10W isolated DC-DC converter DIP package
Wide input and regulated dual/ single output




Patent Protection

CE Report EN62368-1

UKCA Report BS EN62368-1

RoHS

## FEATURES

- Wide 2:1 input voltage range
- High efficiency up to 88%
- No-load power consumption as low as 0.11W
- I/O isolation test voltage 1.5k VDC
- Operating ambient temperature range: -40℃ to +85℃
- Input under-voltage protection, output short-circuit, over-current, over-voltage protection
- Meet CISPR32/EN55032 CLASS A without extra components
- Industry standard pin-out

*VRA_ZP-10WR3 & VRB_ZP-10WR3 series are isolated 10W DC-DC converter products with a wide range of voltage input of 9-18VDC, 18-36VDC, 36-75VDC, isolation voltage of 1500VDC, input under-voltage protection, output short-circuit, over-current, over-voltage protection and EMI meets CISPR32/EN55032 CLASS A without external components; these products are widely used in fields such as industrial control, electric power, instruments and communication.*

## Selection Guide

| Certification | Part No. | Input Voltage (VDC) | | Output | | Full Load Efficiency② (%)Min./Typ. | Capacitive Load③ (μF)Max. |
|---|---|---|---|---|---|---|---|
| | | Nominal (Range) | Max.① | Voltage(VDC) | Current (mA) Max./Min. | | |
| EN/BS EN | VRA1205ZP-10WR3 | 12 (9-18) | 20 | ±5 | ±1000/0 | 81/83 | 1000 |
| | VRA1212ZP-10WR3 | | | ±12 | ±416/0 | 84/86 | 470 |
| | VRA1215ZP-10WR3 | | | ±15 | ±333/0 | 84/86 | 330 |
| | VRB1203ZP-10WR3 | | | 3.3 | 2400/0 | 84/86 | 1200 |
| | VRB1205ZP-10WR3 | | | 5 | 2000/0 | 84/86 | 1000 |
| | VRB1212ZP-10WR3 | | | 12 | 833/0 | 85/87 | 470 |
| | VRB1215ZP-10WR3 | | | 15 | 667/0 | 85/87 | 330 |
| | VRB1224ZP-10WR3 | | | 24 | 416/0 | 86/88 | 100 |
| | VRA2405ZP-10WR3 | 24 (18-36) | 40 | ±5 | ±1000/0 | 81/83 | 1000 |
| | VRA2412ZP-10WR3 | | | ±12 | ±416/0 | 85/87 | 470 |
| | VRA2415ZP-10WR3 | | | ±15 | ±333/0 | 85/87 | 330 |
| | VRB2403ZP-10WR3 | | | 3.3 | 2400/0 | 83/85 | 1200 |
| | VRB2405ZP-10WR3 | | | 5 | 2000/0 | 85/87 | 1000 |
| | VRB2412ZP-10WR3 | | | 12 | 833/0 | 84/86 | 470 |
| | VRB2415ZP-10WR3 | | | 15 | 667/0 | 85/87 | 330 |
| | VRB2424ZP-10WR3 | | | 24 | 416/0 | 84/86 | 100 |
| | VRA4805ZP-10WR3 | 48 (36-75) | 80 | ±5 | ±1000/0 | 81/83 | 1000 |
| | VRA4812ZP-10WR3 | | | ±12 | ±416/0 | 85/87 | 470 |
| | VRA4815ZP-10WR3 | | | ±15 | ±333/0 | 85/87 | 330 |
| | VRB4803ZP-10WR3 | | | 3.3 | 2400/0 | 84/86 | 1200 |
| | VRB4805ZP-10WR3 | | | 5 | 2000/0 | 85/87 | 1000 |
| | VRB4812ZP-10WR3 | | | 12 | 833/0 | 85/87 | 470 |

Note:
①Exceeding the maximum input voltage may cause permanent damage;
②Efficiency is measured at nominal input voltage and rated output load;
③The specified maximum capacitive load for positive and negative output is identical;
④We suggest to connect an external electrolytic capacitor if there is a spike voltage at the input, details please refer to application circuit.

