

# MORNSUN®

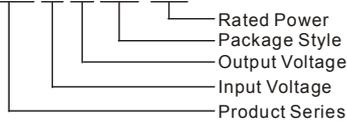
## MSA\_(M)D-3W & MSB\_(M)D-3W Series 3W, WIDE INPUT, ISOLATED & REGULATED DUAL/SINGLE OUTPUT DIP DC-DC CONVERTER



**UL** **CB** Patent Protection RoHS

### PART NUMBER SYSTEM

MSA2405MD-3W



### FEATURES

- 2:1 wide input range
- Efficiency up to 82%
- Operating temperature range:-40°C ~ +85°C
- 1.5KVDC isolation
- Short circuit protection(Automatic recovery)
- Low Temperature rise
- No external component required
- UL94-V0 package
- Industry standard pinout
- MTBF>1,000,000 hours
- IEC60950,UL60950 Approval

### APPLICATIONS

The MSA\_(M)D-3W & MSB\_(M)D-3W series are designed for applications where the output power is directly introduced into the power control circuit board After the AC / DC converter filter circuit from a distributed power system. For these DC-DC converters, You can reduce the design point of failure and save the development of micro power supply's manpower, material and time costs, also better ensure product quality stability, protect safety and reliability of the end of products.

These products apply to where:

- 1) Input voltage variation ranges ≤ 2:1;
- 2) 1.5KVDC input and output isolation;
- 3) Regulated and low ripple noise are required.

### SELECTION GUIDE

| Model Number   | Input Voltage(VDC) |      | Output Voltage (VDC) | Output Current (mA) |      | Input Current (mA)(typ.) |          | Reflected Ripple Current (mA,typ.) | Max. Capacitive Load# (μF) | Efficiency (% , typ.) @Max. Load | Certificate |       |
|----------------|--------------------|------|----------------------|---------------------|------|--------------------------|----------|------------------------------------|----------------------------|----------------------------------|-------------|-------|
|                | Nominal (Range)    | Max* |                      | Max.                | Min. | @Max. Load               | @No Load |                                    |                            |                                  |             |       |
| MSA0505MD-3W   | 5<br>(4.5-9)       | 11   | ±5                   | ±300                | ±30  | 882                      | 85       | 25                                 | 680                        | 68                               | --          |       |
| MSA0515(M)D-3W |                    |      | ±15                  | ±100                | ±10  | 822                      |          |                                    | 220                        | 73                               | --          |       |
| MSB0505D-3W    |                    |      | 5                    | 600                 | 60   | 882                      | 65       |                                    | 1000                       | 68                               | --          |       |
| MSB1205(M)D-3W | 12<br>(9-18)       | 22   | 5                    | 600                 | 60   | 329                      | 35       | 25                                 | 1000                       | 76                               | --          |       |
| MSB1212MD-3W   |                    |      | 12                   | 250                 | 25   | 313                      |          |                                    | 470                        | 80                               | --          |       |
| MSA2415(M)D-3W | 24<br>(18-36)      | 40   | ±15                  | ±100                | ±10  | 154                      | 10       | 20                                 | 220                        | 81                               | --          |       |
| MSB2405(M)D-3W |                    |      | 5                    | 600                 | 60   | 164                      |          |                                    | 15                         | 30                               | 1000        | 76    |
| MSB2412MD-3W   |                    |      | 12                   | 250                 | 25   | 154                      | 470      |                                    |                            |                                  | 81          | UL/CB |
| MSB2415D-3W    |                    |      | 15                   | 200                 | 20   | 156                      | 330      |                                    |                            |                                  | 80          | UL/CB |
| MSB2424(M)D-3W |                    |      | 24                   | 125                 | 12   | 152                      | 220      |                                    |                            |                                  | 82          | UL/CB |
| MSA4812MD-3W   | 48<br>(36-72)      | 80   | ±12                  | ±125                | ±12  | 78                       | 6        | 20                                 | 330                        |                                  | 80          | --    |
| MSA4815D-3W    |                    |      | ±15                  | ±100                | ±10  | 77                       |          |                                    | 220                        | 81                               | --          |       |
| MSB4805MD-3W   |                    |      | 5                    | 600                 | 60   | 82                       | 8        |                                    | 25                         | 1000                             | 76          | --    |
| MSB4809D-3W    |                    |      | 9                    | 333                 | 33   | 80                       |          |                                    |                            | 680                              | 78          | --    |
| MSB4812D-3W    |                    |      | 12                   | 250                 | 25   | 77                       |          |                                    |                            | 470                              | 81          | --    |

Note: 1.\*Input voltage can't exceed this value, or will cause the permanent damage.  
2. #The capacitive loads of positive and negative outputs are the same.

