin Voltage 24 (15~30)	Max. 40	+Vo Voltage 3.3 (1.8~4.5)	5	78/75
	Reverse	+Vo Voltage 3.3 (1.8~4.5)	Max. 5.2	+Vin Voltage 24 (15~30)		

Note:

- ① Forward: energy transfer from +Vin to +Vo; Forward: energy transfer from +Vo to +Vin. (Pin description refer to the size diagram at the appearance);
- ② Exceeding the maximum input/output voltage may cause permanent damage;
- ③ The full text of reverse current is expressed as negative value;
- ④ The recommended range of operating voltage see "Typical Performance Curves".

Control Specifications

Working Status	EN Pin	CD Pin
Forward	Connect to -Vin	Open
Reverse	Connect to -Vin	Connect to -Vin
Static Working	Open	Open or connect to -Vin
Forward operating, test steps	1. Connect the power supply to the +Vin side 2. Connect battery or electronic load (constant voltage is recommended) to the +Vo side 3. Short EN pin to -Vin to enable the product to work at forward status 4. When the product is turned off, follow the above 3/2/1 sequence, suspend and disconnect in turn	
Reverse operating, test steps	1. Connect the battery or power supply to the +Vo side 2. Connect electronic load or battery (additional power supply signal is required when connect electronic load ^②) to the +Vin side 3. Short CD pin to -Vin	

4. Short EN pin to -Vin
5. The product should be suspended and disconnected in the order of 4/3/2/1 above

Note:
 ①The above steps should be sorted in order and operated step by step to avoid product damage;
 ②When the +Vin side is not a battery system load and works in reverse status, the +Vin side needs to increase the power supply signal (recommended power supply signal 9~10V for testing), because the enabling of the EN/CD pin needs a reference voltage level, otherwise the product cannot work.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Surge Voltage (1sec. max.)	Forward, +Vin	Output power range	-0.7	--	40	VDC
	Reverse, +Vo		-0.7	--	5.2	
Static Working Current	+Vin	+Vin Voltage 24V, +Vo Voltage 3.3V	--	5	30	uA
	+Vo		--	-100	-200	
Start-up Voltage	Forward, +Vin	Output voltage range	--	9	15	VDC
	Reverse, +Vo		--	1.1	1.8	
Under-voltage protection	Forward		6	8	--	VDC
	Reverse		0.4	0.9	--	
Input Voltage	Forward, +Vin		15	24	30	VDC
	Reverse, +Vo		1.8	3.3	4.5	
Input Current	Forward, +Vin	MBP2403RP-2A, @+Vin Voltage 24V, +Vo Voltage 3.3V	--	0.21	--	A
	Reverse, +Vo		--	-2	--	
	Forward, +Vin	MBP2403RP-3A, @+Vin Voltage 24V, +Vo Voltage 3.3V	--	0.53	--	
	Reverse, +Vo		--	-3	--	
	Forward, +Vin	MBP2403RP-5A, @+Vin Voltage 24V, +Vo Voltage 3.3V	--	0.88	--	
	Reverse, +Vo		--	-5	--	
Input Filter	+Vin		π filter			
	+Vo		π filter			
Hot Plug ^①			Unavailable			

Note: ①Hot plug may damage the module.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Current	Forward, +Vo	MBP2403RP-2A, full voltage range	1.8	2	2.2	A
	Reverse, +Vin	MBP2403RP-2A, @nominal input voltage, nominal output voltage	--	-0.21	--	
	Forward, +Vo	MBP2403RP-3A, full voltage range	2.7	3	3.3	
	Reverse, +Vin	MBP2403RP-3A, @nominal input voltage, nominal output voltage	--	-0.34	--	
	Forward, +Vo	BP2403RP-2A, @nominal input voltage, nominal output voltage	4.5	5	5.5	
	Reverse, +Vin		--	-0.54	--	
Output Voltage	Forward, +Vo		1.8	3.3	4.5	VDC
	Reverse, +Vin	See Typical Characteristic Curves - Reverse Working Temperature Derating Curve	15	24	30	
Over-voltage Protection*	Forward, +Vo		4.8	5	5.2	VDC
	Reverse, +Vin		--	35	--	
	OVPS, +Vo	Output over-voltage protection trim pin. The output over-voltage protection clamp can be adjusted according to the working conditions (see Fig.4)	2.6	--	5.2	
	OVPP, +Vin		15	--	40	
Start-up delay interval	Full input voltage range, full operating temperature range		--	--	1	s

