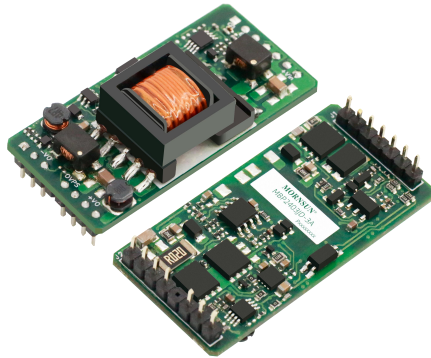Ultra-wide input voltage and isolated single output DIP package, Super-Capacitor group two-way balanced, DC-DC converter

FEATURES

- Two-way switching power supply
- Ultra-wide 4:1 input voltage range
- Efficiency up to 83%
- Output over-voltage protection and adjustable function
- I/O isolation test voltage 3k VAC/4.2k VDC
- Forward constant current output
- Operating ambient temperature range -40℃ to +65℃

Patent Protection RoHS

MBP2403JD-3A is a bidirectional charging power supply module with an input voltage of 10~36VDC and an output voltage of 1.8~5VDC. The forward operation supports charge current constant current output of 3A, reverse operation discharge current is nearly 3A, with isolation voltage 3000VAC/4200VDC, which can be applied to battery BMS active balancing occasions.

Selection Guide

Part No.		Input Voltage (VDC)		Output Voltage (VDC)	Output Current[3] (A,Typ.)	Efficiency(%,Typ.) @+Vin voltage 24V, +Vo voltage 3.3V
MBP2403JD-3A	Forward[1]	+Vin Voltage 24 （10~36）	Max.[2] 40	+Vo Voltage 3.3 （1.8~5）	3	83
	Reverse	+Vo Voltage 3.3 （1.8~5）	Max.[2] 5.3	+Vin Voltage 24 （10~36）	-0.34	81

Note:
①Forward: refers to energy transfer from +Vin to +Vo, Reverse: refers to energy transfer from +Vo to +Vin. (Refer to the dimension part for pin description details);
②Exceeding the maximum input/output voltage may cause permanent damage;
③The reverse working current is represented by a negative value.

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	--	5.5	
Static Working Current	+Vin	+Vin Voltage 24V, +Vo Voltage 3.3V	--	10	30	uA
	+Vo		--	-20	-40	mA
Start-up Voltage	Forward, +Vin	Output voltage range	--	9	10	VDC
	Reverse, +Vo		--	0.7	1.8	
Input under-voltage Protection	Forward		5.5	8.7	--	
	Reverse		0.4	0.7	--	
Input Voltage	Forward, +Vin		10	24	36	
	Reverse, +Vo		1.8	3.3	5	
Input Current	Forward, +Vin	+Vin Voltage 24V, +Vo Voltage 3.3V	--	0.496	0.592	A
	Reverse, +Vo		--	-3	--	
Input Filter	+Vin		C filter			
	+Vo		π filter			
Hot Plug①			Unavailable			

Note: ①Hot plug may damage the module.

Output Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Output Current	Forward, +Vo	Constant current output	2.64	3	3.36	A
	Reverse, +Vin		--	-0.34	--	
Output Voltage	Forward, +Vo		1.8	3.3	5	VDC
	Reverse, +Vin	See Typical Characteristic Curves - Reverse Working Temperature Derating Curve	10	24	36	
Over-voltage Protection*	Forward, +Vo		5.3	5.5	5.7	
	Reverse, +Vin		--	44	46	
	OVPS, +Vo	Output over-voltage protection trim pin. The output over-voltage protection clamp value can be adjusted according to the working conditions. (See Fig.4)	2.6	--	5	
	OVPP, +Vin		10	--	36	
Start-up delay interval		Full input voltage range, full operating temperature range	--	--	3	s

Note: *The measurement method is based on the application of circuit fig. 2.