## Input Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input Current (full load / no-load) | 12VDC input, nominal input voltage | 3.3VDC single output | -- | 759/15 | 777/30 | mA |
| | | 5VDC single output | -- | 958/15 | 980/30 | |
| | | others | -- | 980/9 | 1028/15 | |
| | 24VDC input, nominal input voltage | 3.3VDC single output | -- | 384/10 | 393/25 | |
| | | 5VDC single output | -- | 474/5 | 485/12 | |
| | | others | -- | 490/5 | 515/12 | |
| | 48VDC input, nominal input voltage | 3.3VDC single output | -- | 190/8 | 195/20 | |
| | | 5VDC single output | -- | 237/5 | 243/12 | |
| | | others | -- | 245/4 | 258/8 | |
| Reflected Ripple Current | 12VDC nominal input series, nominal input voltage | | -- | 50 | -- | |
| | 24VDC nominal input series, nominal input voltage | | -- | 40 | -- | |
| | 48VDC nominal input series, nominal input voltage | | -- | 30 | -- | |
| Surge Voltage (1sec. max.) | 12VDC nominal input series | | -0.7 | -- | 25 | VDC |
| | 24VDC nominal input series | | -0.7 | -- | 50 | |
| | 48VDC nominal input series | | -0.7 | -- | 100 | |
| Start-up Voltage | 12VDC nominal input series | | -- | -- | 9 | |
| | 24VDC nominal input series | | -- | -- | 18 | |
| | 48VDC nominal input series | | -- | -- | 36 | |
| Input Under-voltage Protection | 12VDC nominal input series | | 5.5 | 6.5 | -- | |
| | 24VDC nominal input series | | 12 | 15.5 | -- | |
| | 48VDC nominal input series | | 25 | 30.5 | -- | |
| Input Filter | | | Pi filter | | | |
| Hot Plug | | | Unavailable | | | |
| Ctrl * | Module on | | Ctrl pin open or pulled high (3.5-12VDC) | | | |
| | Module off | | Ctrl pin pulled low to GND (0-1.2VDC) | | | |
| | Input current when 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 |
|---|---|---|---|---|---|---|
| Voltage Accuracy① | 0%-100% load | Positive output | -- | ±0.5 | ±2 | % |
| | | Negative output | -- | ±1 | ±3 | |
| Linear Regulation | Full load, the input voltage is from low voltage to high voltage | Positive output | -- | ±0.2 | ±0.5 | |
| | | Negative output | -- | ±0.5 | ±1 | |
| Load Regulation② | 5%-100% load | Positive output | -- | ±0.5 | ±1 | |
| | | Negative output | -- | ±0.5 | ±1.5 | |
| Cross Regulation | Dual output, main circuit with 50% load, auxiliary circuit with 25%-100% load | | -- | -- | ±5 | |
| Transient Recovery Time | 25% load step change, Nominal input voltage | | -- | 300 | 500 | μs |
| Transient Response Deviation | | 3.3VDC/5VDC single output | -- | ±5 | ±8 | % |
| | | others | -- | ±3 | ±5 | |
| Temperature Coefficient | Full load | | -- | -- | ±0.03 | %/℃ |
| Ripple & Noise③ | 20MHz bandwidth, 5%-100% load | 3.3VDC/5VDC single output | -- | 40 | 80 | mVp-p |
| | | others | -- | 40 | 100 | |
| Over-voltage Protection | Input voltage range | | 110 | -- | 160 | %Vo |
| Over-current Protection | Input voltage range | 3.3VDC/5VDC single output | 110 | 160 | 230 | %Io |
| | | others | 110 | 140 | 190 | |
| Short-circuit Protection | Input voltage range | | Continuous, self-recovery | | | |

Note:
①At 0% -5% load, the Max. output voltage accuracy of ±5VDC output converter is ±5%, the Max. output voltage accuracy of 3.3VDC 5VDC output converter is ±3%;
②Load regulation for 0% -100% load increases to ±5%;
③Under 0% -5% load conditions, ripple & noise does not exceed 5%Vo. The "parallel cable" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information. Ripple & Noise at <5% load is 5%Vo max.