Note: *The measurement method of Ripple and Noise is based on the application of circuit figure 2.20 M limited bandwidth measurement, please refer to DC-DC Converter Application Notes for information.

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output Electric Strength test for 1 minute with a leakage current of 5mA max.	5000	--	--	VAC
Insulation Resistance	Input-output Resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	30	--	pF
Storage Humidity	Non-condensing	5	--	95	%RH
Operating Ambient Temperature	See Fig. 1	-40	--	+65	°C
Storage Temperature		-55	--	+125	
Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	+300	
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z			
Switching Frequency	PWM mode	--	300	--	kHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours

Mechanical Specifications

Dimension	60.00 x 30.00 x 12.00 mm
Weight	30g (Typ.)
Cooling method	Free air convection (20LFM)

Typical Performance Curves

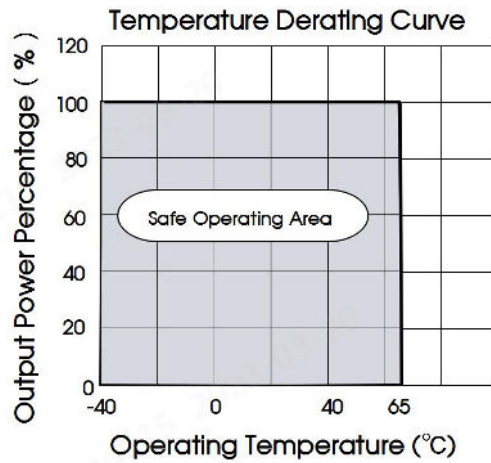
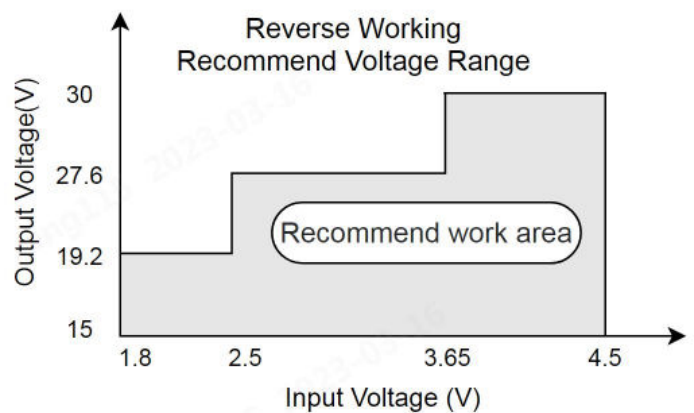
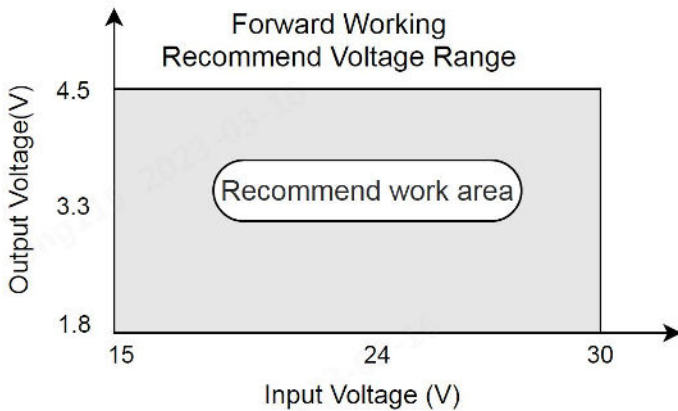


