

50W isolated DC-DC converter
Wide input and regulated single output



CE **UKCA** Patent Protection RoHS
EN62368-1 BS EN62368-1



FEATURES

- Wide input voltage range: 36-75 VDC
- High efficiency up to 93%
- I/O isolation test voltage 2250 VDC
- Operating ambient temperature range: -40°C to +100°C
- Input under-voltage protection, output short circuit, over-current, over-voltage protection, over-temperature protection
- Industry standard package: 1/8 brick
- Meet EN62368 standards

VCF48_EBO-50W(F)R3-N series is a high-performance product specifically designed for a variety of communication power supply field. The DC-DC converters feature 50W output power with a wide 2:1 input voltage and feature efficiencies of up to 93%, input to output isolation is tested with 2250VDC and the converters safety operate ambient temperature of -40°C to +100°C, input under-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection. Meets EN62368 standards. They are ideally and widely used in applications such as industrial control, electric power, instruments and communications.

Selection Guide

| Certification | Part No. ^① | Ctrl Logic ^② | Input Voltage (VDC) | | Output | | Full Load Efficiency ^④ (%) Min./Typ. | Max. Capacitive Load(μF) |
|---------------|-----------------------|-------------------------|---------------------|-------------------|---------------|-----------------------|---|--------------------------|
| | | | Nominal (Range) | Max. ^③ | Voltage (VDC) | Current (A) Max./Min. | | |
| EN/BS EN | VCF4803EBO-50W(F)R3-N | N | 48 (36-75) | 75 | 3.3 | 15.15/0 | 88/90 | 6060 |
| | VCF4805EBO-50W(F)R3-N | | | | 05 | 10.0/0 | 90/92 | 4000 |
| | VCF4812EBO-50W(F)R3-N | | | | 12 | 4.17/0 | 91/93 | 1680 |
| | VCF4824EBO-50W(F)R3-N | | | | 24 | 2.083/0 | 90/92 | 1000 |
| | VCF4828EBO-50W(F)R3-N | | | | 28 | 1.786/0 | 89/91 | 750 |
| -- | VCF4848EBO-50W(F)R3-N | | | | 48 | 1.041/0 | 88/90 | 330 |

Notes:

- ① Use "F" suffix for heat sink mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
- ② "N" means negative logic;
- ③ Exceeding the maximum input voltage may cause permanent damage;
- ④ 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) | Nominal input voltage | 3.3V | -- | 1184/20 | 1300/30 | mA |
| | | 05/12/24V | -- | 1145/20 | 1200/30 | |
| | | 28V | -- | 1157/30 | 1200/50 | |
| | | 48V | -- | 1157/20 | 1184/30 | |
| Reflected Ripple Current | Nominal input voltage | | -- | 30 | -- | |
| Surge Voltage | Continuous | | 0 | -- | 80 | VDC |
| | Transient (100ms max.) | | -0.7 | -- | 100 | |
| Start-up Voltage | | | -- | -- | 36 | |
| Input Under-voltage Protection | | | 26 | 29 | -- | |
| Start-up Time | Nominal input voltage & constant resistance load | | -- | -- | 100 | ms |
| Input Filter | Pi filter | | | | | |
| Hot Plug | Unavailable | | | | | |
| Input Reverse Polarity Protection | Unavailable | | | | | |

| | | | | | |
|--------------------------|---------------------------------|--|----|----|----|
| Ctrl ^① | Module turn-on | Ctrl pin pulled low to -Vin (0-1.2VDC) | | | |
| | Module turn-off | Ctrl pin open or pulled high (TTL 3.5-12VDC) | | | |
| | Input current when switched off | -- | 3 | 10 | mA |
| Ctrl Start-up Delay Time | | -- | 30 | 50 | ms |

Note: ①The Ctrl pin voltage is referenced to input -Vin.

Output Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|--|---|--|-----------|------------|----------|
| Voltage Accuracy | 0%-100% load | -- | ± 1 | ± 3 | |
| Linear Regulation | Input voltage variation from low to high at full load | -- | ± 0.2 | ± 0.5 | % |
| Load Regulation | 10%-100% load | -- | ± 0.5 | ± 0.75 | |
| Transient Recovery Time | 25% load step change, nominal input voltage, $di/dt=2.5A/\mu s$ | 28V | -- | 200 | 400 |
| | | other | -- | 200 | 500 |
| Transient Response Deviation | 25% load step change, $di/dt=2.5A/\mu s$ | 3.3V | -- | ± 8 | ± 12 |
| | | 05V | -- | ± 6 | ± 10 |
| | | other | -- | ± 3 | ± 5 |
| Temperature Coefficient | Full load | -- | -- | ± 0.03 | %/°C |
| Ripple & Noise ^① | 20MHz bandwidth, nominal input voltage, 10%-100% load | 3.3V | -- | 100 | 150 |
| | | 05V, 12V | -- | 120 | 150 |
| | | 24V | -- | 125 | -- |
| | | 48V | -- | 150 | 250 |
| Trim | | 90 | -- | 110 | |
| Sense | | -- | -- | 105 | % |
| Over-temperature Protection ^② | Product surface max. temperature | -- | 135 | -- | °C |
| Over-voltage Protection | | 110 | 125 | 160 | %Vo |
| Over-current Protection | Input voltage range | 110 | 140 | 190 | %Io |
| Short-circuit Protection | | Continuous, self-recovery, time ≤ 3 seconds | | | |

Note:

①The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information. Ripple & Noise at <10% load is 5%Vo max for other output; ripple & noise at <10% load is 5%Vo max for 3.3V output;

②The temperature of over-temperature protection of products with heat sink is subject to the internal device temperature.