## General Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Isolation | Input-output Electric Strength Test for 1 minute with a leakage current of 1mA max. | 1500 | -- | -- | VDC |
| Insulation Resistance | Input-output resistance at 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitance | Input-output capacitance at 100kHz/0.1V | -- | 2000 | -- | pF |
| Operating Temperature | see Fig. 1 | -40 | -- | +85 | ℃ |
| Storage Temperature | | -55 | -- | +125 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Pin Soldering Resistance Temperature* | Soldering spot is 1.5mm away from case for 10 seconds | -- | -- | 300 | ℃ |
| | Wave soldering,10 seconds | 255 | 260 | 265 | |
| Vibration | | 10-150Hz, 5G, 0.75mm. along X, Y and Z | | | |
| Switching Frequency ① | PWM mode | -- | 350 | -- | kHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | k hours |

Note: *The pin resistance temperature is not the actual set temperature of the soldering iron, but the temperature required for a good solder joint. The actual set temperature by the customer needs to be comprehensively set based on the thickness of the PCB, the size of the copper cladding, the power of the soldering iron, and the selection of the soldering iron tip.
①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

## Mechanical Specifications

| | |
|---|---|
| Case Material | Aluminum alloy |
| Dimensions | 32.00 x 20.00 x 10.80 mm |
| Weight | 12.0g (Typ.) |
| Cooling Method | Free air convection |

## Electromagnetic Compatibility (EMC)

| | | | | |
|---|---|---|---|---|
| Emissions | CE | CISPR32/EN55032 | CLASS A (without external components)/ CLASS B (see Fig.3-② for recommended circuit) | |
| | RE | CISPR32/EN55032 | CLASS A (without external components)/ CLASS B (see Fig.3-② for recommended circuit) | |
| Immunity | ESD | IEC/EN61000-4-2 | Contact ±4kV | perf. Criteria B |
| | RS | IEC/EN61000-4-3 | 10V/m | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 | ±2kV (see Fig.3-① for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN61000-4-5 | line to line ±2kV (see Fig.3-①for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN61000-4-6 | 10 Vr.m.s | perf. Criteria A |
| | Immunities of voltage dip, drop and short interruption | IEC/EN61000-4-29 | 0%, 70% | perf. Criteria B |

## Typical Characteristic Curves

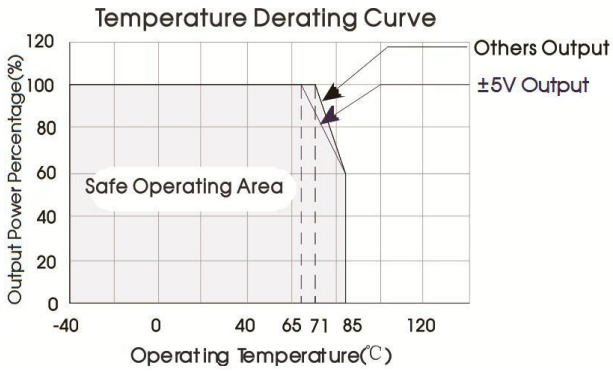
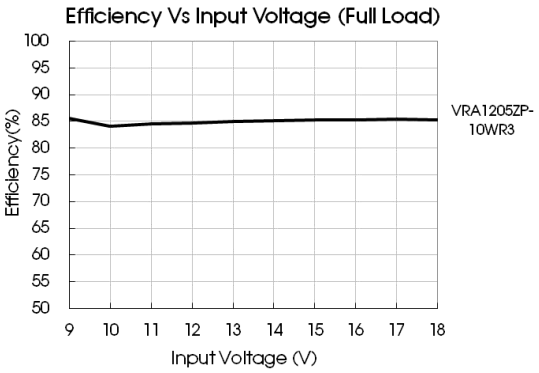
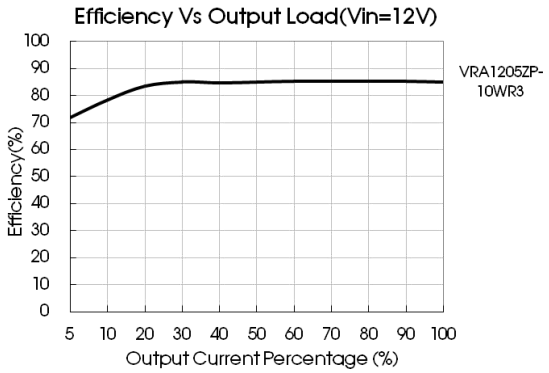
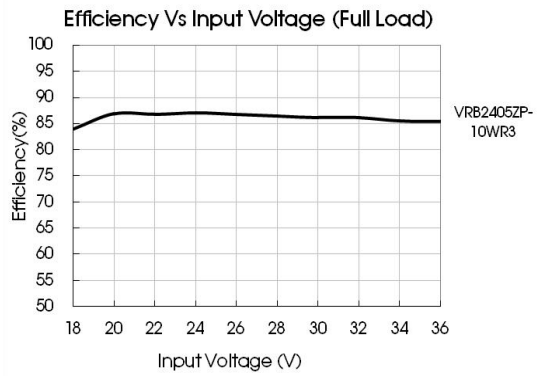
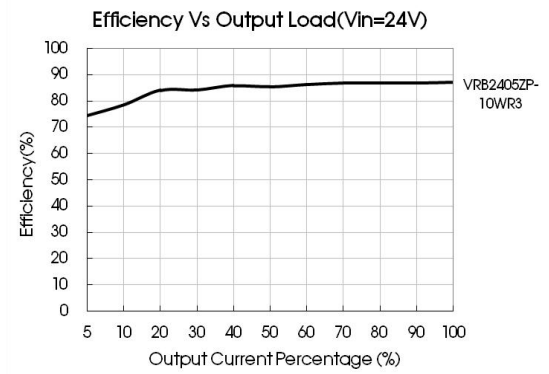