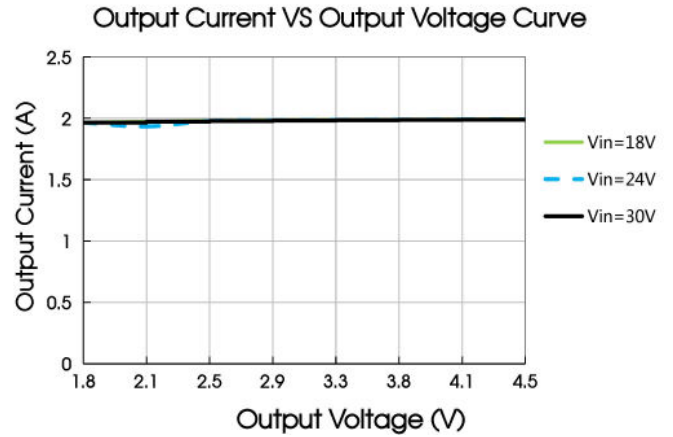
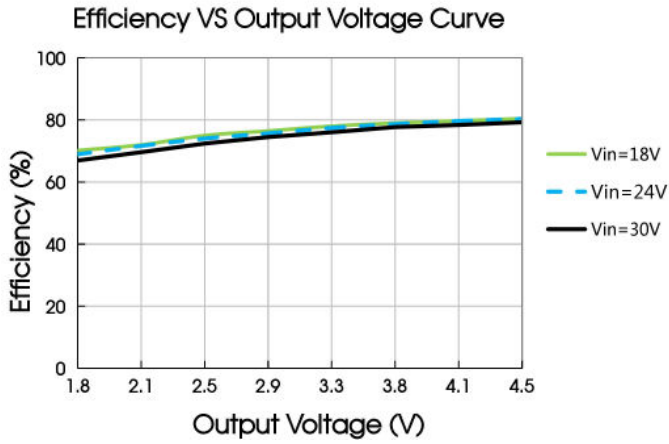
Fig. 1

Operating Voltage Range

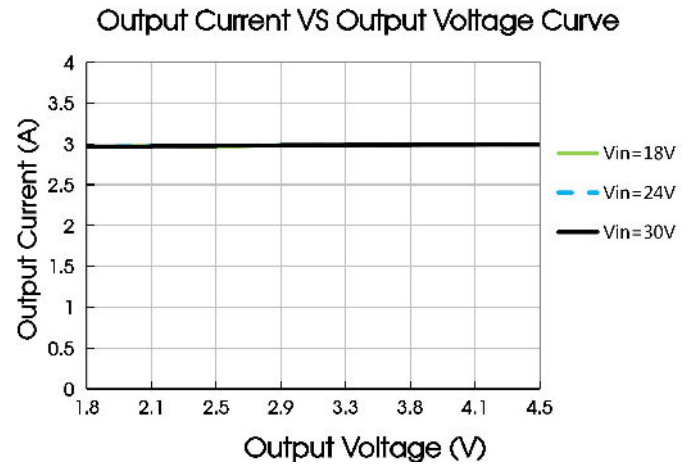
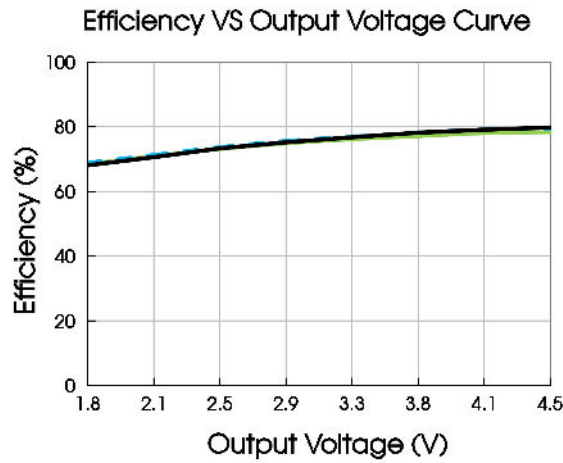


