

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



Patent Protection RoHS



FEATURES

- Wide 2:1 input voltage range
- High efficiency up to 88%
- No load power consumption as low as 0.12W
- I/O isolation test voltage 1.5K VDC
- Input under-voltage protection, output short-circuit, over-current, over-voltage protection
- Operating ambient temperature range: -40°C to +85°C
- Meets CISPR32/EN55032 CLASS A, without extra components
- Industry standard pin-out
- EN62368 approved

VRA_YMD-10WR3 & VRB_YMD-10WR3 series are isolated 10W DC-DC converter products with a 2:1 input voltage range. They feature efficiencies up to 88%, 1500VDC input to output isolation, operating temperature of -40°C to +85°C, input under-voltage protection, output over-voltage, over-current and short circuit protection. They meet CLASS A CISPR32/EN55032 EMI standards(except 5VDC nominal input) without external components and they are widely used in applications such as industrial controls, electric power, instrumentation and communications.

Selection Guide

| Certification | Part No. | Input Voltage (VDC) | | Output | | Full Load Efficiency ^② (%) Min./Typ. | Max. Capacitive Load(μF) |
|---------------|------------------|---------------------|-------------------|---------------|-----------------------|---|--------------------------|
| | | Nominal (Range) | Max. ^① | Voltage (VDC) | Current(mA) Max./Min. | | |
| CE | VRA0505YMD-10WR3 | 5 (4.5-9) | 12 | ±5 | ±1000/0 | 76/78 | 1000 |
| | VRA0512YMD-10WR3 | | | ±12 | ±417/0 | 81/83 | 470 |
| | VRA0515YMD-10WR3 | | | ±15 | ±334/0 | 82/84 | 330 |
| | VRA0524YMD-10WR3 | | | ±24 | ±209/0 | 81/83 | 100 |
| | VRB0505YMD-10WR3 | | | 5 | 2000/0 | 83/85 | 470 |
| | VRB0512YMD-10WR3 | | | 12 | 834/0 | 81/83 | 470 |
| | VRB0515YMD-10WR3 | | | 15 | 667/0 | 82/84 | 330 |
| | VRB0524YMD-10WR3 | | | 24 | 417/0 | 81/83 | 100 |
| -- | VRB1205YMD-10WR3 | 12 (9-18) | 20 | 5 | 2000/0 | 81/83 | 2200 |
| CE | VRB2405YMD-10WR3 | 24 (18-36) | 40 | 5 | 2000/0 | 81/83 | 2200 |
| | VRB2412YMD-10WR3 | | | 12 | 833/0 | 85/87 | 470 |
| | VRB2415YMD-10WR3 | | | 15 | 667/0 | 86/88 | 330 |
| | VRB2424YMD-10WR3 | | | 24 | 416/0 | 86/88 | 100 |
| -- | VRB4803YMD-10WR3 | 48 (36-75) | 80 | 3.3 | 2400/0 | 77/79 | 2200 |
| | VRB4805YMD-10WR3 | | | 5 | 2000/0 | 81/83 | 2200 |
| | VRB4812YMD-10WR3 | | | 12 | 833/0 | 85/87 | 470 |
| | VRB4815YMD-10WR3 | | | 15 | 667/0 | 85/87 | 330 |
| | VRB4824YMD-10WR3 | | | 24 | 416/0 | 86/88 | 100 |

Notes:

- ① Exceeding the maximum input voltage may cause permanent damage;
- ② Efficiency is measured at nominal input voltage and rated output load.

Input Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit | |
|-------------------------------------|---|-----------|--------|----------|----------|----|
| Input Current (full load / no load) | 5VDC nominal input series, nominal input voltage | 5V output | -- | 2353/100 | 2410/150 | mA |
| | | Others | -- | 2500/10 | 2564/30 | |
| | 12VDC nominal input series, nominal input voltage | -- | 1004/5 | 1029/12 | | |
| | 24VDC nominal input series, nominal input voltage | -- | 502/5 | 515/12 | | |