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. | 2250 | -- | -- | VDC |
| Insulation Resistance | Input-output resistance at 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitance | Input-output capacitance at 100KHz/0.1V | -- | 1000 | -- | pF |
| Insulation type | Input-output | Basic insulation | | | |
| Operating Temperature | See Fig. 1 | -40 | -- | +100 | |
| Storage Temperature | | -55 | -- | +125 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Pin Soldering Resistance Temperature | Wave soldering, 10 seconds | -- | -- | +260 | |
| | Soldering spot is 1.5mm away from case for 10 seconds | -- | -- | +300 | |
| Shock and Vibration Test | | 10-55Hz, 10G, 30Min. along X, Y and Z | | | |
| Switching Frequency ^① | PWM mode | -- | 300 | -- | kHz |
| Altitude | | Altitude: ≤ 4000 m, Atmospheric pressure: 60~110kPa | | | |
| MTBF | Telcordia SR-332@25°C | 2000 | -- | -- | k hours |

Note: ①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

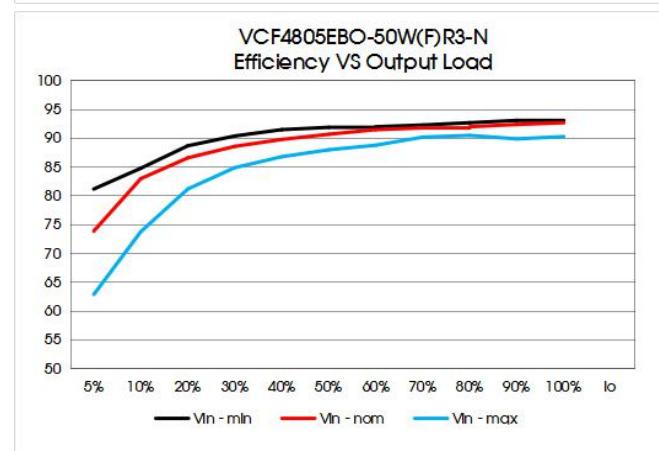
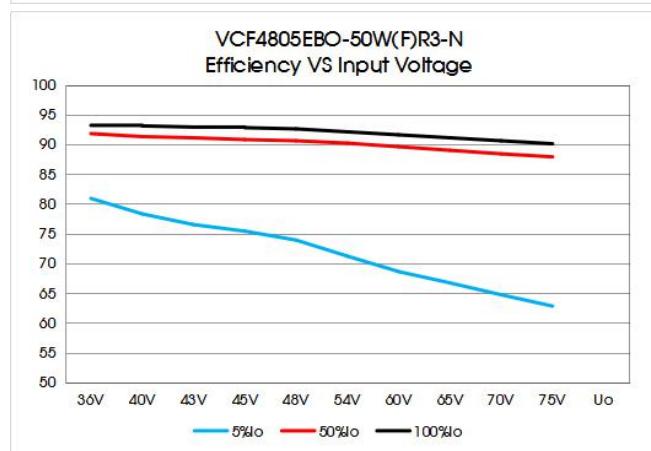
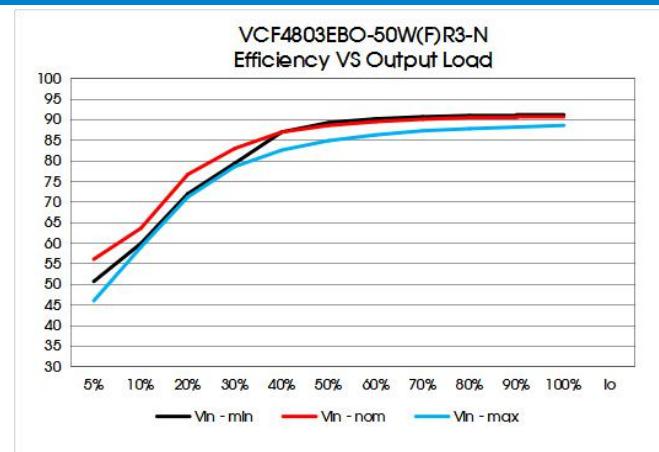
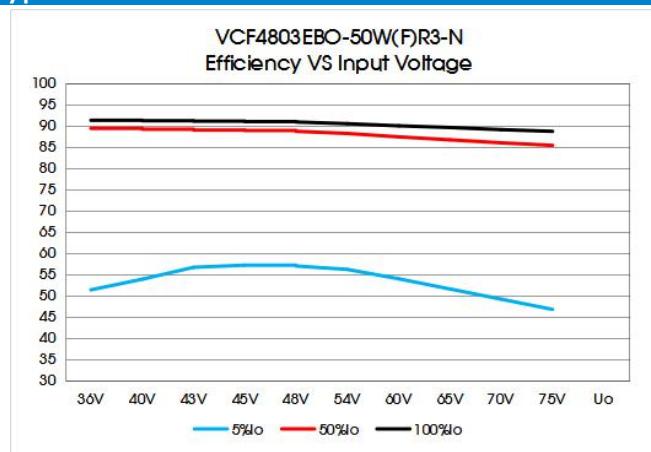
Mechanical Specifications

