

DC/DC Converter

VRA_YMD-6WR3 & VRB_YMD-6WR3 Series

MORNSUN®

6W, wide input, isolated & regulated dual/single output, YMD package, DC-DC converter



UL **us** **CE** **CB** Patent Protection **RoHS**

FEATURES

- Wide input voltage range (2:1)
- High efficiency up to 88%
- No-load power consumption as low as 0.12W
- Isolation voltage :1.5K VDC
- Input under-voltage protection, output short circuit, over-current, over-voltage protection
- Operating temperature range: -40°C to +85°C
- Meet CISPR32/EN55032 CLASS A, without external components
- Reverse voltage protection available with A2S(Chassis mounting) or A4S(35mm DIN-Rail mounting)
- International standard pin-out
- IEC60950, UL60950, EN60950 approval

VRA_YMD-6WR3 & VRB_YMD-6WR3 series are isolated 6W DC-DC products with 2:1 input voltage. The feature efficiency up to 88%, 1500VDC isolation, operating temperature of -40°C to +85°C, input under-voltage protection, output over-voltage, over-current, short circuit protection and EMI meets CISPR32/EN55032 CLASS A, which make them widely applied in medical care, industrial control, electric power, instruments and communication fields. And extension package A2S and A4S also enable them with reverse voltage protection.

Selection Guide

| Certification | Part No. ① | Input Voltage (VDC) | | Output | | Efficiency ^④ (%Min./Typ.) @ Full Load | Max. Capacitive Load ^⑤ (μF) |
|---------------|-----------------|---------------------------------|--------|-------------------------|------------------------------------|--|--|
| | | Nominal ^② (Range) | Max. ③ | Output Voltage (VDC) | Output Current (mA) (Max./Min.) | | |
| UL/CE/ CB | VRA1205YMD-6WR3 | 12 (9-18) | 20 | ±5 | ±600/0 | 79/81 | 470 |
| | VRA1212YMD-6WR3 | | | ±12 | ±250/0 | 83/85 | 100 |
| CE | VRB1205YMD-6WR3 | | | 5 | 1200/0 | 79/81 | 1000 |
| | VRB1212YMD-6WR3 | | | 12 | 500/0 | 83/85 | 470 |
| UL/CE/ CB | VRA2405YMD-6WR3 | 24 (18-36) | 40 | ±5 | ±600/0 | 81/83 | 470 |
| | VRA2412YMD-6WR3 | | | ±12 | ±250/0 | 85/87 | 100 |
| | VRA2415YMD-6WR3 | | | ±15 | ±200/0 | 85/87 | 100 |
| CE | VRB2403YMD-6WR3 | | | 3.3 | 1500/0 | 75/77 | 1800 |
| | VRB2405YMD-6WR3 | | | 5 | 1200/0 | 80/82 | 1000 |
| -- | VRB2409YMD-6WR3 | | | 9 | 667/0 | 83/85 | 470 |
| CE | VRB2412YMD-6WR3 | 12 | 500/0 | 83/85 | 470 | | |
| | VRB2415YMD-6WR3 | 15 | 400/0 | 84/86 | 220 | | |
| | VRB2424YMD-6WR3 | 24 | 250/0 | 83/85 | 100 | | |
| -- | VRB4803YMD-6WR3 | 48 (36-75) | 80 | 3.3 | 1500/0 | 77/79 | 1800 |
| | VRB4805YMD-6WR3 | | | 5 | 1200/0 | 81/83 | 1000 |
| | VRB4812YMD-6WR3 | | | 12 | 500/0 | 85/87 | 470 |
| | VRB4815YMD-6WR3 | | | 15 | 400/0 | 86/88 | 220 |
| | VRB4824YMD-6WR3 | | | 24 | 250/0 | 86/88 | 100 |

Notes:

- ① Part No. with suffix of "A2S" means chassis mounting and suffix of "A4S" means DIN-Rail mounting (e.g. VRB2405YMD-6WR3A2S means chassis mounting; VRB2405YMD-6WR3A4S means DIN-Rail mounting);
- ② A2S (wiring) and A4S (rail) Model due to input reverse polarity protection function, input voltage range the minimum value and starting voltage is higher than 1VDC DIP package;
- ③ Absolute maximum rating without damage on the converter, but it isn't recommended;
- ④ Efficiency is measured in nominal input voltage and rated output load; A2S (wiring) and A4S (rail) Model due to input reverse polarity protection, minimum efficiency greater than Min.-2 is qualified;
- ⑤ The capacitive loads of positive and negative outputs are identical.