| | | | | | | |
|----------------------------|--|-------------|--|-------|-------|-----|
| | 48VDC nominal input series, nominal input voltage | 3.3V output | -- | 208/4 | 215/8 | mA |
| | | Others | -- | 251/4 | 258/8 | |
| Reflected Ripple Current | 5VDC / 12VDC nominal input series | | -- | 50 | -- | mA |
| | 24VDC nominal input series | | -- | 40 | -- | |
| | 48VDC nominal input series | | -- | 30 | -- | |
| Surge Voltage (1sec. max.) | 5VDC nominal input series | | -0.7 | -- | 16 | VDC |
| | 12VDC nominal input series | | -0.7 | -- | 25 | |
| | 24VDC nominal input series | | -0.7 | -- | 50 | |
| | 48VDC nominal input series | | -0.7 | -- | 100 | |
| Start-up Voltage | 5VDC nominal input series | | -- | -- | 4.5 | VDC |
| | 12VDC nominal input series | | -- | -- | 9 | |
| | 24VDC nominal input series | | -- | -- | 18 | |
| | 48VDC nominal input series | | -- | -- | 36 | |
| Under-voltage Protection | 5VDC nominal input series | | 3 | 3.5 | -- | mA |
| | 12VDC nominal input series | | 5.5 | 6.5 | -- | |
| | 24VDC nominal input series | | 12 | 15.5 | -- | |
| | 48VDC nominal input series | | 26 | 30 | -- | |
| Start-up Time | Nominal input voltage & constant resistance load | | -- | 10 | -- | ms |
| Input Filter | | | Pi filter | | | |
| Hot Plug | | | Unavailable | | | |
| Ctrl* | Module on | | Ctrl pin open or pulled high TTL (3.5-12VDC) | | | |
| | Module off | | Ctrl pin pulled low to GND (0-1.2VDC) | | | |
| | Input current when off | | -- | 6 | 10 | mA |

Note: *The Ctrl pin voltage is referenced to input GND.

Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit | |
|------------------------------|---|--|---------------------------|------|-------|--------|---|
| Voltage Accuracy | 0%-100% load | 5VDC input | Positive output | -- | ±1 | ±2 | |
| | | | Negative output | -- | ±1 | ±3 | |
| | | Others | -- | ±1 | ±3 | | |
| Linear Regulation | Input voltage variation from low to high at full load | 5VDC input | Singe output | -- | -- | ±0.5 | |
| | | | Dual output | -- | -- | ±1 | |
| | | Others | -- | ±0.2 | ±0.5 | | |
| Load Regulation ^① | 0%-100% load | 5VDC input | Singe output | -- | -- | ±1 | |
| | 5%-100% load | | Dual output | -- | -- | ±1.5 | |
| | 0%-100% load | 12VDC/48VDC input | -- | ±0.5 | ±1 | | |
| | 0%-100% load | 24VDC input | -- | ±0.5 | ±1 | | |
| Cross Regulation | Input voltage range, 25%-100% load | | -- | -- | ±5 | | |
| Transient Recovery Time | | | -- | 300 | 500 | μs | |
| Transient Response Deviation | 25% load step change, nominal input voltage | ±5V output, VRB4803YMD-10WR3, VRB4805YMD-10WR3 | | -- | ±5 | ±8 | % |
| | | Others | | -- | ±3 | ±5 | |
| Temperature Coefficient | Full load | | -- | -- | ±0.03 | %/°C | |
| Ripple & Noise ^② | 20MHz bandwidth, 5%-100% load | | -- | 40 | 100 | mV p-p | |
| Over-voltage Protection | | | 110 | -- | 160 | %Vo | |
| Over-current Protection | Input voltage range | | 110 | 140 | 190 | %Io | |
| Short-circuit Protection | | | Continuous, self-recovery | | | | |

Note:

① Load regulation for 0% -100% for 12VDC/48VDC nominal input series parts to ±5%;

② Ripple & Noise at < 5% load is 5%Vo max. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information.

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 | -- | 1000 | -- | 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 | ℃ |
| Vibration | | 10-150Hz, 5G, 90 Min. along X, Y and Z | | | |
| Switching Frequency* | PWM mode | -- | 350 | -- | KHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | K hours |

Note:*Switching 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 | Horizontal package | 25.40 x 25.40 x 11.70 mm | | | |
| Weight | VRB0505YMD-10WR3 | 15.0g (Typ.) | | | |
| | Others | 12.5g (Typ.) | | | |
| Cooling Method | Free air convection | | | | |

