

# DC/DC Converter

## VRA\_(X)D-10WR2 & VRB\_(X)D-10WR2 Series

MORNSUN®

10W, wide input isolated & regulated positive and negative dual/single output DC-DC converter



Patent Protection RoHS 

### FEATURES

- Wide range of input voltage (2:1)
- Efficiency up to 90%
- Isolation voltage : 1.5K VDC
- Short circuit protection
- Output over-voltage protection
- Operating temperature range: -40° C to +85° C
- Six-sided metal shielding package
- International standard pin-out
- Low ripple & noise
- Meet CISPR22/EN55022 CLASS A
- A2S (wring mounting) and A4S (35mm rail mounting) products featuring anti-reverse connection for input
- Meet EN60950

VRA\_(X)D-10WR2 & VRB\_(X)D-10WR2 series products are of 10W output power, extremely wide range of voltage input of 9-18VDC, 18-36VDC, 36-75VDC isolation voltage of 1500VDC, output over-voltage protection and output short circuit protection with the bare component in compliance with CISPR22/EN55022 CLASS A; these products are widely used in fields such as industrial control, electric power, instruments and communication.

### Selection Guide

| Part No. ①        | Input Voltage(VDC) |        | Output                  |                                       | Efficiency<br>③(%Typ.)<br>@ Full Load | Max.<br>Capacitive<br>Load④<br>(μF) | certification |
|-------------------|--------------------|--------|-------------------------|---------------------------------------|---------------------------------------|-------------------------------------|---------------|
|                   | Nominal<br>(Range) | Max. ② | Output Voltage<br>(VDC) | Output Current<br>(mA)<br>(Max./Min.) |                                       |                                     |               |
| VRA1205(X)D-10WR2 | 12V<br>(9-18)      | 20     | ±5                      | ±1000/±50                             | 82                                    | 680                                 |               |
| VRA1212(X)D-10WR2 |                    |        | ±12                     | ±416/±21                              | 86                                    | 220                                 |               |
| VRA1215(X)D-10WR2 |                    |        | ±15                     | ±333/±16                              | 87                                    | 100                                 |               |
| VRA1224(X)D-10WR2 |                    |        | ±24                     | ±208/±10                              | 87                                    | 47                                  |               |
| VRB1203(X)D-10WR2 |                    |        | 3.3                     | 2400/120                              | 77                                    | 2200                                |               |
| VRB1205(X)D-10WR2 |                    |        | 5                       | 2000/100                              | 82                                    | 2200                                | CE            |
| VRB1212(X)D-10WR2 |                    |        | 12                      | 833/42                                | 86                                    | 470                                 | CE            |
| VRB1215(X)D-10WR2 |                    |        | 15                      | 667/33                                | 87                                    | 220                                 |               |
| VRB1224(X)D-10WR2 |                    |        | 24                      | 416/21                                | 88                                    | 100                                 |               |
| VRA2405(X)D-10WR2 | 24V<br>(18-36)     | 40     | ±5                      | ±1000/±50                             | 83                                    | 680                                 | CE            |
| VRA2412(X)D-10WR2 |                    |        | ±12                     | ±416/±21                              | 86                                    | 330                                 | CE            |
| VRA2415(X)D-10WR2 |                    |        | ±15                     | ±333/±16                              | 88                                    | 220                                 | CE            |
| VRA2424(X)D-10WR2 |                    |        | ±24                     | ±208/±10                              | 87                                    | 100                                 |               |
| VRB2403(X)D-10WR2 |                    |        | 3.3                     | 2400/120                              | 77                                    | 2200                                |               |
| VRB2405(X)D-10WR2 |                    |        | 5                       | 2000/100                              | 84                                    | 2200                                | CE            |
| VRB2412(X)D-10WR2 |                    |        | 12                      | 833/42                                | 88                                    | 680                                 | CE            |
| VRB2415(X)D-10WR2 |                    |        | 15                      | 667/33                                | 90                                    | 330                                 | CE            |
| VRB2424(X)D-10WR2 |                    |        | 24                      | 416/21                                | 87                                    | 100                                 | CE            |
| VRA4805(X)D-10WR2 | 48V<br>(36-75)     | 80     | ±5                      | ±1000/±50                             | 83                                    | 680                                 |               |
| VRA4812(X)D-10WR2 |                    |        | ±12                     | ±416/±21                              | 88                                    | 470                                 | CE            |
| VRA4815(X)D-10WR2 |                    |        | ±15                     | ±333/±16                              | 89                                    | 220                                 |               |
| VRA4824(X)D-10WR2 |                    |        | ±24                     | ±208/±10                              | 88                                    | 100                                 |               |
| VRB4803(X)D-10WR2 |                    |        | 3.3                     | 2400/120                              | 78                                    | 2200                                |               |
| VRB4805(X)D-10WR2 |                    |        | 5                       | 2000/100                              | 82                                    | 2200                                | CE            |
| VRB4812(X)D-10WR2 |                    |        | 12                      | 833/42                                | 88                                    | 820                                 | CE            |
|                   |                    |        |                         |                                       |                                       |                                     |               |