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Input Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit | |
|-------------------------------------|---|-------------|--------|--------|------|--------|
| Input Current (full load / no-load) | 12VDC nominal input series, nominal input voltage | -- | 603/10 | 633/22 | mA | |
| | 24VDC nominal input series, nominal input voltage | 3.3V output | -- | 268/5 | | 275/15 |
| | | Others | -- | 296/5 | | 313/15 |
| | 48VDC nominal input series, nominal input voltage | 3.3V output | -- | 130/4 | | 134/8 |
| Others | | -- | 150/4 | 155/8 | | |
| Reflected Ripple Current | | -- | 20 | -- | | |
| 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 | | |
| Starting Voltage | 12VDC nominal input series | -- | -- | 9 | VDC | |
| | 24VDC nominal input series | -- | -- | 18 | | |
| | 48VDC nominal input series | -- | -- | 36 | | |
| Input Under-voltage Protection | 12VDC nominal input series | 5.5 | 6.5 | -- | VDC | |
| | 24VDC nominal input series | 12 | 15.5 | -- | | |
| | 48VDC nominal input series | 26 | 30 | -- | | |
| Input Filter | | Pi filter | | | | |
| Hot Plug | | Unavailable | | | | |

Output Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit | |
|--------------------------------|---|---------------------------|------|-------|--------|----|
| Output Voltage Accuracy | 5%-100% load | -- | ±1 | ±3 | % | |
| | 0%-5% load | ±5V output | -- | ±2 | | ±5 |
| | | others | -- | ±1 | | ±3 |
| Line 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 Regulation ^① | 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 10%-100% load | -- | -- | ±5 | | |
| Transient Recovery Time | | -- | 300 | 500 | μs | |
| Transient Response Deviation | 25% load step change | 3.3V, 5V, ±5V output | -- | ±5 | ±8 | % |
| | | Others | -- | ±3 | ±5 | |
| Temperature Coefficient | Full load | -- | -- | ±0.03 | %/°C | |
| Ripple & Noise ^② | 20MHz bandwidth, 5%-100% load | -- | 60 | 85 | mV p-p | |
| Output Over-voltage Protection | | 110 | -- | 160 | %Vo | |
| Output Over-current Protection | Input voltage range | 110 | 140 | 190 | %Io | |
| Short circuit Protection | | Continuous, self-recovery | | | | |

Note: ①When testing from 0% -100%load working conditions, load regulation index is ±5%;

②0%-5% load ripple&Noise is no more than 5%Vo.Ripple and noise are measured by "parallel cable" method, please see DC-DC Converter Application Notes for specific operation.

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 | °C |
| Storage Humidity | Without condensation | 5 | -- | 95 | %RH |

| | | | | | |
|-----------------------|--|--|-----|------|---------|
| Storage Temperature | | -55 | -- | +125 | °C |
| Lead 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 | -- | 300 | -- | KHz |
| MTBF | MIL-HDBK-217F@25°C | 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 | Aluminum alloy | |
| Dimension | Horizontal package | 25.40*25.40*11.70 mm |
| | A2S chassis mounting | 76.00*31.50*21.20 mm |
| | A4S DIN-rail mounting | 76.00*31.50*25.80 mm |
| Weight | Horizontal package/A2S wiring package/A4S rail package | 14g /36g /56g(Typ.) |
| Cooling method | Free air convection | |

EMC Specifications

| | | | | |
|-----|---|-----------------------------------|--|---|
| EMI | CE | 12VDC, 24VDC nominal input series | CISPR32/EN55032 | CLASS A (without external components)/ CLASS B (see Fig.3-② for recommended circuit) |
| | | 48VDC nominal input series | CISPR32/EN55032 | CLASS B (see Fig.3-② for recommended circuit) |
| | RE | 12VDC,24VDC nominal input series | CISPR32/EN55032 | CLASS A (without external components)/ CLASS B (see Fig.3-② for recommended circuit) |
| | | 48VDC nominal input series | CISPR32/EN55032 | CLASS B (see Fig.3-② for recommended circuit) |
| EMS | 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 | 3 Vr.m.s | perf. Criteria A |
| | Voltage dips, short interruptions and voltage variations immunity | IEC/EN61000-4-29 | 0%, 70% | perf. Criteria B |