Reverse operating characteristic curve:

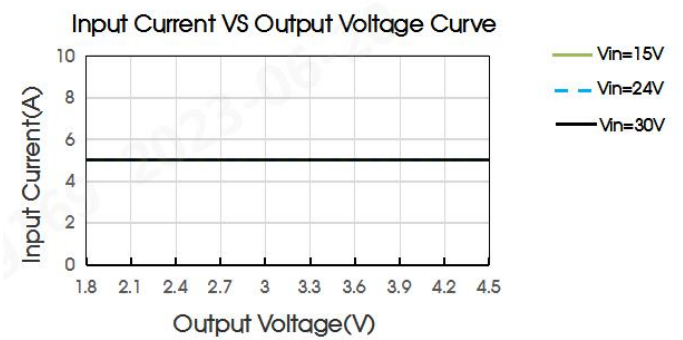
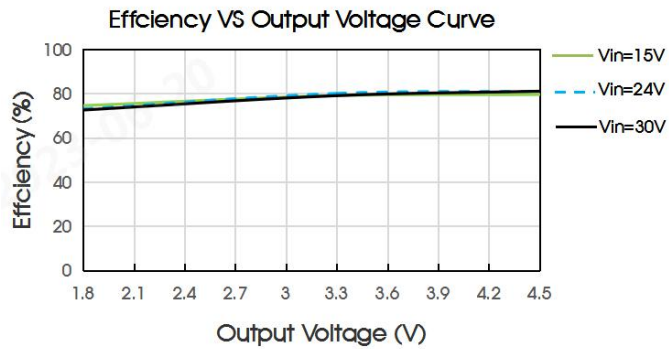
MBP2403RP-2A



MBP2403RP-3A

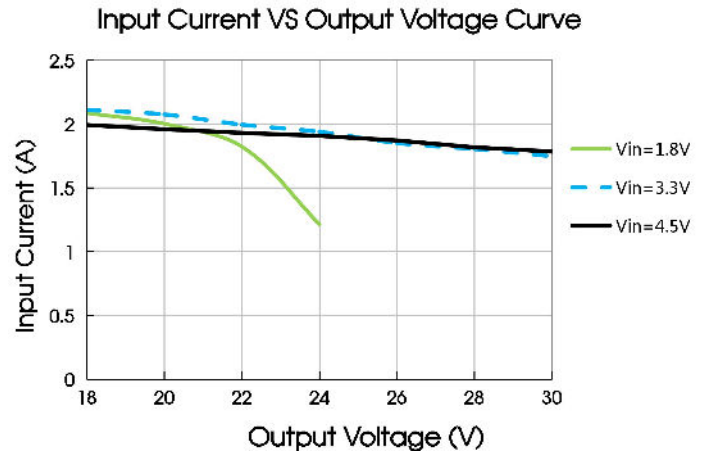
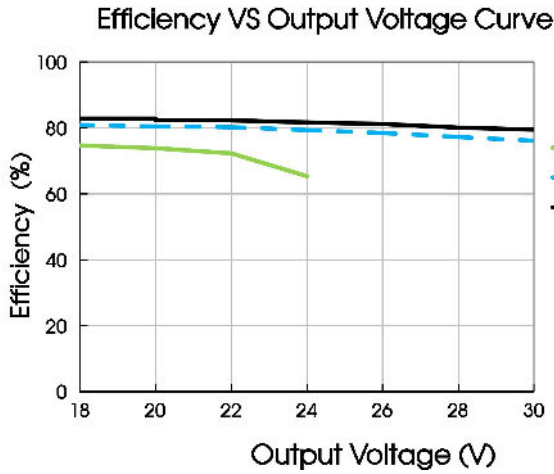