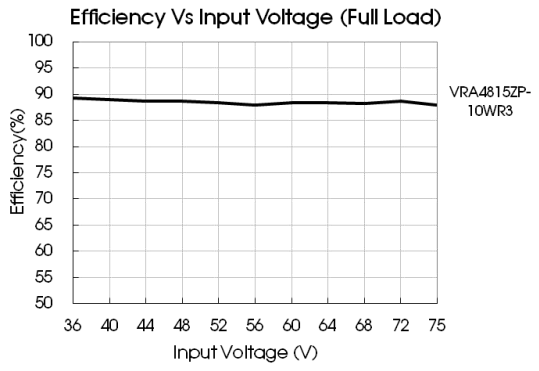

Fig. 1

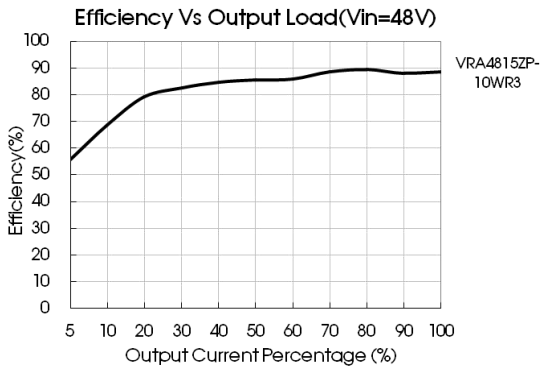


## Design Reference

### 1. Typical application

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.
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). Also make sure that the capacitance is not exceeding the max. capacitive load value of the product.

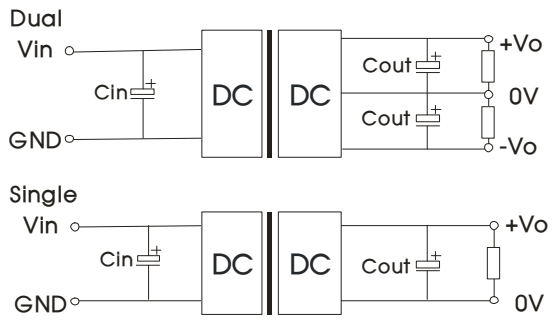
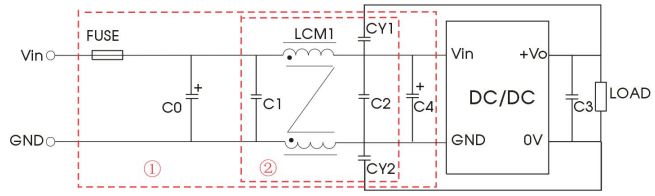



Fig. 2

| Vin(VDC) | Vout(VDC) | Cin | Cout |
|---|---|---|---|
| 12 | 3.3/5/±5 | 100μF/35V | 10μF/16V |
| | 12/15/±12/±15 | | 10μF/25V |
| | 24 | | 10μF/50V |
| 24 | 3.3/5/±5 | 100μF/50V | 10μF/16V |
| | 12/15/±12/±15 | | 10μF/25V |
| | 24 | | 10μF/50V |
| 48 | 3.3/5/±5 | 10μF ~47μF/100V | 10μF/16V |
| | 12/15/±12/±15 | | 10μF/25V |
| | 24 | | 10μF/50V |