Product Characteristic Curve

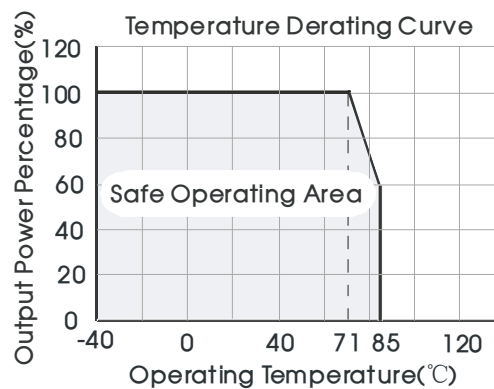
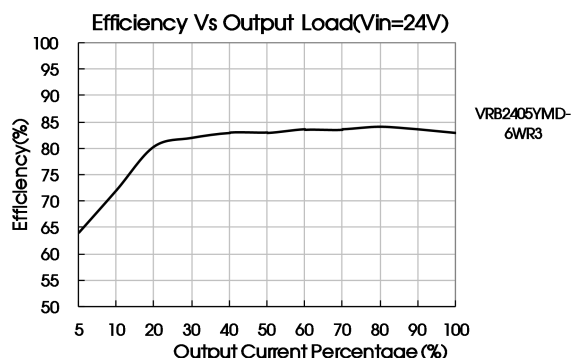
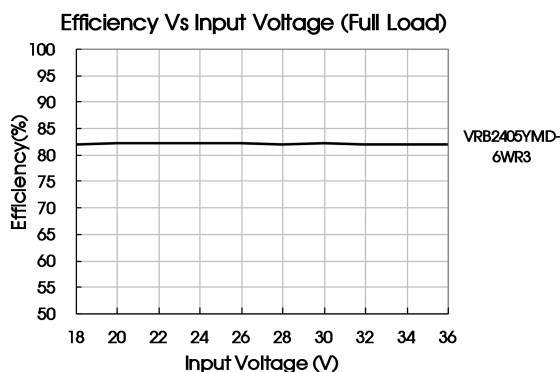
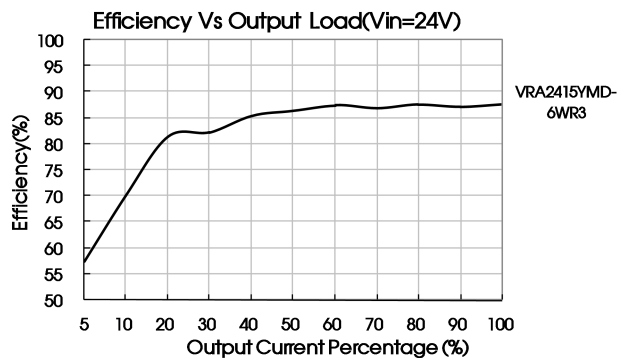
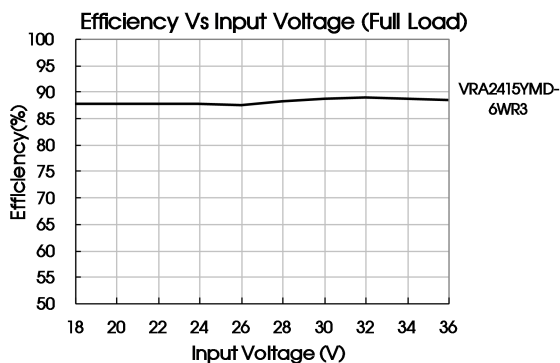


