10W, wide input, isolated & regulated single output, SIP package, DC-DC converter


Patent Protection RoHS

## FEATURES

- Wide input voltage range (2:1)
- High efficiency up to 88%
- Isolation voltage :1.5K VDC
- Input under-voltage protection, output short circuit, over-current protection
- Operating temperature range: -40℃ to +85℃
- International standard pin-out
- Meets EN62368 standards (Pending)

*VRB_S-10WR3 series are isolated 10W DC-DC products with 2:1 input voltage. The feature efficiency up to 88%, 1500VDC isolation, operating temperature of -40℃ to +85℃, input under-voltage protection, output over-current, short circuit protection, which make them widely applied in medical care, industrial control, electric power, instruments and communication fields.*

## Selection Guide

| Certification | Part No. | Input Voltage (VDC) | | Output | | Efficiency② (%,Min./Typ.) @ Full Load | Max. Capacitive Load (μF) |
|---|---|---|---|---|---|---|---|
| | | Nominal (Range) | Max.① | Output Voltage (VDC) | Output Current (mA) (Max./Min.) | | |
| CE Pending | VRB1203S-10WR3 | 12 (9-18) | 20 | 3.3 | 2400/0 | 81/83 | 2200 |
| | VRB1205S-10WR3 | | | 5 | 2000/0 | 84/86 | 2200 |
| | VRB1209S-10WR3 | | | 9 | 1111/0 | 84/86 | 680 |
| | VRB1212S-10WR3 | | | 12 | 833/0 | 84/86 | 470 |
| | VRB1215S-10WR3 | | | 15 | 667/0 | 84/86 | 330 |
| | VRB1224S-10WR3 | | | 24 | 417/0 | 84/86 | 220 |
| | VRB2403S-10WR3 | 24 (18-36) | 40 | 3.3 | 2400/0 | 83/85 | 2200 |
| | VRB2405S-10WR3 | | | 5 | 2000/0 | 86/88 | 2200 |
| | VRB2409S-10WR3 | | | 9 | 1111/0 | 86/88 | 680 |
| | VRB2412S-10WR3 | | | 12 | 833/0 | 86/88 | 470 |
| | VRB2415S-10WR3 | | | 15 | 667/0 | 86/88 | 330 |
| | VRB2424S-10WR3 | | | 24 | 417/0 | 86/88 | 220 |

Notes:
①Absolute maximum rating without damage on the converter, but it isn't recommended;
②Efficiency is measured In nominal input voltage and rated output load.

## Input Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input Current (full load / no-load) | 12VDC nominal input series, nominal input voltage | 3.3V output | -- | 777/35 | 796/50 | mA |
| | | 5V output | -- | 969/35 | 992/50 | |
| | | Others | -- | 969/9 | 992/18 | |
| | 24VDC nominal input series, nominal input voltage | 3.3V output | -- | 389/25 | 398/45 | |
| | | 5V output | -- | 474/25 | 485/45 | |
| | | Others | -- | 474/9 | 485/18 | |
| Reflected Ripple Current | | | -- | 50 | -- | |
| Surge Voltage (1sec. max.) | 12VDC nominal input voltage | | -0.7 | -- | 25 | VDC |
| | 24VDC nominal input voltage | | -0.7 | -- | 50 | |
| Starting Voltage | 12VDC nominal input voltage | | -- | -- | 9 | |
| | 24VDC nominal input voltage | | -- | -- | 18 | |
| Input Under-voltage Protection | 12VDC nominal input voltage | | 5.5 | 6.5 | -- | VDC |
| | 24VDC nominal input voltage | | 12 | 15.5 | -- | |
| Input Filter | | | Capacitance Filter | | | |
| Hot Plug | | | Unavailable | | | |

| | | | | | |
|---|---|---|---|---|---|
| Ctrl* | Module switch on | Ctrl open circuit or connected to TTL high level (3.5-12VDC) | | | |
| | Module switch off | Ctrl pin connected to GND or low level (0-1.2VDC) | | | |
| | Input current when switched off | -- | 6 | 10 | mA |
| Note: * The voltage of Ctrl pin is relative to input pin GND. | | | | | |

## Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Accuracy① | 5%-100% load | | -- | ±1.5 | ±2 | % |
| Line Regulation | Full load, the input voltage is from low voltage to high voltage | | -- | ±0.25 | ±0.5 | |
| Load Regulation② | 5%-100% load | | -- | ±0.5 | ±1 | |
| Transient Recovery Time | 25% load step change | | -- | 300 | 500 | μs |
| Transient Response Deviation | | 3.3V/ 5V output | -- | ±5 | ±8 | % |
| | | Others | -- | ±3 | ±5 | |
| Temperature Coefficient | Full load | | -- | -- | ±0.03 | %/℃ |
| Ripple & Noise③ | 20MHz bandwidth, 5%-100% load | 3.3V/ 5V output | -- | 60 | 120 | mV p-p |
| | | Others | -- | 75 | 150 | |
| Output Over-current Protection | Input voltage range | | 110 | 160 | 230 | %Io |
| Short circuit Protection | | | Continuous, self-recovery | | | |

Note: ①At 0%-5% load, the Max. output voltage accuracy is ±3%;
②When testing from 0% -100%load working conditions, load regulation index is ±3%;
③0%-5% load ripple&Noise is no more than 300mV. Ripple and noise are measured by Fig.2

## General Specification

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Insulation Voltage | Input-output, with the test time of 1 minute and the leak current lower than 1mA | 1500 | -- | -- | VDC |
| Insulation Resistance | Input-output, insulation voltage 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitance | Input-output, 100KHz/0.1V | -- | 1000 | -- | pF |
| Operating Temperature | see Fig. 1 | -40 | -- | +85 | ℃ |
| Storage Humidity | Without condensation | 5 | -- | 95 | %RH |
| Storage Temperature | | -55 | -- | +125 | ℃ |
| Pin Welding Resistance Temperature | Welding spot is 1.5mm away from the casing, 10 seconds | -- | -- | +300 | |
| Vibration | | 10-150Hz, 5G, 0.75mm. along X, Y and Z | | | |
| Switching Frequency * | PWM mode | -- | 500 | -- | KHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | K hours |

Note:* This series of products using reduced frequency technology, the switching frequency is test value of full load,When the load is reduced to below 50%, the switching frequency decreases with decreasing load.

## Physical Specifications

| | |
|---|---|
| Casing Material | Black flame-retardant and heat-resistant plastic (UL94 V-0) |
| Dimension | 22.00*9.50*12.00 mm |
| Weight | 5.5g (Typ.) |
| Cooling method | Free air convection (20LFM) |

## EMC Specifications

| | | | | |
|---|---|---|---|---|
| EMI | CE | CISPR32/EN55032 | CLASS B (see Fig.4-② for recommended circuit) | |
| | RE | CISPR32/EN55032 | CLASS B (see Fig.4-② for recommended circuit) | |
| EMS | ESD | IEC/EN61000-4-2 | Contact ±6KV | perf. Criteria B |
| | RS | IEC/EN61000-4-3 | 10V/m | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 | ±2KV (see Fig.4-① for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN61000-4-5 | line to line ±2KV (see Fig.4-① for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN61000-4-6 | 3 Vr.m.s | perf. Criteria A |