Electromagnetic Compatibility (EMC)

| | | | | | | |
|-----------|-------|---------------------|--|---|------------------|------------------|
| Emissions | CE | 5VDC nominal input | CISPR32/EN55032 CLASS B (see Fig.5-② for recommended circuit) | | | |
| | | 12VDC nominal input | CISPR32/EN55032 CLASS A (without extra components.)/ CLASS B (see Fig.4-② for recommended circuit) | | | |
| | | 24VDC nominal input | CISPR32/EN55032 CLASS A (without extra components.)/ CLASS B (see Fig.3-② for recommended circuit) | | | |
| | | 48VDC nominal input | CISPR32/EN55032 CLASS B (see Fig.3-② for recommended circuit) | | | |
| | RE | 5VDC nominal input | CISPR32/EN55032 CLASS B (see Fig.5-② for recommended circuit) | | | |
| | | 12VDC nominal input | CISPR32/EN55032 CLASS A(without extra components.)/CLASS B(see Fig.4-② for recommended circuit) | | | |
| | | 24VDC nominal input | CISPR32/EN55032 CLASS A(without extra components.)/CLASS B(see Fig.3-② for recommended circuit) | | | |
| | | 48VDC nominal input | CISPR32/EN55032 CLASS B (see Fig.3-② for recommended circuit) | | | |
| Immunity | ESD | 5VDC nominal input | IEC/EN61000-4-2 | Contact ±6KV | perf. Criteria B | |
| | | Others | IEC/EN61000-4-2 | Contact ±4KV | perf. Criteria B | |
| | RS | | | IEC/EN61000-4-3 | 10V/m | perf. Criteria A |
| | | Others | IEC/EN61000-4-4 | ±2KV (see Fig.3-① for recommended circuit) | | perf. Criteria B |
| | EFT | 5VDC nominal input | IEC/EN61000-4-4 | ±2KV (see Fig.5-① for recommended circuit) | | perf. Criteria B |
| | | 12VDC nominal input | IEC/EN61000-4-4 | ±2KV (see Fig.4-① for recommended circuit) | | perf. Criteria B |
| | Surge | Others | IEC/EN61000-4-5 | line to line ±2KV (see Fig.3-① for recommended circuit) | | perf. Criteria B |
| | | 5VDC nominal input | IEC/EN61000-4-5 | line to line ±2KV (see Fig.5-① for recommended circuit) | | perf. Criteria B |
| | | 12VDC nominal input | 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 |

Typical Characteristic Curves

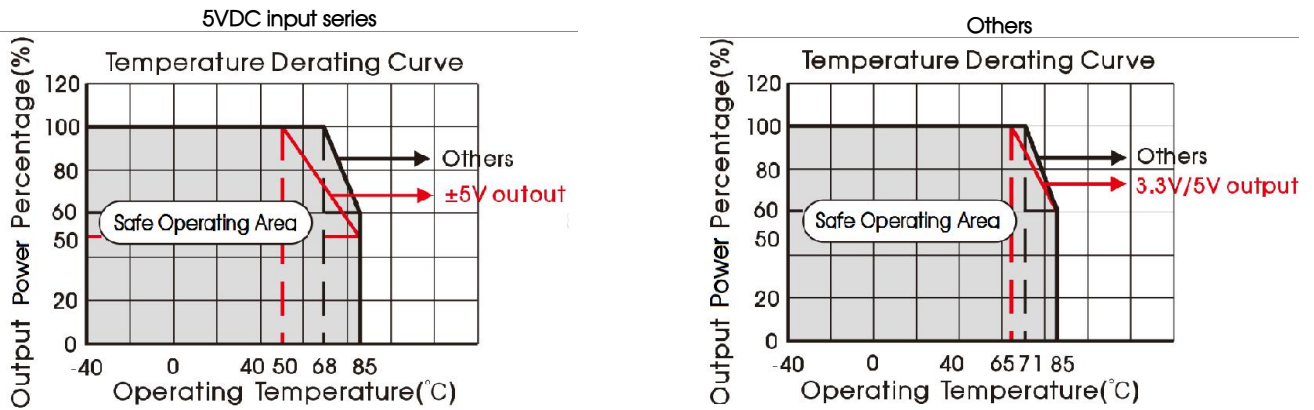
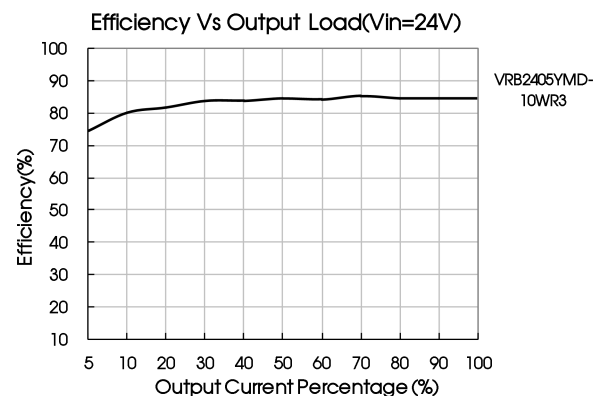
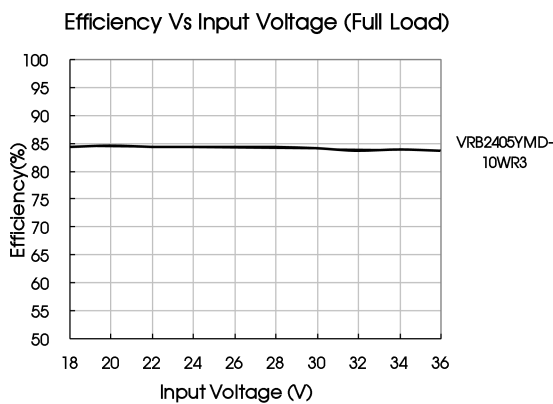
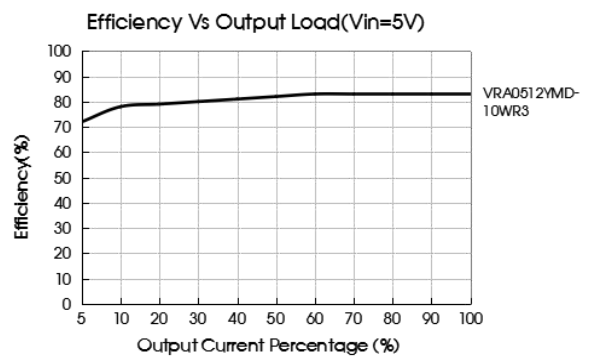
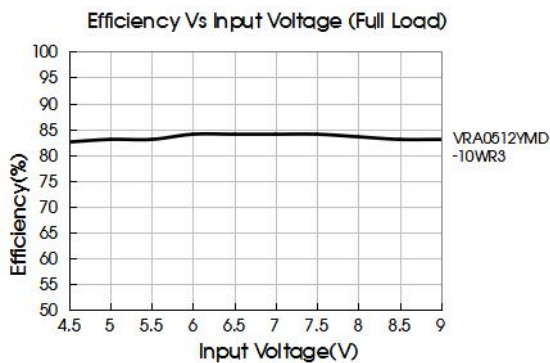