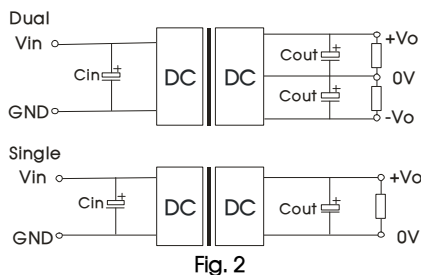
Fig. 1



Design Reference

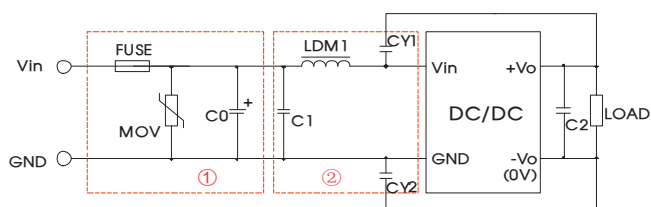
1. Typical application

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 C_{in} and C_{out} or select capacitors of low equivalent impedance provided that the capacitance is no larger than the max. capacitive load of the product.



| Vin(VDC) | Cin(μ F) | Cout(μ F) |
|----------|---------------|----------------|
| 12 | 100 | 10 |
| 24 | 10 - 47 | |
| 48 | 100 | |

2. EMC solution-recommended circuit



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

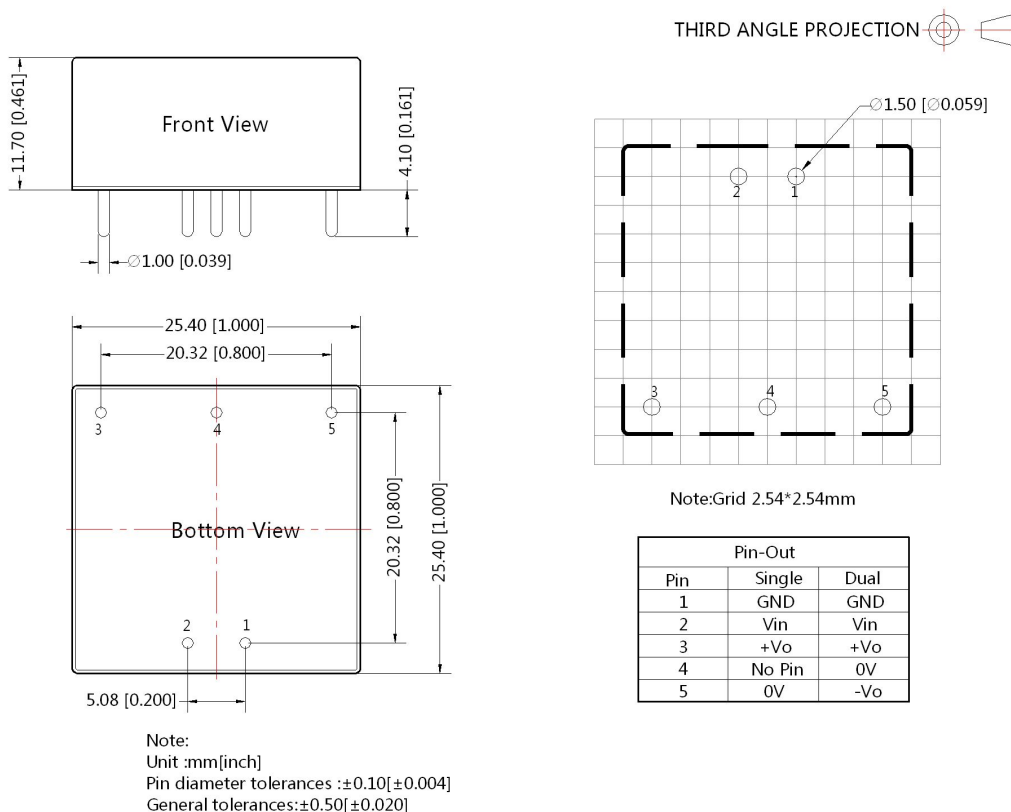
Parameter description

| Model | Vin:12V | Vin:24V | Vin:48V |
|---------|--|------------------|------------------|
| FUSE | Choose according to actual input current | | |
| MOV | S14K20 | S20K30 | 14D101K |
| C0 | 1000 μ F/35V | 1000 μ F/50V | 330 μ F/100V |
| C1 | 1 μ F/50V | | 4.7 μ F/100V |
| C2 | Refer to the Cout in Fig.2 | | |
| LDM1 | 4.7 μ H | | |
| CY1/CY2 | 1nF/2KV | | |