## Product Characteristic Curve

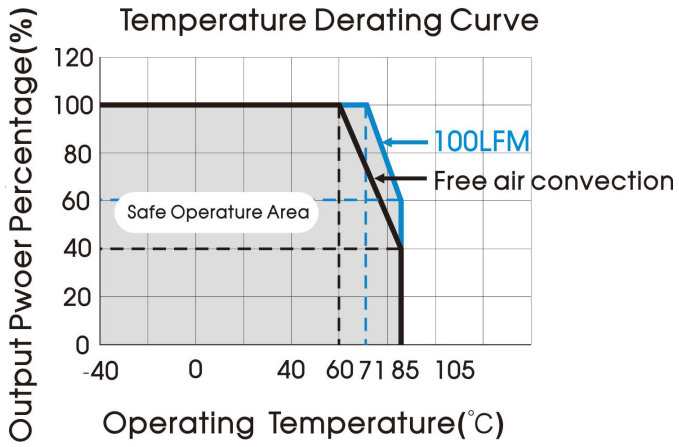
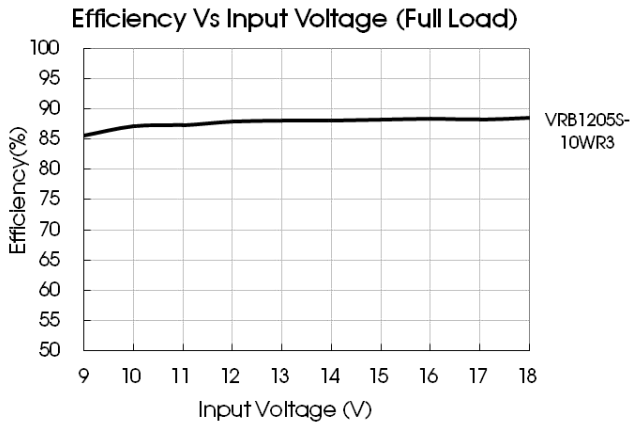
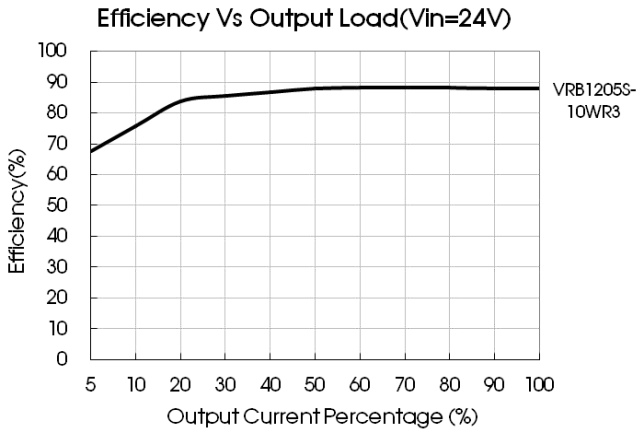
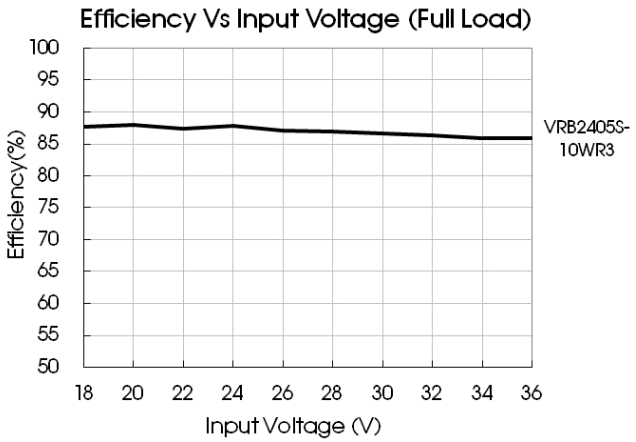
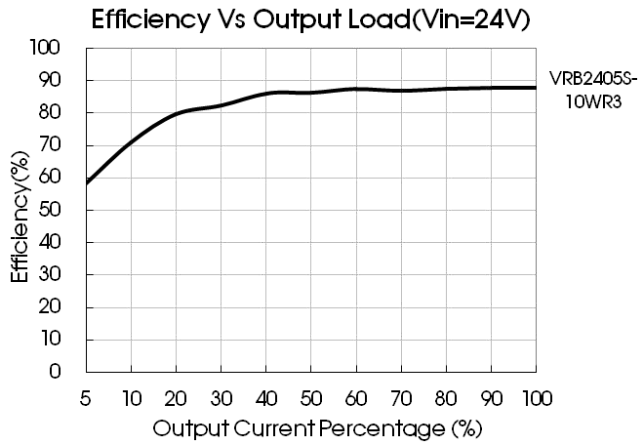



Fig. 1



## Design Reference

### 1. Ripple & Noise

All the VRB_S-10WR3 series have been tested according to the following recommended test circuit before delivery (see Fig. 2).
The connection of probe to copper foil is shortened as far as possible.

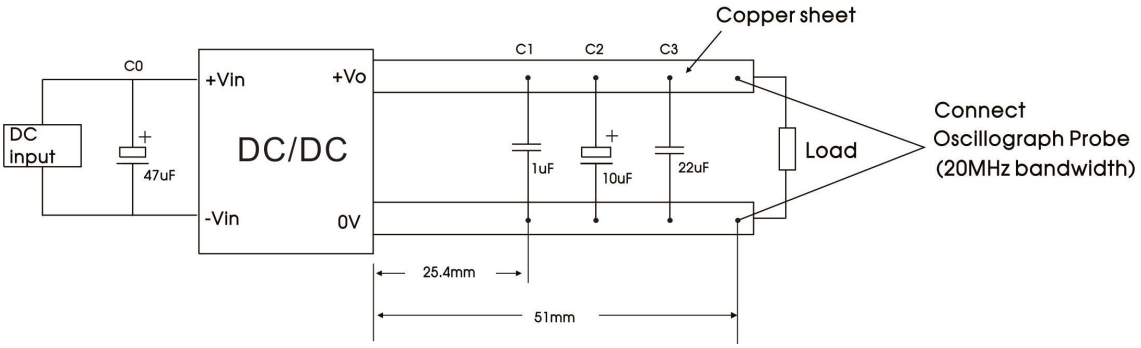



Fig. 2

### 2. Typical application

If it is required to further reduce input and output ripple, properly increase the input & output of additional capacitors Cin and Cout or select capacitors of low equivalent impedance provided that the capacitance is no larger than the max. capacitive load of the product.