MBP2403RP-5A

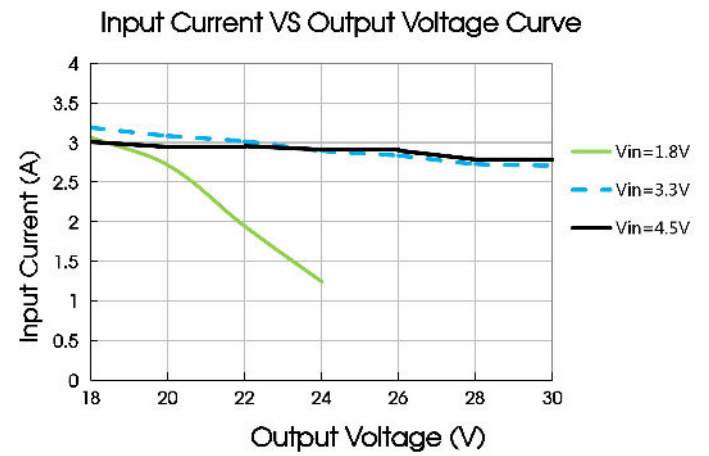
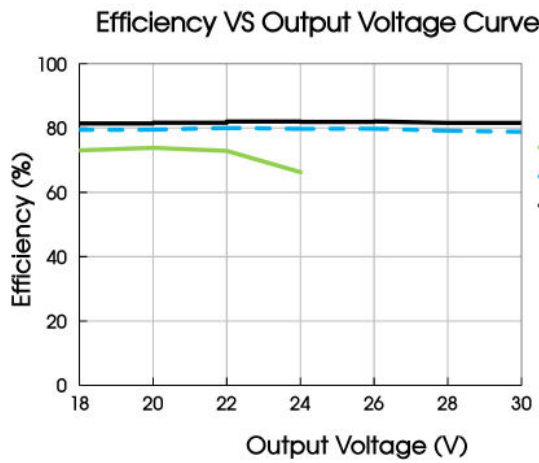


Forward operating characteristic curve:

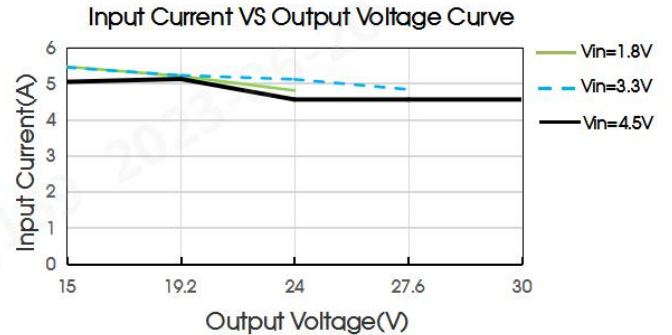
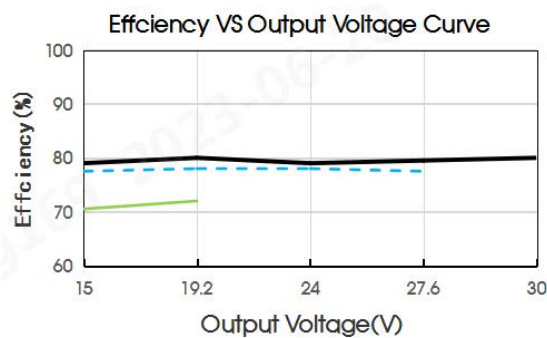
MBP2403RP-2A



MBP2403RP-3A



MBP2403RP-5A



Design Reference

1. Model Testing Circuit

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.

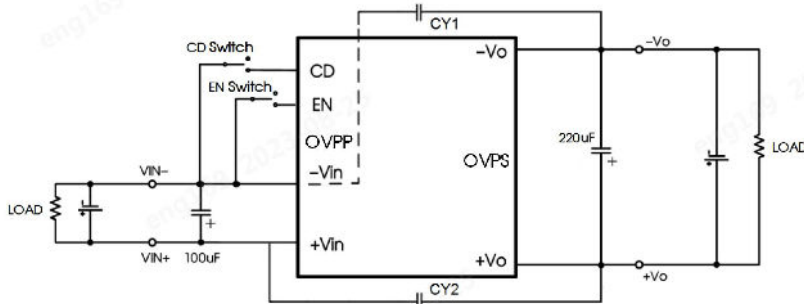


Fig. 2

Parameter description:

CY1	102K/250VAC
CY2	CY2 can be selected according to the actual situation to further reduce the output Ripple & Noise.