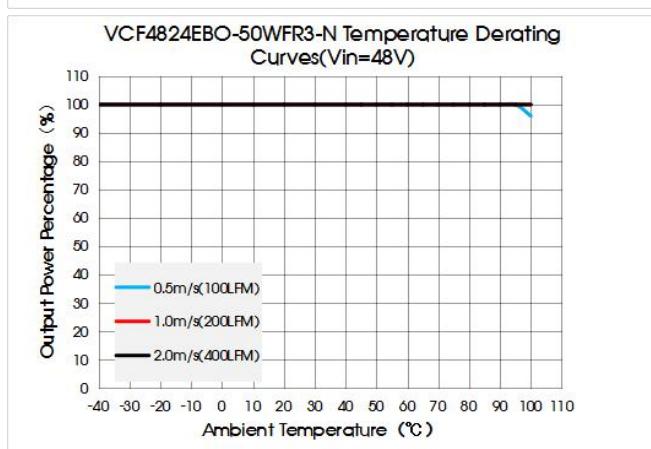
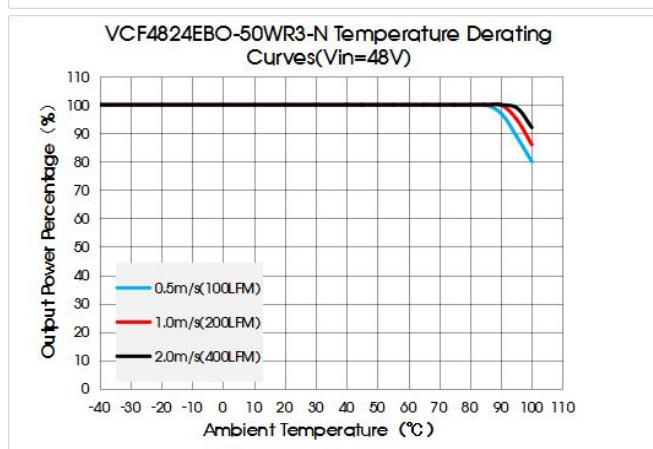
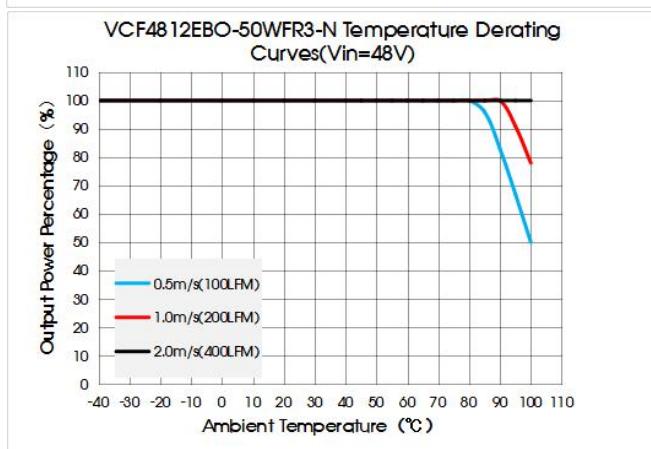
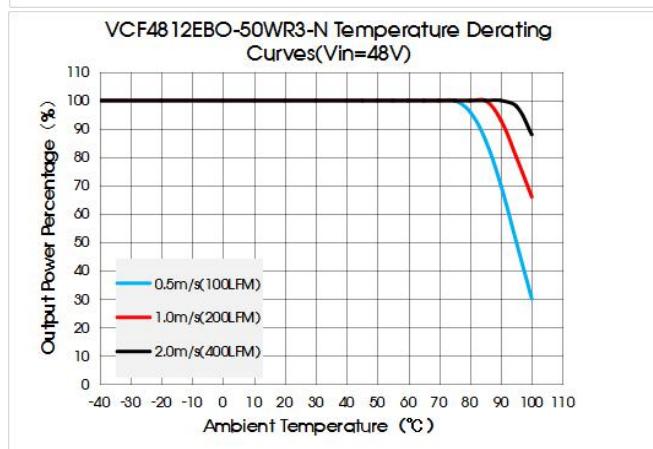
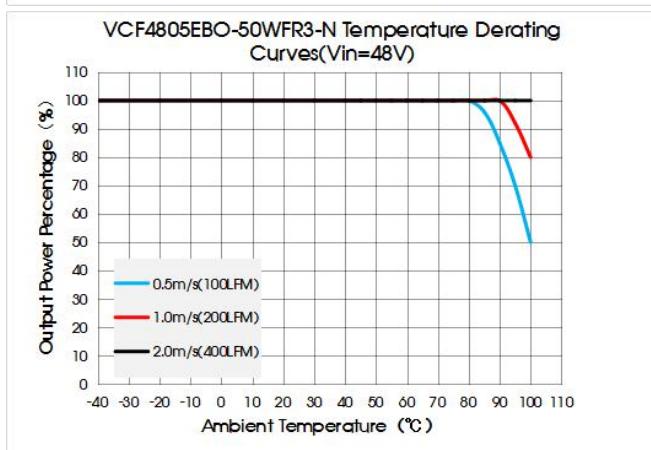
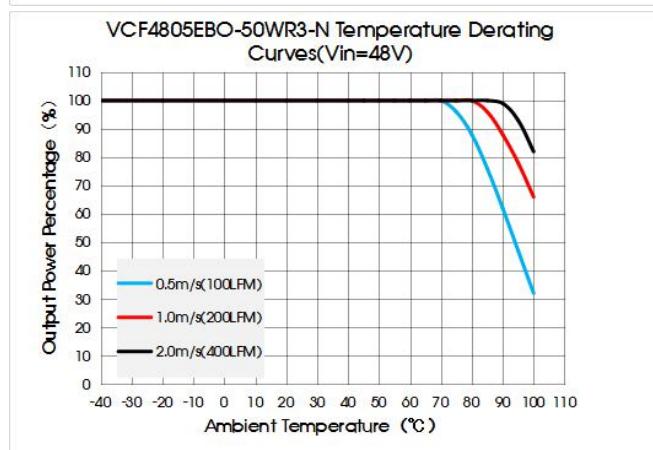
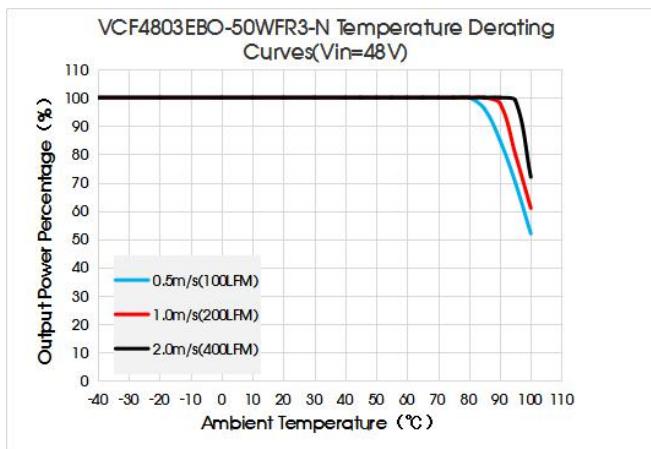
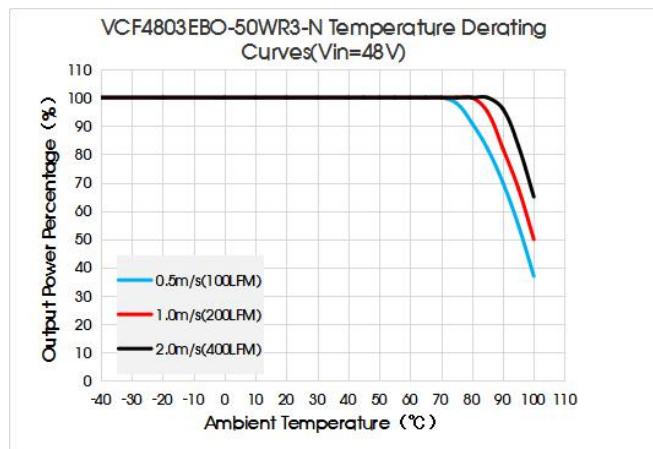
| | | |
|----------------|---|-------------------------|
| Dimensions | VCF4803/05/12/24/28EBO-50WR3-N | 58.42 x 22.86 x 9.69 mm |
| | VCF4803/05/12/24/28EBO-50WFR3-N | 58.42 x 22.86 x 12.7 mm |
| | VCF4848EBO-50WR3-N | 58.42 x 22.86 x 9.86 mm |
| | VCF4848EBO-50WFR3-N | 58.42 x 22.86 x 13.2 mm |
| Weight | VCF48_EBO-50WR3-N | 27.0g (Typ.) |
| | VCF48_EBO-50WFR3-N | 35.9g (Typ.) |
| Cooling Method | Natural convection or forced air convection | |