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.	3000	--	--	VAC
	Input-output Electric Strength test for 1 minute with a leakage current of 1mA max.	4200	--	--	VDC
Insulation Resistance	Input-output Resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	36	--	pF
Storage Humidity	Non-condensing	5	--	95	%RH
Operating Ambient Temperature	See Fig. 1	-40	--	65	℃
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℃	1000	--	--	k hours

Mechanical Specifications

Dimension	49.00 x 23.60 x 17.05 mm
Weight	14.3g (Typ.)
Cooling method	Free air convection

Typical Performance Curves

Temperature Derating Curve

Fig. 1

Forward Operating

Efficiency VS Output Voltage Curve

Vin=10V
Vin=24V
Vin=36V

Output Current VS Output Voltage Curve (Charging)

Vin=10V
Vin=24V
Vin=36V

Reverse Operating

Efficiency VS Output Voltage Curve

Vin=1.8V
Vin=3.3V
Vin=5V

Input Current VS Output Voltage Curve (Discharging)

Vin=1.8V
Vin=3.3V
Vin=5V
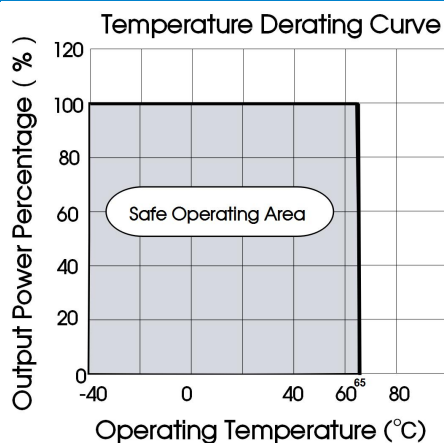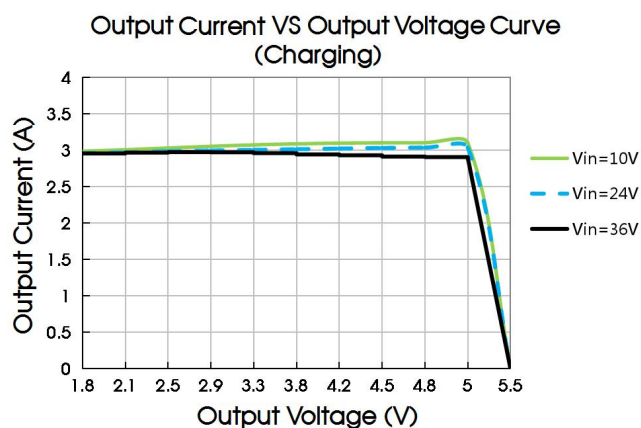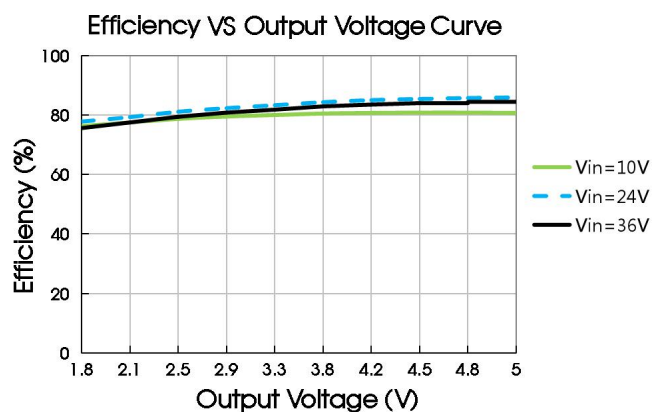
Operating Voltage Range
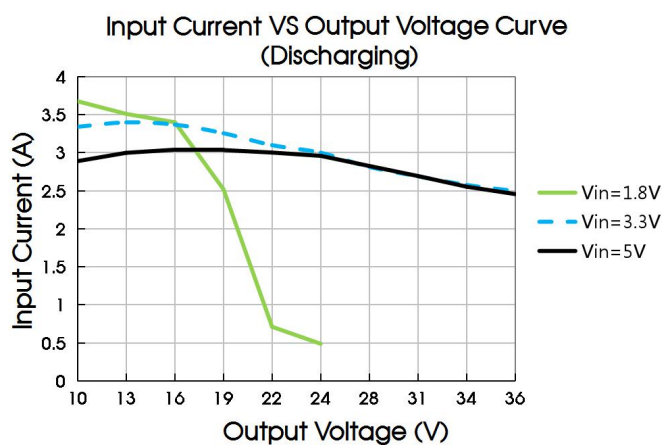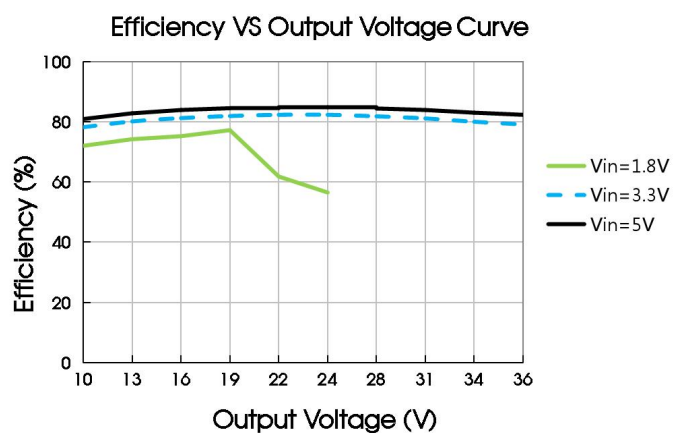
Forward Operating Recommend Voltage Range