2. Model Control recommended circuit

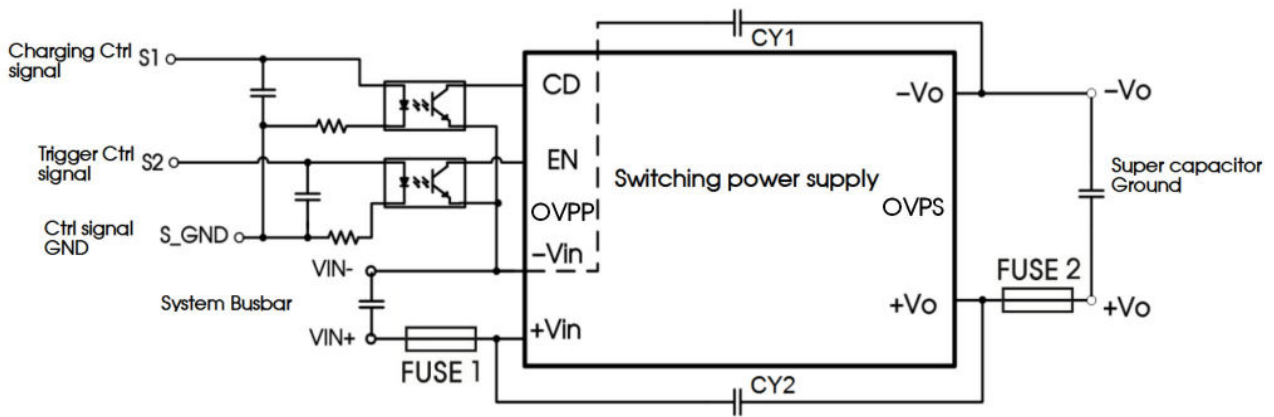


Fig. 3

3. OVPP/OVPS Function for Output Voltage Adjustment (open if unused)

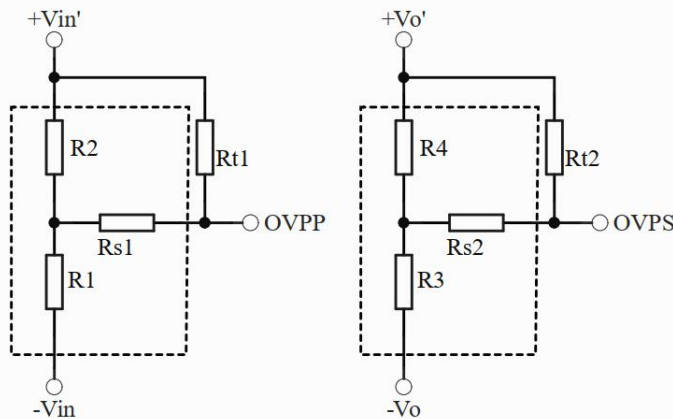


Fig.4 OVPP/OVPS resistor connection (dashed line shows internal resistor network):

Calculating resistor values:

$$\text{OVPP: } Rt_1 = \frac{aR_2}{R_2 - a} - Rs1 \quad a = \frac{(Vin' - 0.5 - Vref1)R_1}{Vref1}$$

$$\text{OVPS: } Rt_2 = \frac{(Vo' - Vref2)}{b} - Rs2 \quad b = \frac{Vref2}{R3} - \frac{(Vo' - 0.1 - Vref2)}{R4}$$

R_{t1} , R_{t2} are external resistors, a , b are a self-defined parameter, with no real meaning.