Electromagnetic Compatibility (EMC)

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

Typical Characteristic Curve





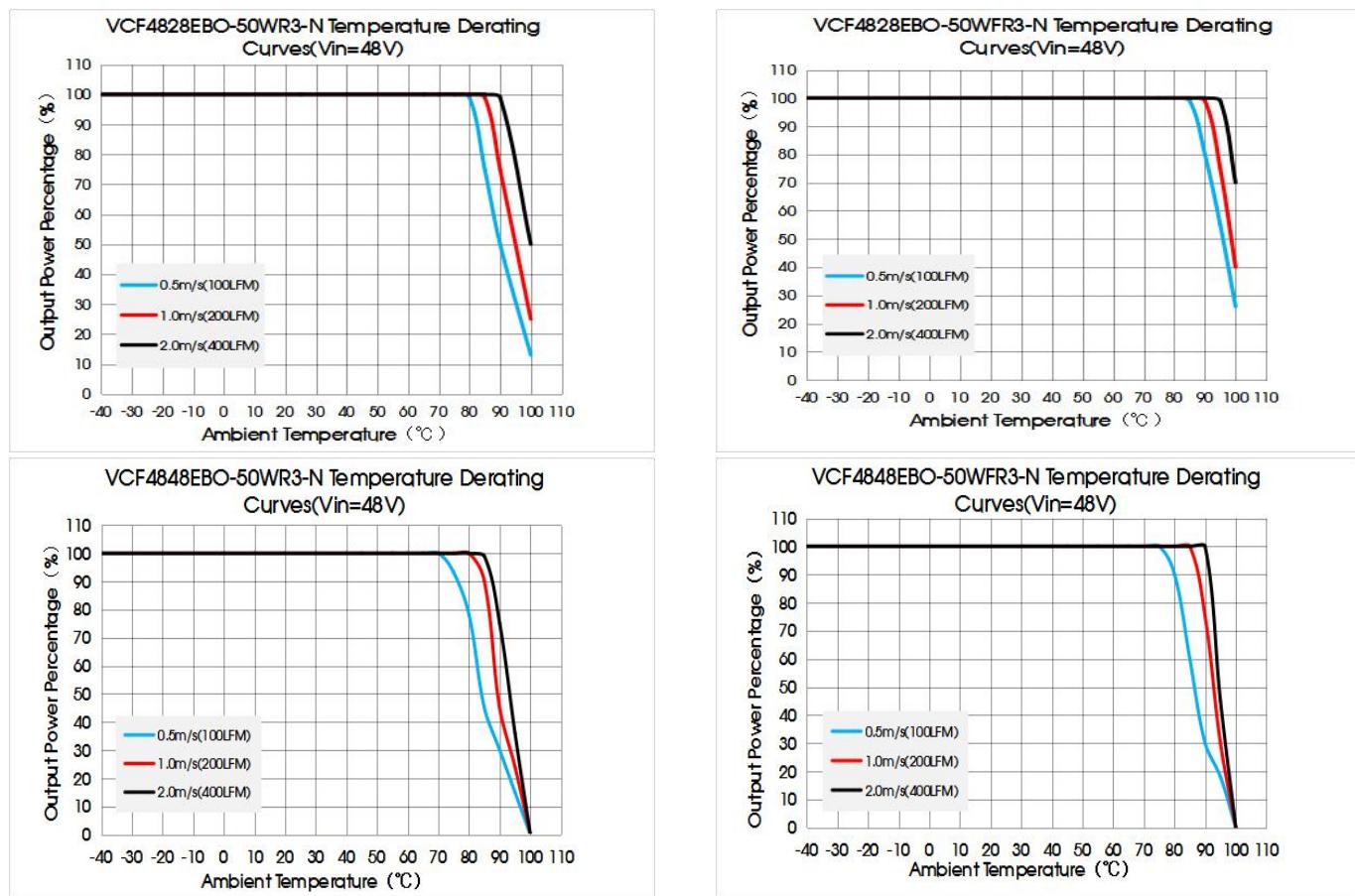


Fig. 1

Remote Sense Application

1. Remote Sense Connection if not used

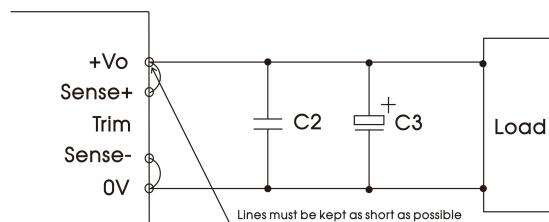


Fig. 2

Notes:

- (1) If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only.
- (2) The connections between sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation

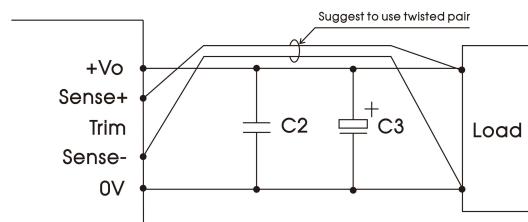


Fig. 3

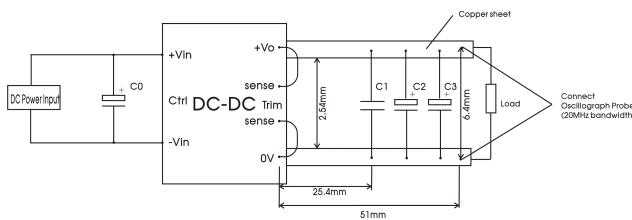
Notes:

- (1) Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used.
- (2) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wires are suggested for remote compensation and must be kept as short as possible.
- (3) We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.
- (4) Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.

Design Reference

1. Ripple & Noise

All the DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 4.



| Capacitors Output voltage | C0 | C1 | C2 | C3 |
|------------------------------|----------------|---------|----------|------------|
| 3.3/05/12VDC | | | | 330μF/63V |
| 24/28VDC | 100μF/ 100V | 1μF/50V | 10μF/50V | 470μF/100V |
| 48VDC | | | | 100μF/100V |

Fig. 4

2. Typical application

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 5.

We recommend using Mornsun's EMC circuit, otherwise please ensure that at least a 100μF electrolytic capacitors is connected at the input in order to ensure adequate voltage surge suppression and protection.

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 specified max. capacitive load value of the product.

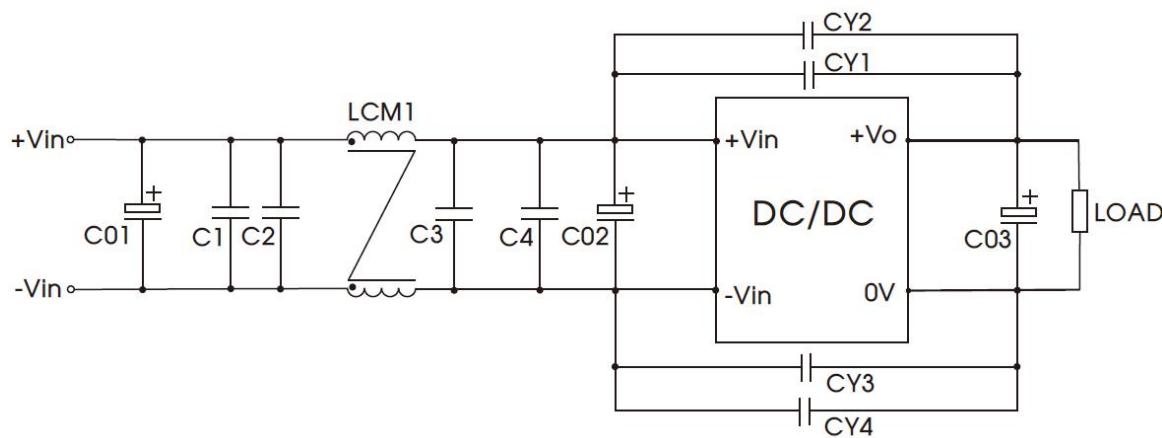


| Vout (VDC) | Cin | Cout |
|------------|------------|------------|
| 3.3/05/12 | | 330μF/63V |
| 24 | 100μF/100V | 470μF/100V |
| 48 | | 100μF/100V |