Reverse Operating Recommend Voltage Range

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.
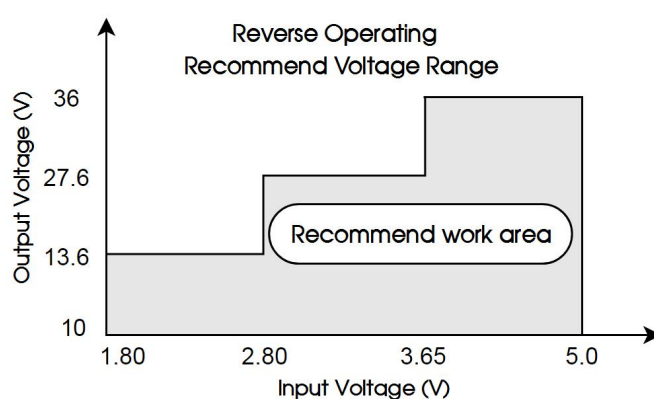
2. Model Control recommended circuit
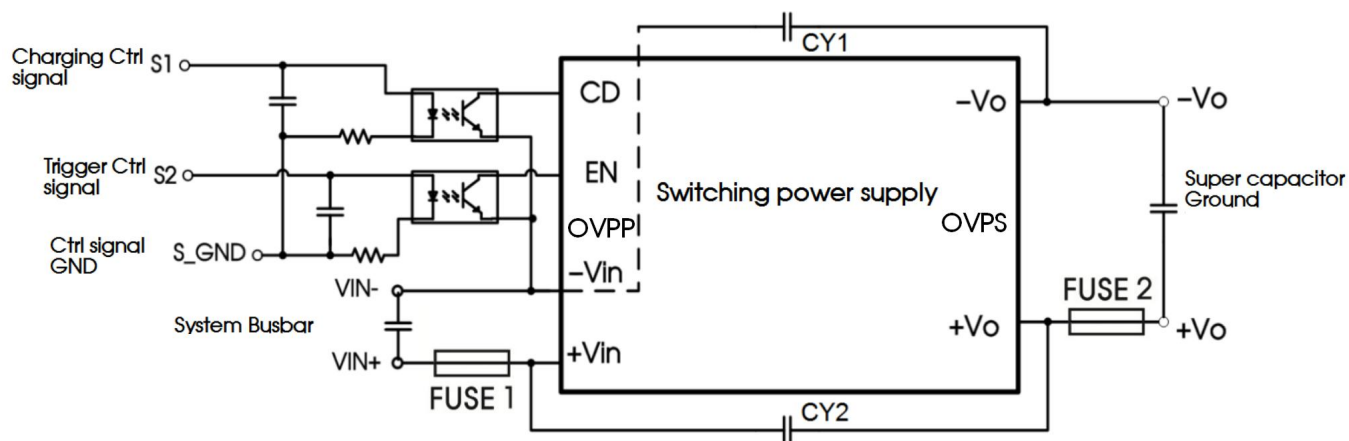
Fig. 3