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### Selection Guide

| Part No. <sup>①</sup> | Input Voltage(VDC) |                   | Output                  |                                       | Efficiency<br>®(%Typ.)<br>@ Full Load | Max.<br>Capacitive<br>Load <sup>③</sup><br>(μF) | certification |
|-----------------------|--------------------|-------------------|-------------------------|---------------------------------------|---------------------------------------|-------------------------------------------------|---------------|
|                       | Nominal<br>(Range) | Max. <sup>②</sup> | Output Voltage<br>(VDC) | Output Current<br>(mA)<br>(Max./Min.) |                                       |                                                 |               |
| VRB4815(X)D-10WR2     | 48V<br>( 36-75)    | 80                | 15                      | 667/33                                | 89                                    | 470                                             | CE            |
| VRB4824(X)D-10WR2     |                    |                   | 24                      | 416/21                                | 88                                    | 220                                             |               |

Note:

- ①."X" means the model without Ctrl pin, series with suffix "A2S" are chassis mounting, with suffix "A4S" are DIN-Rail mounting, for example VRB2405XD-10WR2A2S is chassis mounting without Ctrl pin,VRB2405D-10WR2A4S is DIN-Rail mounting with Ctrl pin.  
 ②.Absolute maximum rating without damage on the converter, but it isn't recommended.  
 ③.The efficiency of "A2S" and "A4S" is approx. 2% lower for the protection of inverse polarity.  
 ④.For dual output converter, the given value is the same for each output.

### Input Specifications

| Input Specifications                |                                 |                                                           |         |      |      |
|-------------------------------------|---------------------------------|-----------------------------------------------------------|---------|------|------|
| Item                                | Operating Conditions            | Min.                                                      | Typ.    | Max. | Unit |
| Input Current (full load / no-load) | 12VDC input                     | —                                                         | 25/1016 | —    | mA   |
|                                     | 24VDC input                     | —                                                         | 12/496  | —    |      |
|                                     | 48VDC input                     | —                                                         | 6/254   | —    |      |
| Reflected Ripple Current            | 12VDC input                     | —                                                         | 20      | —    |      |
|                                     | 24VDC input                     | —                                                         | 20      | —    |      |
|                                     | 48VDC input                     | —                                                         | 20      | —    |      |
| Input Impulse Voltage (1sec. max.)  | 12VDC input                     | -0.7                                                      | --      | 25   | VDC  |
|                                     | 24VDC input                     | -0.7                                                      | --      | 50   |      |
|                                     | 48VDC input                     | -0.7                                                      | --      | 100  |      |
| Starting Voltage                    | 12VDC input                     | —                                                         | --      | 9    |      |
|                                     | 24VDC input                     | —                                                         | --      | 18   |      |
|                                     | 48VDC input                     | —                                                         | --      | 36   |      |
| Input Filter                        |                                 | Pi filter                                                 |         |      |      |
| Ctrl*                               | Module switch on                | Ctrl suspended 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 | —                                                         | 1       | 3    | mA   |

Note: \* the voltage of Ctrl pin is relative to input pin GND.