### INPUT SPECIFICATIONS

| Item                             | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|-----------------|------|------|------|------|
| Input Surge Voltage (1sec. max.) | 5VDC input      | -0.7 | --   | 12   | VDC  |
|                                  | 12VDC input     | -0.7 | --   | 25   |      |
|                                  | 24VDC input     | -0.7 | --   | 50   |      |
|                                  | 48VDC input     | -0.7 | --   | 100  |      |

|                           |             |           |     |     |   |
|---------------------------|-------------|-----------|-----|-----|---|
| Start-up Voltage          | 5VDC input  | --        | 4.0 | 4.5 |   |
|                           | 12VDC input | --        | 8.5 | 9   |   |
|                           | 24VDC input | --        | 17  | 18  |   |
|                           | 48VDC input | --        | 34  | 36  |   |
| Short Circuit Input Power |             | --        | 1.5 | 2.5 | W |
| Input Filter              |             | Pi Filter |     |     |   |

## OUTPUT SPECIFICATIONS

| Item                         | Test Conditions                | Min.                           | Typ. | Max.  | Unit  |
|------------------------------|--------------------------------|--------------------------------|------|-------|-------|
| Output Power                 |                                | 0.3                            | --   | 3     | W     |
| Positive voltage accuracy    | Refer to recommended circuit   | --                             | ±1   | ±3    | %     |
| Negative voltage accuracy    |                                | --                             | ±3   | ±5    |       |
| Output Voltage Balance       | Dual Output, Balanced Loads    | --                             | ±0.5 | ±1    |       |
| Line Regulation              | Input voltage from low to high | --                             | ±0.2 | ±0.5  |       |
| Load Regulation              | From 10% to 100% load          | --                             | ±0.5 | ±1    |       |
| Transient Recovery Time      | 25% Load step change           | --                             | 6    | 15    | ms    |
| Transient Response Deviation |                                | --                             | ±3   | ±5    | %     |
| Temperature Drift            | Refer to recommended circuit   | --                             | --   | ±0.03 | %/°C  |
| Ripple & Noise*              | 20MHz Bandwidth                | --                             | 50   | 100   | mVp-p |
| Short Circuit Protection     |                                | Continuous, automatic recovery |      |       |       |

Note: 1. Dual output models unbalanced load: ≤±5%.

2. \*Ripple and noise tested by "parallel cable" method. See detailed operation instructions at Testing of Power Converter section, application notes.

## COMMON SPECIFICATIONS

| Item                  | Test Conditions  | Min.                                     | Typ. | Max. | Unit    |
|-----------------------|--|--|------|------|---------|
| Isolation Voltage     | Input-output, with the test time of 1 minute and the leak current lower than 1mA | 1500                                     | --   | --   | VDC     |
| Isolation Resistance  | Test at 500VDC   | 1000                                     | --   | --   | MΩ      |
| Isolation Capacitance | Input/Output, 100KHz/1V  | --                                       | 80   | --   | pF      |
| Switching Frequency   | 100% load, input voltage range   | --                                       | 300  | --   | KHz     |
| MTBF                  | MIL-HDBK-217F@25°C   | 1000                                     | --   | --   | K hours |
| Case Material         |  | D: Plastic(UL94-V0), MD: Stainless steel |      |      |         |
| Weight                |  | --                                       | 15   | --   | g       |