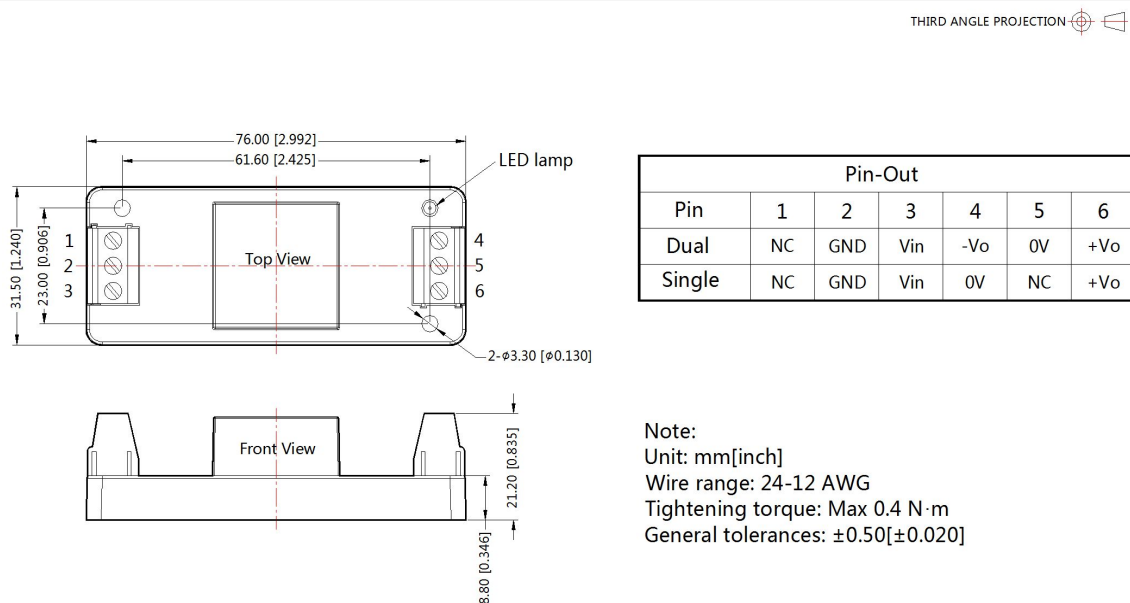
3. It is not allowed to connect modules output in parallel to enlarge the power

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

Dimensions and Recommended Layout

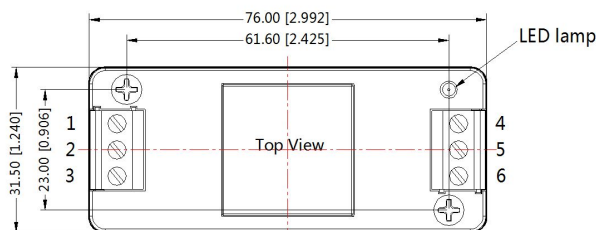


VRA_YMD-6WR3A2S & VRB_YMD-6WR3A2S Dimensions

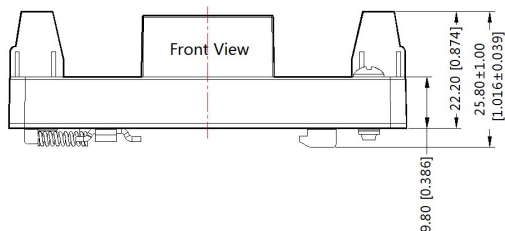


VRA_YMD-6WR3A4S & VRB_YMD-6WR3A4S Dimensions

THIRD ANGLE PROJECTION



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



Note:
Unit: mm[inch]
Mounting rail: TS35
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±1.00[±0.039]

- Note:
1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Packing bag number: 58210003(DIP), 58220022(A2S/A4S package);
 2. The recommended unbalance degree of the dual output module load is $\leq \pm 5\%$; if the degree exceeds $\pm 5\%$, then the product performance cannot be guaranteed to comply with all parameters in the datasheet. Please contact our technicians directly for specific information;
 3. The maximum capacitive load offered were tested at input voltage range and full load;
 4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of $T_a=25^\circ\text{C}$, humidity $<75\%$ RH with nominal input voltage and rated output load;
 5. All index testing methods in this datasheet are based on Company's corporate standards;
 6. We can provide product customization service, please contact our technicians directly for specific information;
 7. Products are related to laws and regulations: see "Features" and "EMC";
 8. 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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