### Output Specifications

| Item                           | Operating Conditions                                                          | Min.                      | Typ. | Max.  | Unit   |
|--------------------------------|-------------------------------------------------------------------------------|---------------------------|------|-------|--------|
| Output Voltage Accuracy        |                                                                               | --                        | ±1   | ±2    | %      |
| Balance of Output Voltage      | Dual output, balanced load                                                    | --                        | ±0.5 | ±1.5  |        |
| Line Regulation                | Full load, the input voltage is from low voltage to high voltage              | --                        | ±0.2 | ±0.5  |        |
| Load Regulation                | 5%-100% load                                                                  | --                        | ±0.5 | ±1    |        |
| Cross Regulation               | Dual output, main circuit with 50% load, auxiliary circuit with 10%-100% load | --                        | --   | ±5    |        |
| Transient Recovery Time        | 25% load step change                                                          | --                        | 300  | 500   | μs     |
| Transient Response Deviation   |                                                                               | --                        | ±3   | ±5    | %      |
| Temperature Drift Coefficient  | Full load                                                                     | --                        | --   | ±0.03 | %/°C   |
| Ripple*                        | 20MHz bandwidth                                                               | --                        | 15   | 35    | mV p-p |
| Noise*                         |                                                                               | --                        | 40   | 80    |        |
| Output Over-voltage Protection | Input voltage range                                                           | 110                       | 120  | 140   | %Vo    |
| Short circuit Protection       |                                                                               | Continuous, self-recovery |      |       |        |

Note: \* Ripple and noise tested with "parallel cable" method, please see *DC-DC Converter Application Notes* for specific operation methods.

### General Specifications

| 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                                                                                          | Derating if the temperature is ≥71℃ (see Fig. 1)*                                | -40                                    | —    | 85   | %       |
| Storage Humidity                                                                                               | Non-condensing                                                                   | 5                                      | —    | 95   | ℃       |
| Storage Temperature                                                                                            |                                                                                  | -55                                    | —    | 125  |         |
| Max. Operating Temperature for Casing                                                                          | Within the operating temperature curve                                           | —                                      | —    | 105  |         |
| Pin Welding Resistance Temperature                                                                             | Welding spot is 1.5mm away from the casing, 10 seconds                           | —                                      | —    | 300  |         |
| Vibration                                                                                                      |                                                                                  | 10-55Hz, 10G, 30 Min. along X, Y and Z |      |      |         |
| Switching Frequency                                                                                            | PWM mode                                                                         | —                                      | 350  | —    | KHz     |
| MTBF                                                                                                           | MIL-HDBK-217F@25℃                                                                | 1000                                   | —    | —    | K hours |
| Note: * VRB1205 (X) D-10WR2 temperature derating to 65 ℃ with full load , 85 ℃ corresponding load is constant. |                                                                                  |                                        |      |      |         |

Note: \* VRB1205 (X) D-10WR2 temperature derating to 65 °C with full load , 85 °C corresponding load is constant.

### Physical Specifications

|                    |                                                        |                     |
|--------------------|--------------------------------------------------------|---------------------|
| Casing Material    |                                                        | Aluminum alloy      |
| Package Dimensions | Horizontal package                                     | 50.8*25.4*11.8 mm   |
|                    | A2S wiring package                                     | 76.0*31.5*21.2 mm   |
|                    | A4S rail package                                       | 76.0*31.5*25.8 mm   |
| Weight             | Horizontal package/A2S wiring package/A4S rail package | 22g/44g/64g(Typ.)   |
| Cooling method     |                                                        | Free air convection |

### EMC Specifications

|     |                                                        |                  |                                                                         |
|-----|--------------------------------------------------------|------------------|-------------------------------------------------------------------------|
| EMI | Conducted disturbance                                  | CISPR22/EN55022  | CLASS A (Bare component)/ CLASS B (see Fig.3-② for recommended circuit) |
|     | Radiated emission                                      | CISPR22/EN55022  | CLASS A (Bare component)/ CLASS B (see Fig.3-② for recommended circuit) |
| EMS | Electrostatic discharge                                | IEC/EN61000-4-2  | Contact $\pm 4\text{KV}$ perf. Criteria B                               |
|     | Radiation immunity                                     | IEC/EN61000-4-3  | 10V/m perf. Criteria A                                                  |
|     | EFT                                                    | IEC/EN61000-4-4  | $\pm 2\text{KV}$ (see Fig.3-① for recommended circuit) perf. Criteria B |
|     | Surge Immunity                                         | IEC/EN61000-4-5  | $\pm 2\text{KV}$ (see Fig.3-① for recommended circuit) perf. Criteria B |
|     | Conducted disturbance immunity                         | IEC/EN61000-4-6  | 3 Vr.m.s perf. Criteria A                                               |
|     | Immunities of voltage dip, drop and short interruption | IEC/EN61000-4-29 | 0-70% perf. Criteria B                                                  |