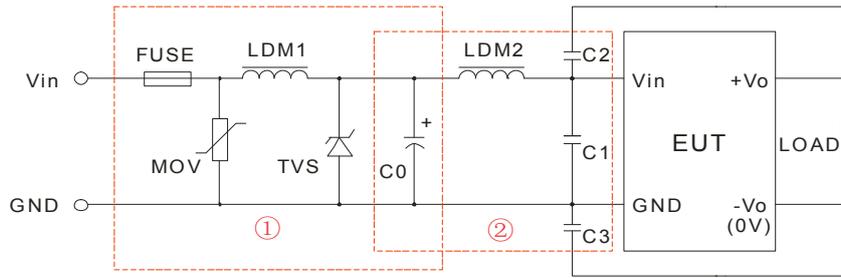
## ENVIRONMENTAL SPECIFICATIONS

| Item                    | Test Conditions                | Min.                | Typ. | Max. | Unit |
|-------------------------|--------------------------------|---------------------|------|------|------|
| Storage Humidity        | Non condensing                 | --                  | --   | 95   | %    |
| Operating Temperature   | Power derating (above 71°C)    | -40                 | --   | 85   | °C   |
| Storage Temperature     |                                | -55                 | --   | 125  |      |
| Temp. rise at full load | Ta=25°C                        | --                  | 15   | --   |      |
| Soldering Temperature   | 1.5mm from case for 10 seconds | --                  | --   | 300  |      |
| Cooling                 |                                | Free air convection |      |      |      |

## EMC SPECIFICATIONS

|     |       |  |  |  |  |
|-----|-------|--|--|--|--|
| EMI | CE    | CISPR22/EN55022 CLASS A (External Circuit Refer to Figure 1-②)               |  |  |  |
| EMS | ESD   | IEC/EN61000-4-2 Contact ±4KV perf. Criteria B                                |  |  |  |
|     | EFT   | IEC/EN61000-4-4 ±2KV perf. Criteria B (External Circuit Refer to Figure 1-①) |  |  |  |
|     | Surge | IEC/EN61000-4-5 ±2KV perf. Criteria B (External Circuit Refer to Figure 1-①) |  |  |  |

## EMC RECOMMENDED CIRCUIT



(Figure1)

MSA\_(M)D-3W Recommended external circuit parameters:

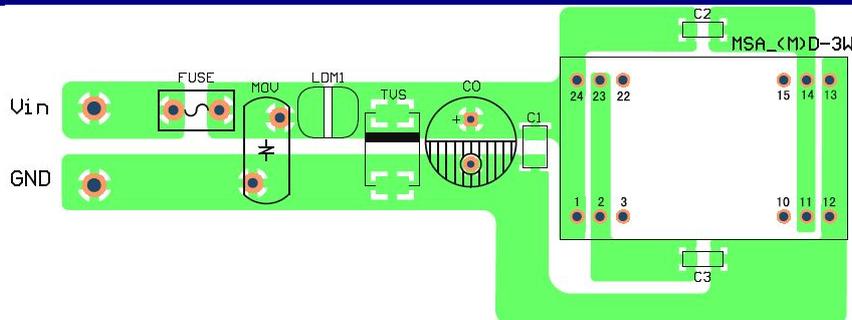
| Model |      | Vin: 5V                                     | Vin: 24V   | Vin: 48V               |
|-------|------|---|--|------------------------|
| EMS   | FUSE | Choose according to practical input current |  |                        |
|       | MOV  | --  | 10D560K  | 10D101K                |
|       | LDM1 | --  | 56 $\mu$ H   | 56 $\mu$ H             |
|       | TVS  | SMCJ13A                                     | SMCJ48A  | SMCJ90A                |
|       | C0   | 680 $\mu$ F/16V                             | 120 $\mu$ F/50V                                    | 120 $\mu$ F/100V       |
| EMI   | C0   | 680 $\mu$ F/16V                             | --   | --                     |
|       | C1   | --  | 4.7 $\mu$ F/50V                                    | 4.7 $\mu$ F/100V       |
|       | C2   | --  | 100pF/2KV (MSA24_D-3W)<br>1000pF/2KV (MSA24_MD-3W) | 100pF/2KV (MSA48_D-3W) |
|       | C3   | --  | --   | 100pF/2KV (MSA48_D-3W) |

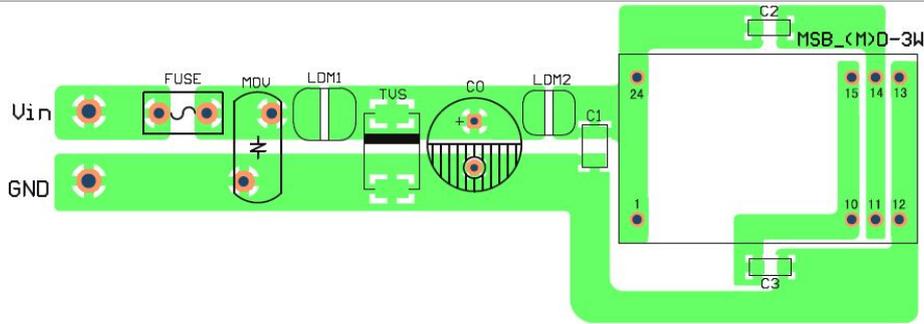
MSB\_(M)D-3W Recommended external circuit parameters:

| Model |      | Vin: 5V                                     | Vin: 12V   | Vin: 24V                 | Vin: 48V                |
|-------|------|---|--|--------------------------|-------------------------|
| EMS   | FUSE | Choose according to practical input current |  |                          |                         |
|       | MOV  | --  | --   | 10D560K                  | 10D101K                 |
|       | LDM1 | --  | --   | 56 $\mu$ H               | 56 $\mu$ H              |
|       | TVS  | SMCJ13A                                     | SMCJ28A  | SMCJ48A                  | SMCJ100A                |
|       | C0   | 680 $\mu$ F/16V                             | 680 $\mu$ F/25V                                    | 120 $\mu$ F/50V          | 120 $\mu$ F/100V        |
| EMI   | C0   | 680 $\mu$ F/16V                             | --   | --                       | --                      |
|       | LDM2 | 4.7 $\mu$ H (MSB05_MD-3W)                   | --   | --                       | --                      |
|       | C1   | --  | 4.7 $\mu$ F/50V                                    | 4.7 $\mu$ F/50V          | 4.7 $\mu$ F/100V        |
|       | C2   | --  | 100pF/2KV (MSB12_D-3W)<br>1000pF/2KV (MSB12_MD-3W) | 1000pF/2KV (MSB24_MD-3W) | 100pF/2KV (MSB48_MD-3W) |
|       | C3   | --  | 100pF/2KV (MSB12_D-3W)                             | 100pF/2KV (MSB24_D-3W)   | 100pF/2KV (MSB48_D-3W)  |

Note: 1. In Figure 1, part ① is EMS Recommended external circuit, part ② is EMI recommended external circuit. Choose according to requirements.  
2. If there is no recommended parameters, the model no require the external component.

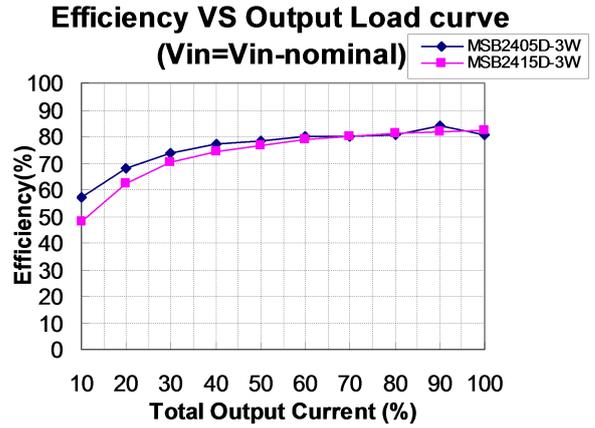
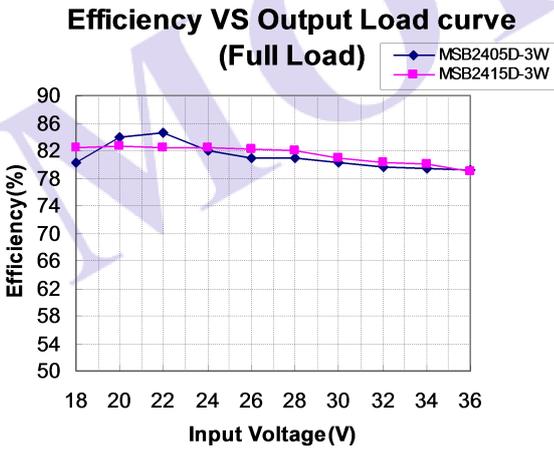
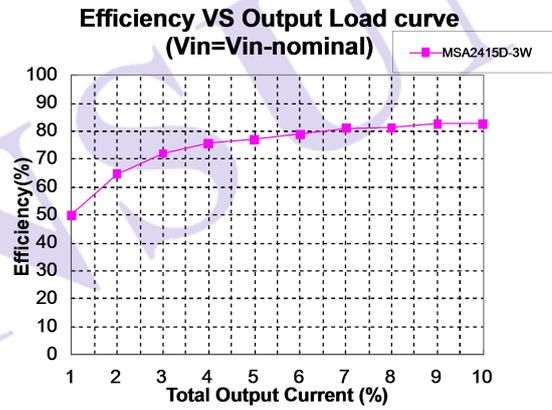
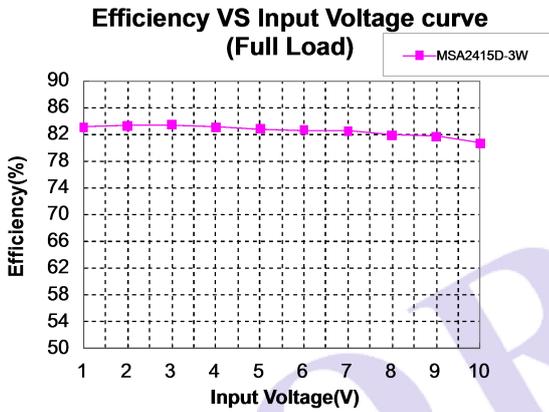
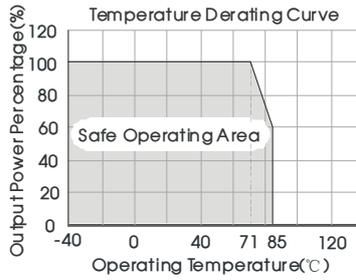
## EMC RECOMMENDED CIRCUIT PCB LAYOUT