Fig. 3

| Cin(uF) | Cout(uF) |
|---|---|
| 47 | 22 |

### 3. EMC solution-recommended circuit

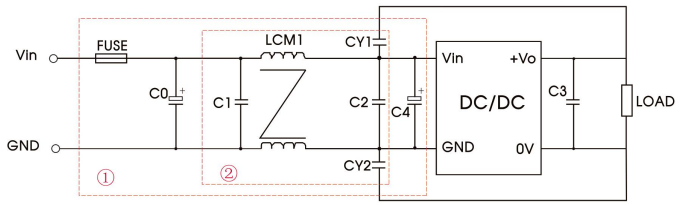



图 4

Notes: Part ① in the Fig. 4 is used for EMC test and part ② for EMI filtering; selected based on needs.

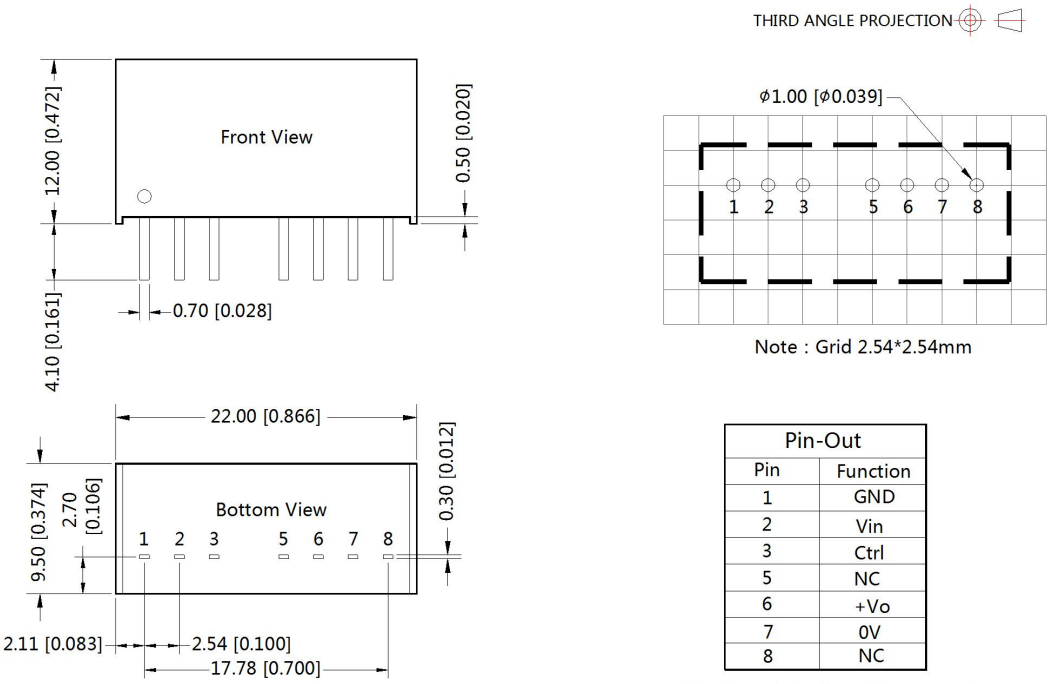
Fig. 4 Parameter description

| Model | Vin:12V | Vin:24V |
|---|---|---|
| FUSE | Choose according to actual input current | |
| C0, C4 | 330μF/35V | 330μF/50V |
| C1, C2 | 10μF/50V | |
| C3 | 22μF/50V | |
| LCM1 | 1.4-1.7mH（TN150P-RH12.7*12.7*7.9） | |
| CY1, CY2 | 1nF/2000VDC | |

### 4. It is not allowed to connect modules output in parallel to enlarge the power

### 5. For more information please find DC-DC converter application notes on www.mornsun-power.com

## Dimensions and Recommended Layout




| Pin-Out | |
|---|---|
| Pin | Function |
| 1 | GND |
| 2 | Vin |
| 3 | Ctrl |
| 5 | NC |
| 6 | +Vo |
| 7 | 0V |
| 8 | NC |

NC: Pin to be isolated from circuitry

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

Note:
1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Packing bag number: 58210004;
2. The maximum capacitive load offered were tested at input voltage range 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 Company's 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.

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