Fig. 5

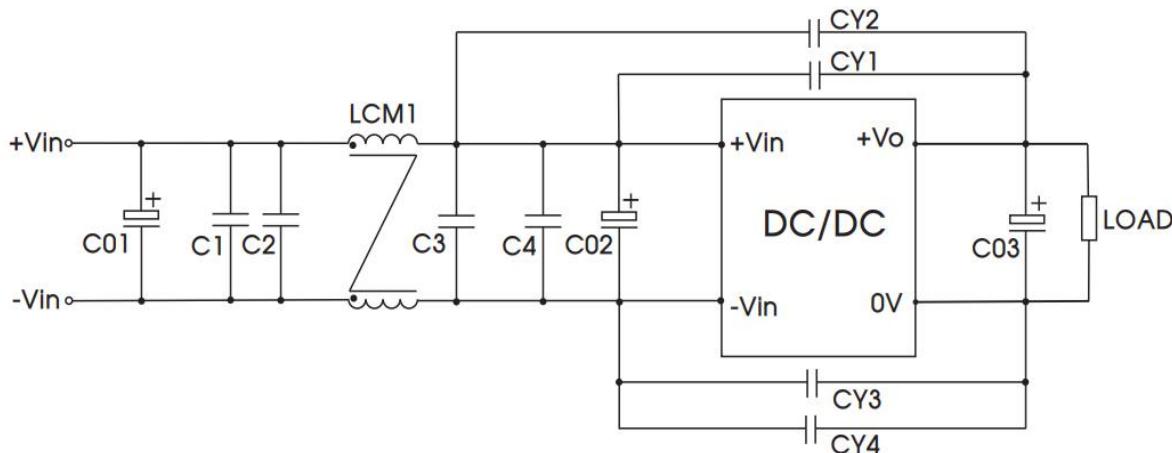
3. EMC compliance recommended circuit

VCF4803/05/12EBO-50W(F)R3-N



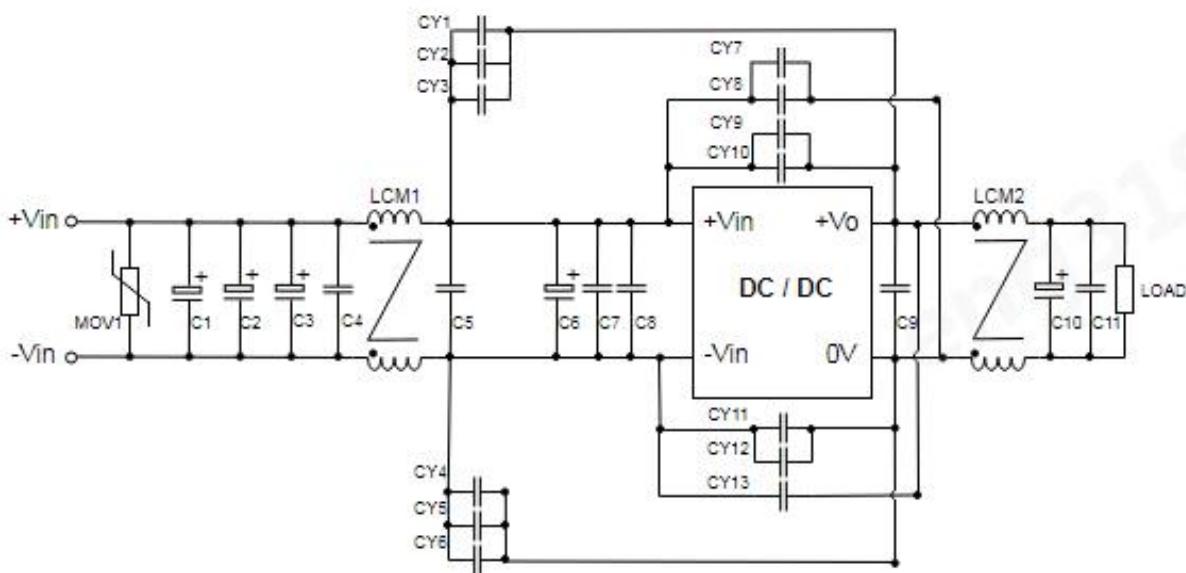
| | |
|--------------------|--|
| C01 | 470μF/100V (electrolytic capacitor) |
| C02 | 100μF/100V (electrolytic capacitor) |
| C03 | 330μF/63V (electrolytic capacitor) |
| C1, C2, C3, C4 | 4.7μF/100V |
| CY1, CY2, CY3, CY4 | 2.2nF/2KV |
| LCM1 | 2mH, recommended to use MORNSUN P/N: FL2D-A2-202(C) |

VCF4824EBO-50W(F)R3-N



| | |
|--------------------|--|
| C01 | 470μF/100V (electrolytic capacitor) |
| C02 | 100μF/100V (electrolytic capacitor) |
| C03 | 330μF/63V (electrolytic capacitor) |
| C1, C2, C3, C4 | 4.7μF/100V |
| CY1, CY2, CY3, CY4 | 2.2nF/2KV |
| LCM1 | 2.0mH, recommended to use MORNSUN P/N: FL2D-A2-202(C) |

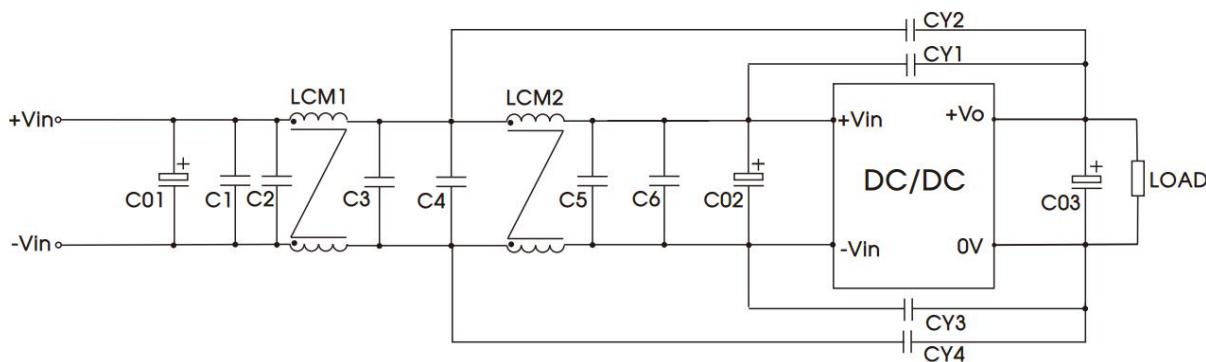
VCF4828/48EBO-50W(F)R3-N



| | |
|-----------------------|---|
| MOV1 | 20101 Voltage sensitive resistor |
| C1/C6 | 470uF/100V(electrolytic capacitor) |
| C2/C3/C10 | 150uF/100V(electrolytic capacitor) |
| C4/C5/C7/C8/C9/C11 | 4.7uF/100V*4 Ceramic capacitor |
| CY3/CY6/CY8/CY10/CY12 | 1nF/400VAC Safety Y capacitance |
| CY2/CY5/CY9/CY11/CY13 | 2.2nF/400VAC Safety Y capacitance |
| CY1/CY4 | 4.7nF/400VAC*2 Safety Y capacitance |
| CY7 | 4.7nF/400VAC Safety Y capacitance |
| LCM1 | 7.0mH, recommended to use MORNSUN P/N: FL2D-60-702 |
| LCM2 | 200uH, recommended to use MORNSUN P/N: FL2D-B0-200 |