(Figure 2)

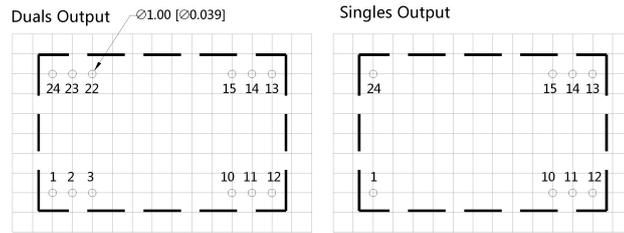
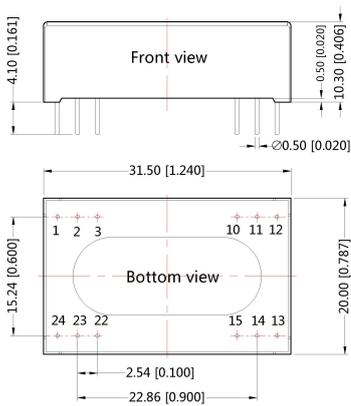
**PRODUCT TYPICAL CURVE**



# OUTLINE DIMENSIONS, RECOMMENDED FOOTPRINT & PACKAGING

## MSA\_MD-3W & MSB\_MD-3W series

THIRD ANGLE PROJECTION



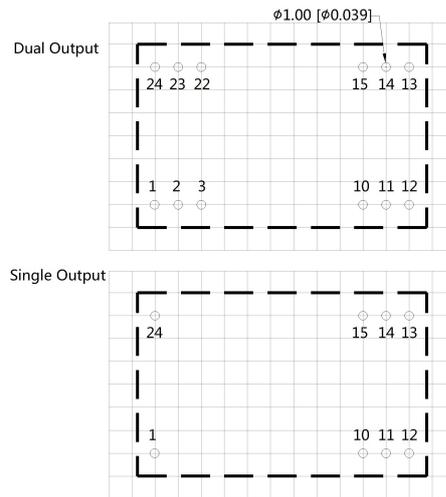
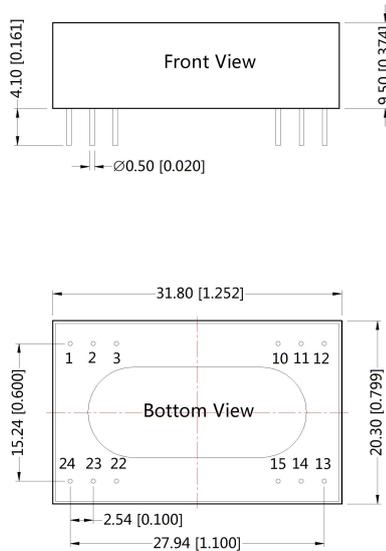
Note: Grid 2.54\*2.54mm

| Pin-Out |        |      |
|---------|--------|------|
| Pin     | Single | Dual |
| 1,24    | Vin    | Vin  |
| 2,23    | No Pin | -Vo  |
| 3,22    | No Pin | 0V   |
| 10,15   | 0V     | 0V   |
| 11,14   | +Vo    | +Vo  |
| 12,13   | GND    | GND  |