### Product Characteristic Curve

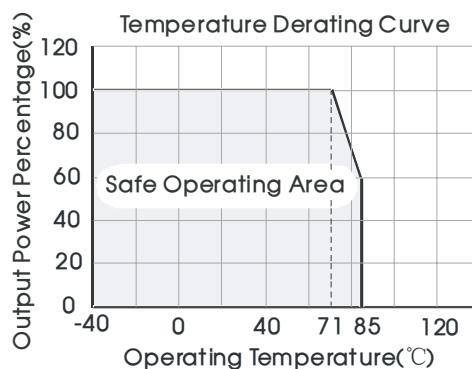
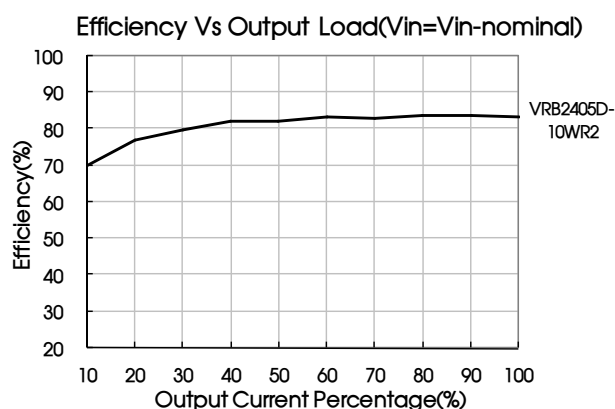
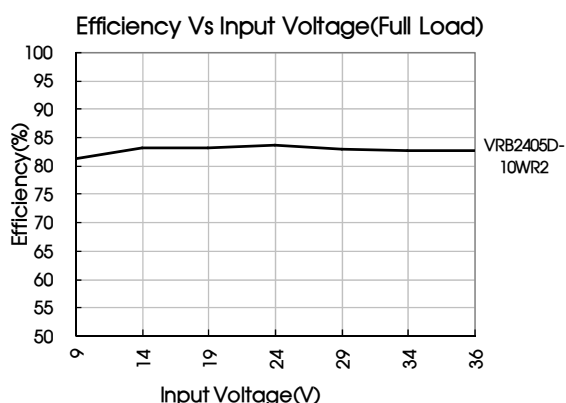
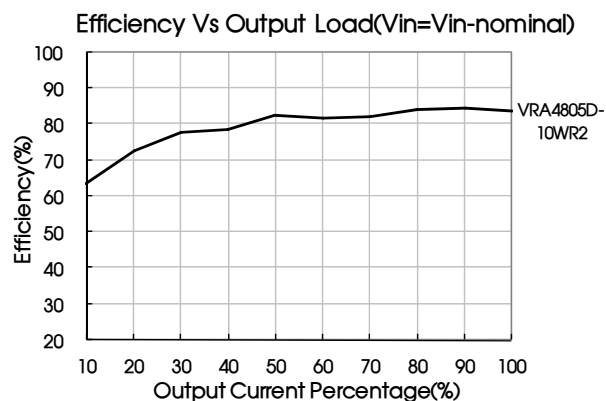
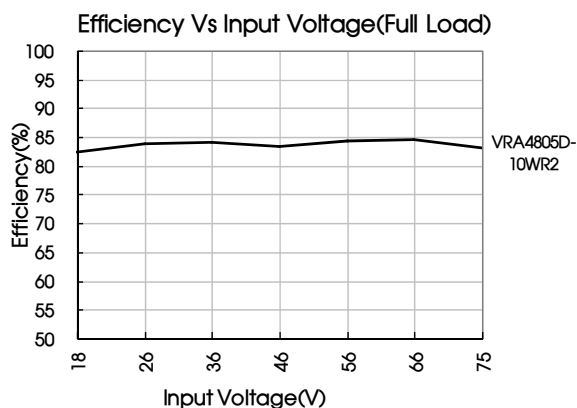


Fig. 1

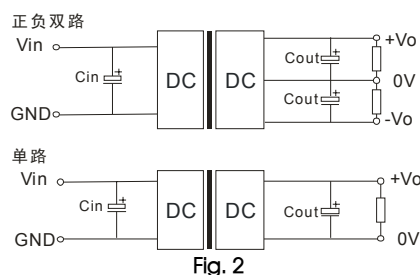


## Design Reference

### 1. Typical application

All the DC/DC converters of this series are tested according to the recommended circuit (see Fig. 2) before delivery.