3. OVPP/OVPS Function for Output Voltage Adjustment (open if unused)
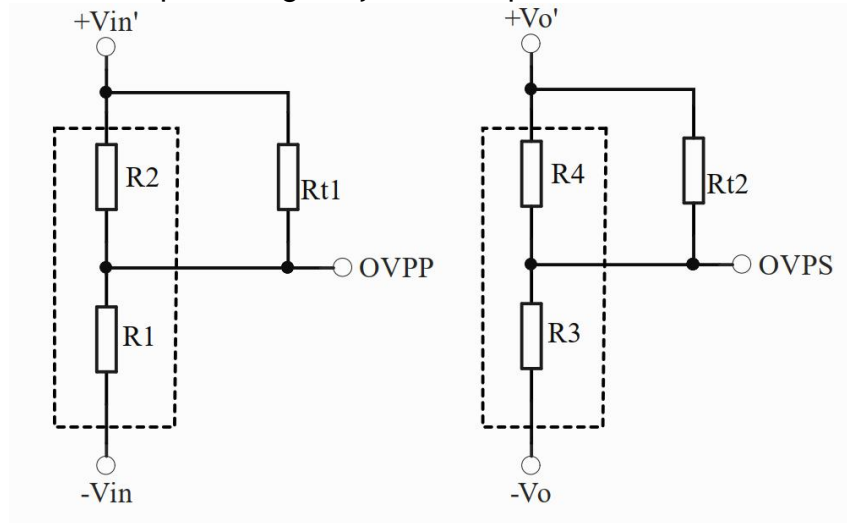
Fig. 4 OVPP/OVPS resistor connection (dashed line shows internal resistor network):

Calculating resistor values:

OVPP: $\quad Rt_1 = \dfrac{aR_2}{R_2 - a} \qquad a = \dfrac{(Vin'-0.7-Vref1)R_1}{Vref1}$

OVPS: $\quad Rt_2 = \dfrac{bR_4}{R_4 - b} \qquad b = \dfrac{(Vo'-Vref2)R_3}{Vref2}$

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

OVPP application resistance (Typ.):

Adjustable value(V)	Rt1(kΩ)	R1(kΩ)	R2(kΩ)	Vref1(V)
Vin': 27.6	200.9	3.9	133	1.25

OVPS application resistance (Typ.):

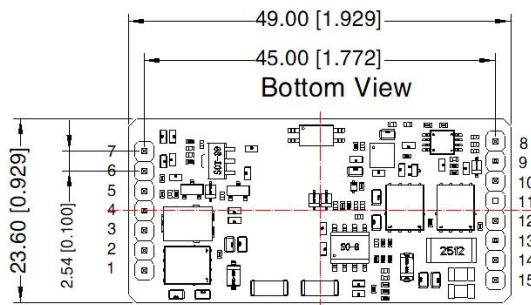| Adjustable value(V)	Rt2(kΩ)	R3(kΩ)	R4(kΩ)	Vref2(V)
Vo': 4.2	15.7	10	12	2.5

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

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Front View

2.50 [0.098]
4.10 [0.161]
Max13.00[0.512]
1.55 [0.061]
□0.64 [0.025]

13–φ1.2[φ0.047]

Top View
(PCB layout)

Note：Grid 2.54*2.54mm

Bottom View

49.00 [1.929]
45.00 [1.772]
23.60 [0.929]
2.54 [0.100]
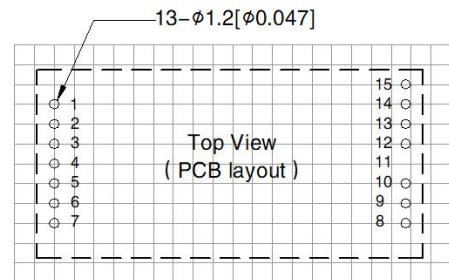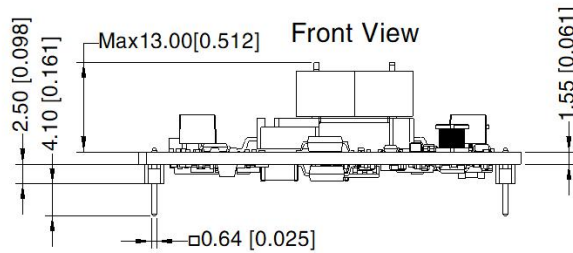
Note：
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
The layout of the device is for reference
only，please refer to the actual product

Pin–Out	
Pin	Mark
1,2	+Vin
3,4	–Vin
5	OVPP
6	EN
7	CD
8,9,10	–Vo
11	No Pin
12	OVPS
13,14,15	+Vo

Note:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220250;

2. The input terminal of the module is connected to the voltage range of the ultracapacitor bank (10-36V), and the output terminal is connected to the voltage range of the system bus or battery (1.8-5V). 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 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" ;

7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.