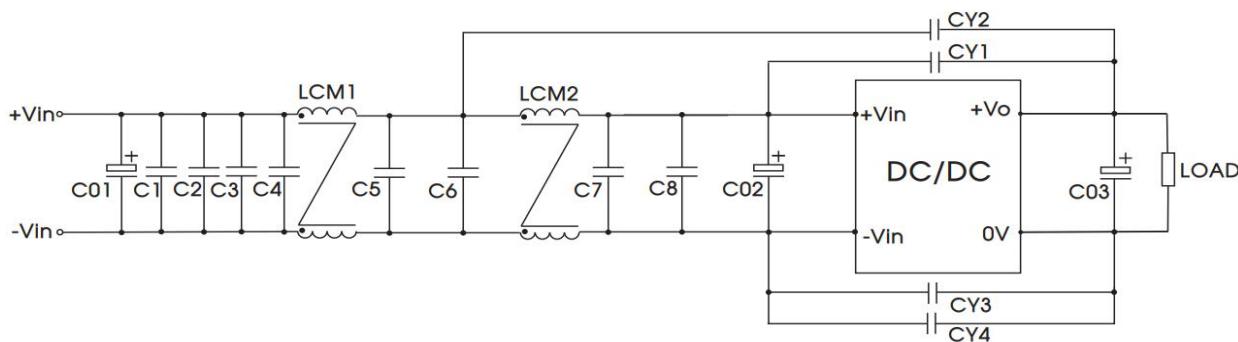
Fig. 6-1

VCF4803/05/12EBO-50W(F)R3-N



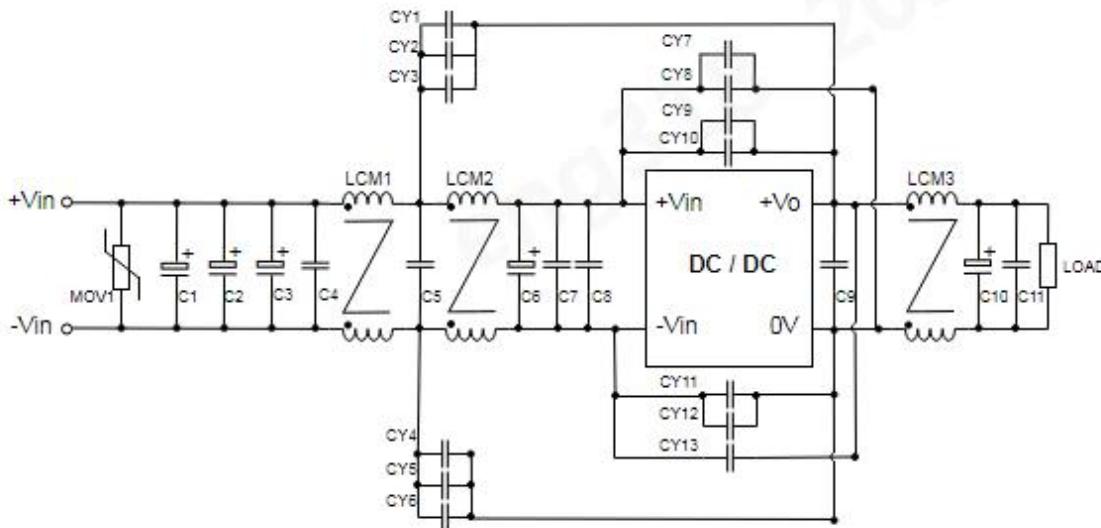
| | |
|------------------------|--|
| C01 | 470μF/100V (electrolytic capacitor) |
| C02 | 100μF/100V (electrolytic capacitor) |
| C03 | 330μF/63V (electrolytic capacitor) |
| C1, C2, C3, C4, C5, C6 | 4.7μF/100V |
| CY1, CY2, CY3, CY4 | 4.7nF/1.5KV |
| LCM1, LCM2 | 2.0mH, recommended to use MORNSUN P/N: FL2D-A2-202(C) |

VCF4824EBO-50W(F)R3-N



| | |
|--------------------------------|--|
| C01 | 470μF/100V(electrolytic capacitor) |
| C02 | 100μF/100V(electrolytic capacitor) |
| C03 | 330μF/63V(electrolytic capacitor) |
| C1, C2, C3, C4, C5, C6, C7, C8 | 4.7μF/100V |
| CY1, CY2, CY3, CY4 | 4.7nF/1.5KV |
| LCM1, LCM2 | 2.0mH, recommended to use MORNSUN P/N: FL2D-A2-202(C) |

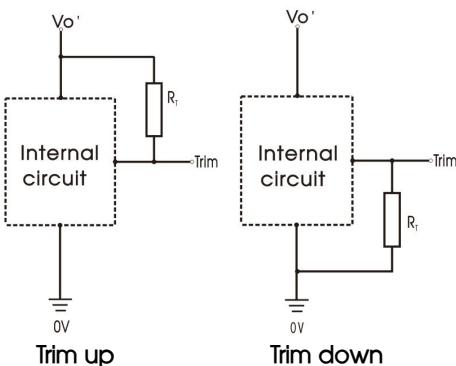
VCF4828/48EBO-50W(F)R3-N



| | |
|-----------------------|---|
| MOV1 | 20101 Voltage sensitive resistor |
| C1/C6 | 470μF/100V(electrolytic capacitor) |
| C2/C3/C10 | 150μF/100V(electrolytic capacitor) |
| C4/C5/C7/C8/C9/C11 | 4.7μF/100V*4 Ceramic capacitor |
| CY3/CY6/CY8/CY10/CY12 | 1nF/400VAC Safety Y capacitance |
| CY2/CY5/CY9/CY11/CY13 | 2.2nF/400VAC Safety Y capacitance |
| CY1/CY4 | 4.7nF/400VAC*2 Safety Y capacitance |
| CY7 | 4.7nF/400VAC Safety Y capacitance |
| LCM1 | 7.0mH, recommended to use MORNSUN P/N: FL2D-60-702 |
| LCM2 | 12mH, recommended to use MORNSUN P/N: FL2D-40-123 |
| LCM3 | 200uH, recommended to use MORNSUN P/N: FL2D-B0-200 |