### 2. EMC solution-recommended circuit

3.3VDC/5VDC single output:




Others:

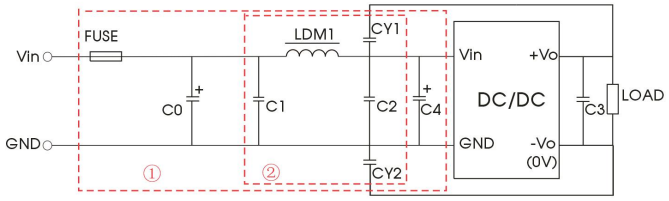



Fig. 3

Note: Part ① in the Fig. 3 is used for EMC test and part ② for emissions filtering; Selecting based on needs.

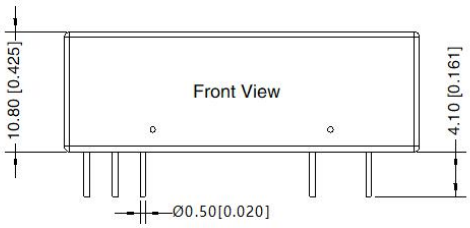
Parameter description:

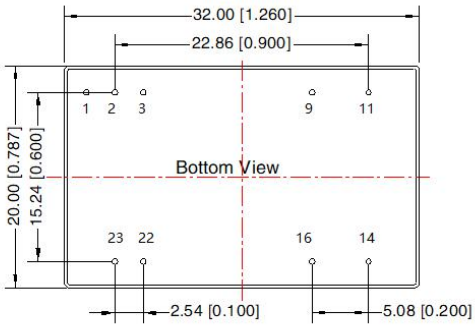
| Model | Vin: 12VDC | Vin: 24VDC | Vin: 48VDC |
|---|---|---|---|
| FUSE | Selected based on the actual input current in application | | |
| C0, C4 | 470μF/35V | 330μF/50V | 330μF/100V |
| C1, C2 | 10μF/50V | | 10μF/100V |
| C3 | Refer to the Cout in Fig.2 | | |
| LDM1 | 10μH | | |
| LCM1 | 1.4-1.7mH（TN150P-RH12.7*12.7*7.9） | | |
| CY1, CY2 | 1nF/2kV | | |

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

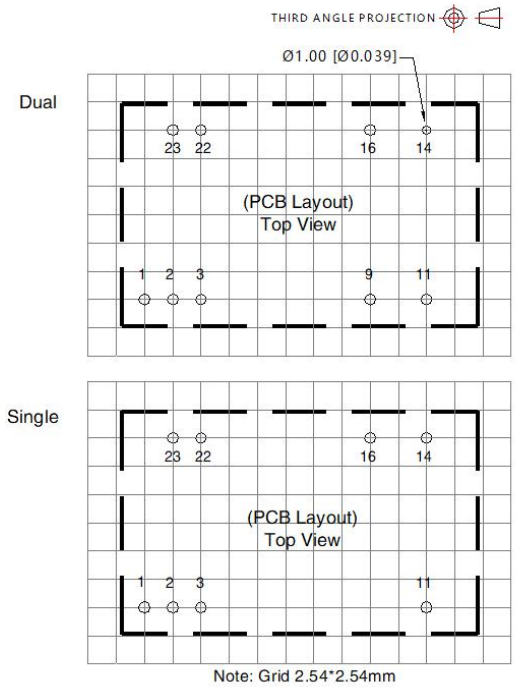
### 4. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

## Dimensions and Recommended Layout




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




Note: Grid 2.54*2.54mm

| Pin-Out | | |
|---|---|---|
| Pin | Single | Dual |
| 1 | Ctrl | Ctrl |
| 2,3 | GND | GND |
| 9 | No Pin | 0V |
| 11 | NC | -Vo |
| 14 | +Vo | +Vo |
| 16 | 0V | 0V |
| 22,23 | Vin | Vin |

NC: Pin to be isolated from circuit

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210008;
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 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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