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.



| Vin     | Cin        | Cout |
|---------|------------|------|
| 12V     | 100μF      | 10μF |
| 24V&48V | 10μF ~47μF |      |

### 2. EMC solution-recommended circuit

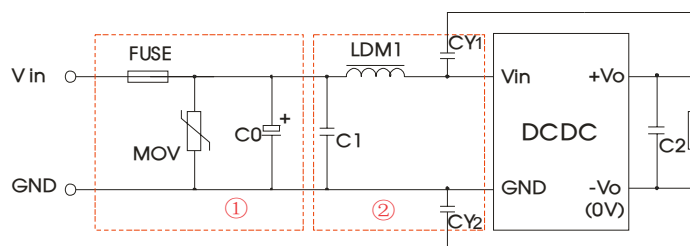


Fig. 3

Notes: Part ① in the Fig. 3 is used for EMS test and part ② for EMI filtering; selected based on needs.

#### Parameter description

| Model | Vin: 12V                                 | Vin: 24V  | Vin: 48V   |
|-------|------------------------------------------|-----------|------------|
| FUSE  | Choose according to actual input current |           |            |
| MOV   | S14K25                                   | S14K35    | S14K60     |
| C0    | 680μF/25V                                | 330μF/50V | 330μF/100V |
| C1    | 1μF/50V                                  |           | 1μF/100V   |
| LDM1  | 4.7μH                                    |           |            |
| CY1   | 1nF/2KV                                  |           |            |
| CY2   | 1nF/2KV                                  |           |            |
| C2    | Refer to the Cout in Fig.2               |           |            |

### EMC solution-recommended circuit PCB layout

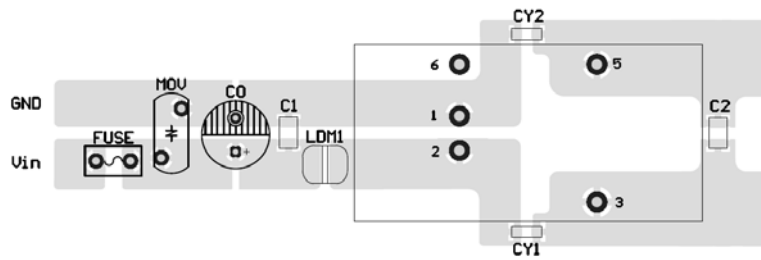
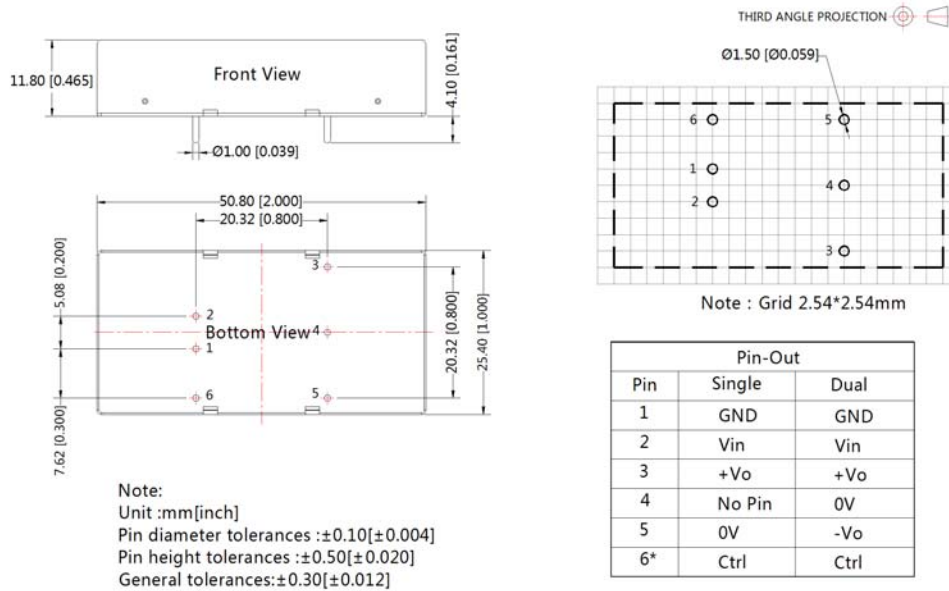