Fig. 1



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 C_{in} and C_{out} and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

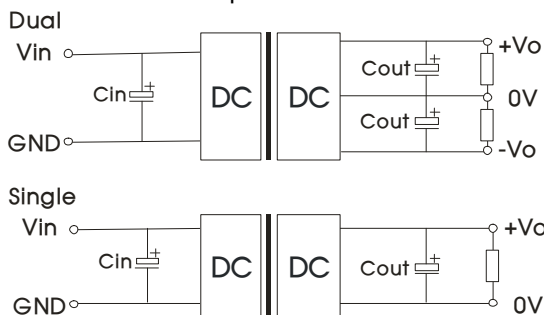


Fig. 2

| | |
|------|----------------|
| Vin | 5V/12V/24V/48V |
| Cin | 100μF |
| Cout | 10μF |

2. EMC compliance circuit

24VDC/48VDC nominal input series

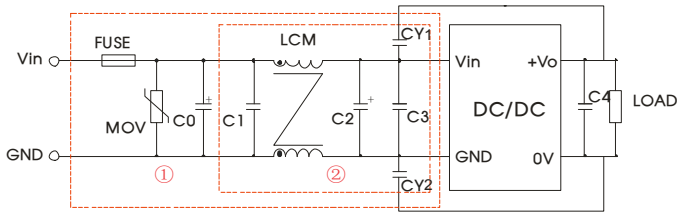


Fig. 3

Notes: For EMC tests we use Part ① in Fig. 3 for immunity and part ② for emissions test. Selecting based on needs.

Parameter description:

| Model | Vin:24V | Vin:48V |
|---------|---|------------|
| FUSE | Select fuse value according to actual input current | |
| MOV | S20K30 | S14K60 |
| C0 | 680μF/50V | 680uF/100V |
| C1 | 1μF/50V | 1uF/100V |
| C2 | 330μF/50V | 330μF/100V |
| C3 | 4.7μF/50V | 4.7uF/100V |
| C4 | Refer to the Cout in Fig.2 | |
| LCM | 4.7mH, recommended to use MORNSUN FL2D-30-472 | |
| CY1/CY2 | 1nF/2KV | |