OVPP application resistance (Typ.):

R1(kΩ)	R2(kΩ)	Vref1(V)	Rs1(kΩ)
36	1000	1.25	10

OVPS application resistance (Typ.):

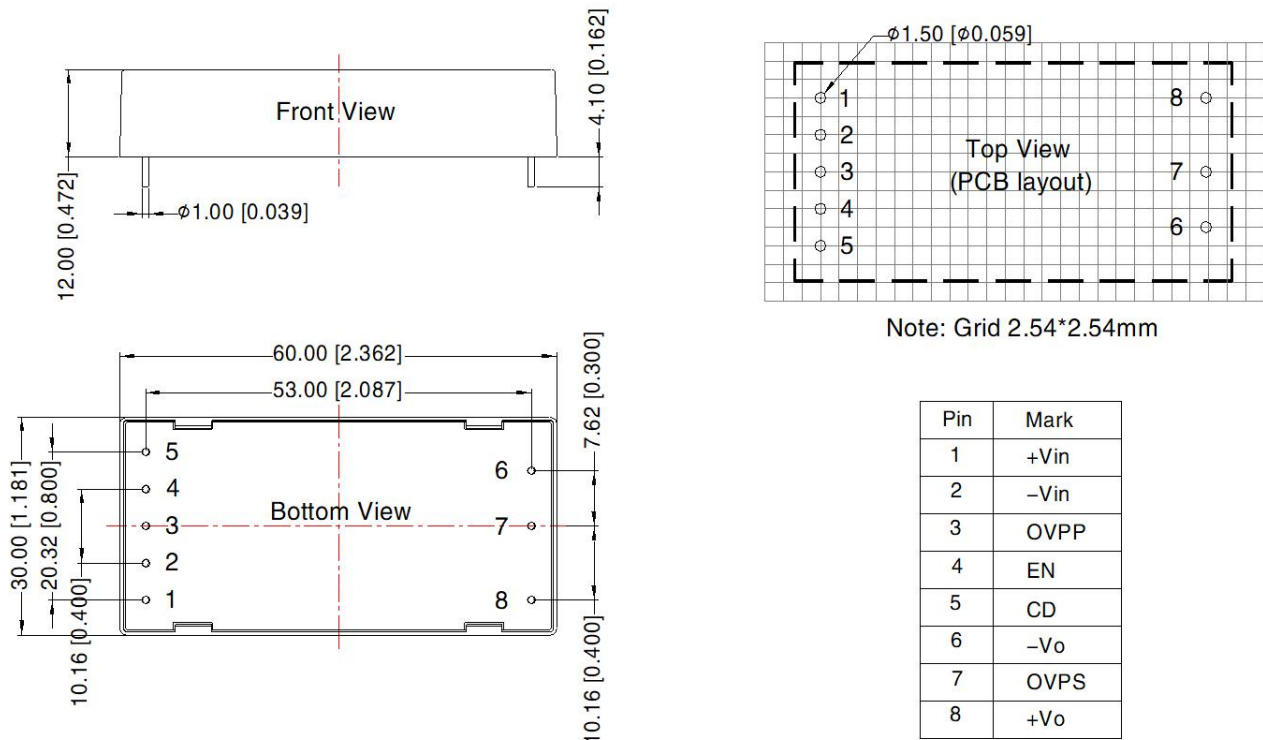
R3(kΩ)	R4(kΩ)	Vref2(V)	Rs2(kΩ)
68	68	2.5	1

Note: The above is for reference only, please subject to the actual product results.

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

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION 



Note:
Unit: mm[inch]
Pin diameter tolerances: $\pm 0.10[\pm 0.004]$
General tolerances: $\pm 0.50[\pm 0.020]$

Note:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113;
2. The input terminal of the module is connected to the voltage range of the ultracapacitor bank (15-30V), and the output terminal is connected to the voltage range of the system bus or battery (1.8-4.5V). Failure risks may occur if the voltage range exceeds the voltage range;
3. Unless otherwise specified, data in this datasheet should be tested under the conditions of $T_a=25^{\circ}\text{C}$, 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" ;
7. 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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