Fig. 4

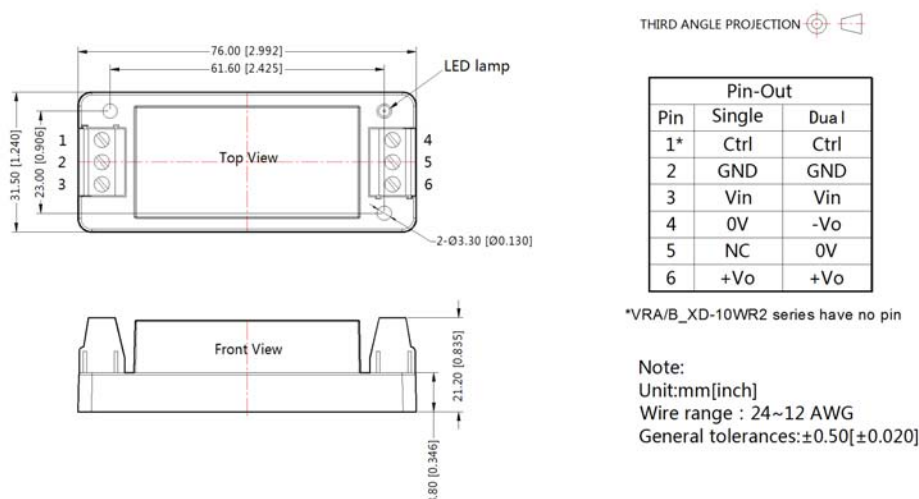
Note: the min. distance of the bonding pads between input & output isolation capacitors (CY1/CY2) shall be  $\geq 2\text{mm}$ .

3. The product does not support output in parallel with power per liter or hot-plug use
4. For more information please find the application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

### Dimensions and Recommended Layout

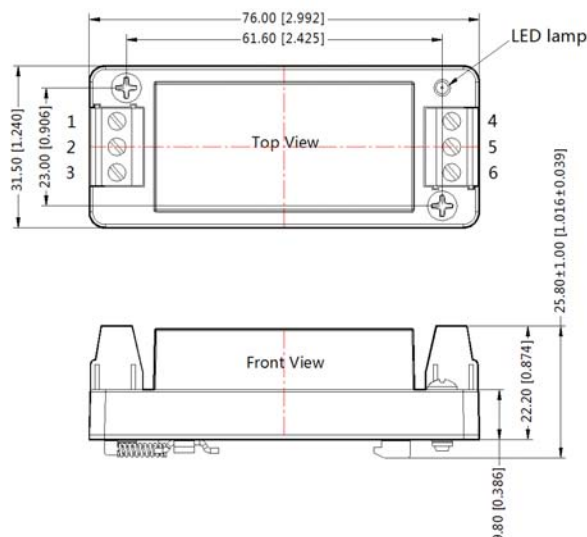


### VRA\_(X)D-10WR2A2S & VRB\_(X)D-10WR2A2S Wiring Package



VRA\_(X)D-10WR2A4S& VRB\_(X)D-10WR2A4S Rail Package

THIRD ANGLE PROJECTION



| Pin-Out |      |     |     |     |    |     |
|---------|------|-----|-----|-----|----|-----|
| Pin     | 1*   | 2   | 3   | 4   | 5  | 6   |
| Dual    | Ctrl | GND | Vin | -Vo | 0V | +Vo |
| Single  | Ctrl | GND | Vin | 0V  | NC | +Vo |

\*VRA/B\_XD-10WR2 series have no pin

Note:  
Unit:mm[inch]  
Wire range : 24~12 AWG  
General tolerances:±0.50[±0.020]

Note:

1. Packing Information please refer to 'Product Packing Information'. The Packing bag number of Horizontal package : 58200035, the Packing bag number of A2S/A4S package:58220022;
2. The min. load shall be no lower than 5% , or the output ripple may increase rapidly; If the product is operated under the min. required load, the product performance cannot be guaranteed to comply with all performance indexes in the Manual, but the reliability of the product will not be influenced;
3. The unbalance degree of the recommended dual output module load:  $\leq 5\%$ ; if the degree exceeds  $\pm 5\%$ , then the product performances cannot be guaranteed to comply with all the performance indicators in the manual, and please directly contact our technicians for specific information;
4. The max. capacitive load should be tested within the input voltage range and under full load conditions;
5. Unless otherwise specified, data in this datasheet should be tested under the conditions of  $T_a=25^\circ\text{C}$ , humidity<75% when inputting nominal voltage and outputting rated load;
6. All index testing methods in this datasheet are based on our Company's corporate standards;
7. The performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technicians for specific information;
8. We can provide product customization service;
9. Specifications of this product are subject to changes without prior notice.

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