12VDC nominal input series

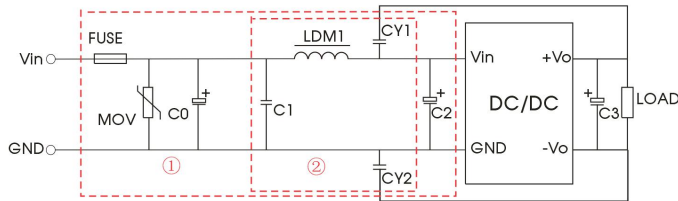


Fig. 4

Notes: For EMC tests we use Part ① in Fig. 4 for immunity and part ② for emissions test. Selecting based on needs

Parameter description:

| Model | Vin:12V |
|---------|---|
| FUSE | Select fuse value according to actual input current |
| MOV | S20K30 |
| C0/C2 | 330μF/50V |
| C1 | 1μF/50V |
| C3 | Refer to the Cout in Fig.2 |
| LDM1 | 4.7μH |
| CY1/CY2 | 1nF/2KV |

5VDC nominal input series

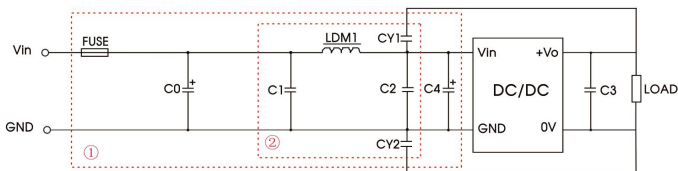


Fig. 5

Notes: For EMC tests we use Part ① in Fig. 5 for immunity and part ② for emissions test. Selecting based on needs

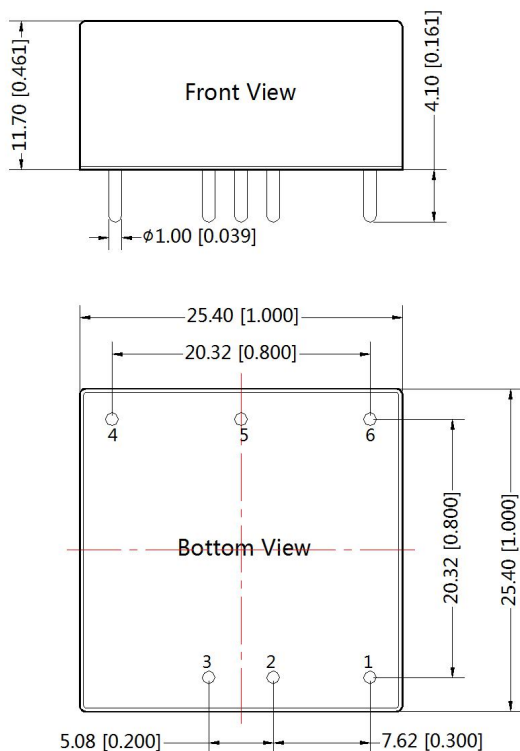
Parameter description:

| Model | Vin: 5V |
|---------|---|
| FUSE | Select fuse value according to actual input current |
| C0 | 2200μF/35V |
| C1/C2 | 4.7μF/50V |
| C3 | Refer to the Cout in Fig.2 |
| C4 | 1000μF/35V |
| LDM1 | 4.7μH |
| CY1/CY2 | 1nF/2KV |

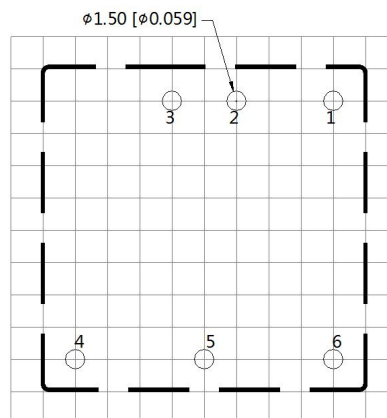
3. The products do not support parallel connection of their output

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

Dimensions and Recommended Layout



THIRD ANGLE PROJECTION



Note: Grid 2.54*2.54mm

| Pin | Pin-Out | |
|-----|---------|------|
| | Single | Dual |
| 1 | Ctrl | Ctrl |
| 2 | GND | GND |
| 3 | Vin | Vin |
| 4 | +Vo | +Vo |
| 5 | No Pin | 0V |
| 6 | 0V | -Vo |

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

- Note:
- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210003 (DIP);
 - If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
 - The maximum capacitive load offered were tested at input voltage range and full load;
 - 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;
 - All index testing methods in this datasheet are based on company corporate standards;
 - We can provide product customization service, please contact our technicians directly for specific information;
 - Products are related to laws and regulations: see "Features" and "EMC";
 - 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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