Note:  
Unit :mm[inch]  
Pin diameter tolerances:±0.10[±0.004]  
General tolerances:±0.50[±0.020]

## MSA\_D-3W & MSB\_D-3W series

THIRD ANGLE PROJECTION



Note : Grid 2.54\*2.54mm

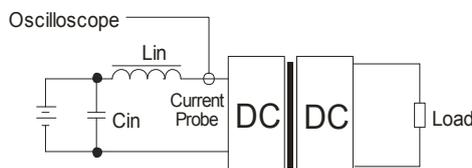
| Pin-Out |        |      |
|---------|--------|------|
| Pin     | Single | Dual |
| 1, 24   | Vin    | Vin  |
| 2, 23   | No Pin | -Vo  |
| 3, 22   | No Pin | 0V   |
| 10, 15  | 0V     | 0V   |
| 11, 14  | +Vo    | +Vo  |
| 12, 13  | GND    | GND  |

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

## TEST CONFIGURATIONS

### Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.



Lin(4.7μH)      Cin(220μF, ESR < 1.0Ω at 100 KHz)

## DESIGN CONSIDERATIONS

### 1) Requirement on output load

To ensure this module can operate efficiently and reliably, During operation, the minimum output load **could not be less than 10% of the full load**. If the actual output power is very small, please connect a resistor with proper resistance at the output end in parallel to increase the load, or use our company's products with a lower rated output power.

### 2) Overload Protection

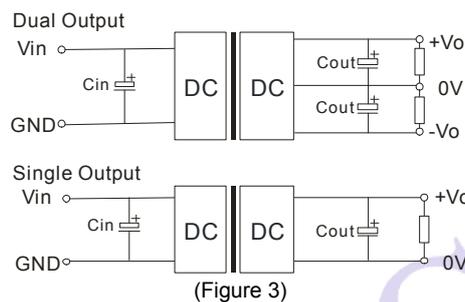
Under normal operating conditions, the output circuit of these products has no protection against overload. The simplest method is add a circuit breaker to the circuit.

### 3) Recommended circuit

All the MSA\_(M)D-3W & MSB\_(M)D-3W Series have been tested according to the following recommended testing circuit before leaving factory(Figure 3).

If you want to further decrease the input/output ripple, you can increase a capacitance properly or choose capacitors with low ESR. However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor must less than the Max. Capacitive Load. Generally: If you want to use the products in high EMI, please choose our metal packaged products (MSA\_MD-3W & MSB\_MD- 3W).

General: Cin: 5V&12V 100 $\mu$ F  
24V&48V 10 $\mu$ F~47 $\mu$ F  
Cout: 10 $\mu$ F/100mA

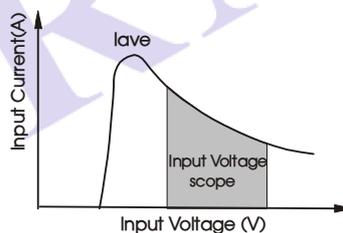


(Figure 3)

### 4) Input current

Nominal input voltage range. The input current of the power supply must be sufficient to the startup current ( $I_p$ ) of the DC/DC module(Figure 4).

Generally: Vin=5V Iave =1373mA  
Vin=12V Iave=614mA  
Vin=24V Iave=307mA  
Vin=48V Iave =154mA



(Figure 4)

### 5) Cannot use in parallel and hot swap

Note:

1. Packing information please refer to Product Packing Information which can be downloaded from [www.mornsun-power.com](http://www.mornsun-power.com). Packing bag number: 58210008;
2. Operation under minimum load will not damage the converter; However, they may not meet all specification listed.
3. Max. Capacitive Load tested at input voltage range and full load.
4. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
5. In this datasheet, all the test methods of indications are based on our corporate standards.
6. All characteristics are for listed model only, non-standard models may perform differently, please contact our technical person for more detail.
7. Contact us for your specific requirement.
8. Specifications subject to change without prior notice.

### MORNSUN Science & Technology Co.,Ltd.

Address: No. 5, Kehui St. 1, Kehui development center, Science Ave., Guangzhou Science City, Luogang district, Guangzhou,P.R.China.

Tel: 86-20-38601850

Fax:86-20-38601272

[Http://www.mornsun-power.com](http://www.mornsun-power.com)