Fig. 6-2

4. Trim Function for Output Voltage Adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Note:

R_T = Trim Resistor value

$$\Delta\% = \left| \frac{V_{nom} - V_{out}}{V_{nom}} \right| \times 100$$

V_{nom} = nominal output voltage

V_{out} = desired output voltage

Calculating Trim resistor values:

Trim up

$$R_T = \left(\frac{5.11V_{nom}(100 + \Delta\%)}{1.225\Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) (k\Omega)$$

Trim down

$$R_T = \left(\frac{511}{\Delta\%} \right) - 10.22 (k\Omega)$$

When the output voltage is 12V, the up-regulated voltage is +5%, that is, the output voltage set to 13.2V:

$$\Delta\% = \left| \frac{12 - 13.2}{12} \right| * 100 = 10 \quad R_T = \frac{5.11 * 12 * (100 + 10)}{1.225 * 10} - \frac{511}{10} - 10.22 = 489K\Omega$$

When the output voltage is 12V, the down-regulated voltage is -5%, that is, the output voltage set to 10.8V:

$$\Delta\% = \left| \frac{12 - 10.8}{12} \right| * 100 = 10 \quad R_T = \frac{511}{10} - 10.22 = 40.88K\Omega$$

5. Recommended solution for thermal testing

During the application process, the thermal design of the product can be evaluated in combination with the temperature derating curve of the product, or it can be determined by testing the temperature at the hot test point in Fig. 7 (Product with heat sink, test at the same point). It is a safe operating area for VCF405/12EBO-50(F)WR3-N, VCF4824/28EBO-50WR3-N if the temperature lower than 125°C at point A. It is a safe operating area for VCF4824/28EBO-50WR3-N if the temperature lower than 130°C at point B. It is a safe operating area for VCF4803EBO-50WR3-N if the temperature lower than 130°C at point C. It is a safe operating area for VCF4848EBO-50W(F)R3-N if the temperature lower than 135°C at point D.

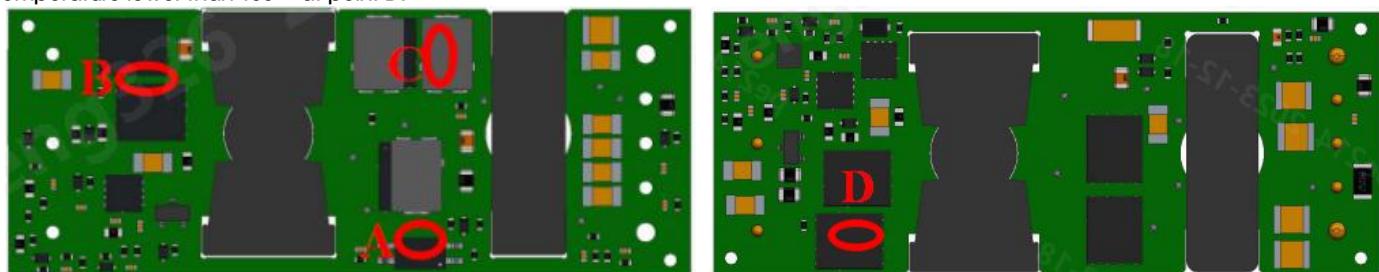


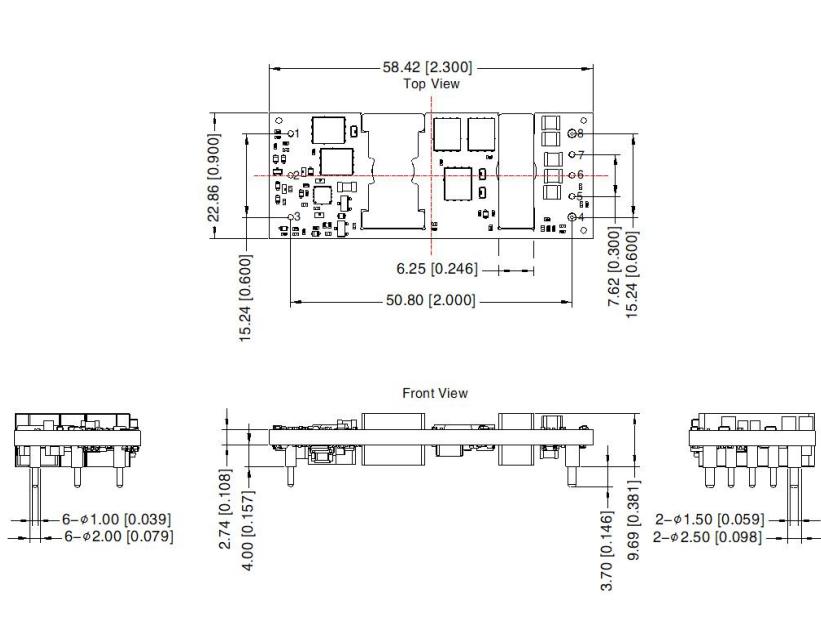
Fig. 7

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

7. For additional information please refer to DC-DC converter application notes on

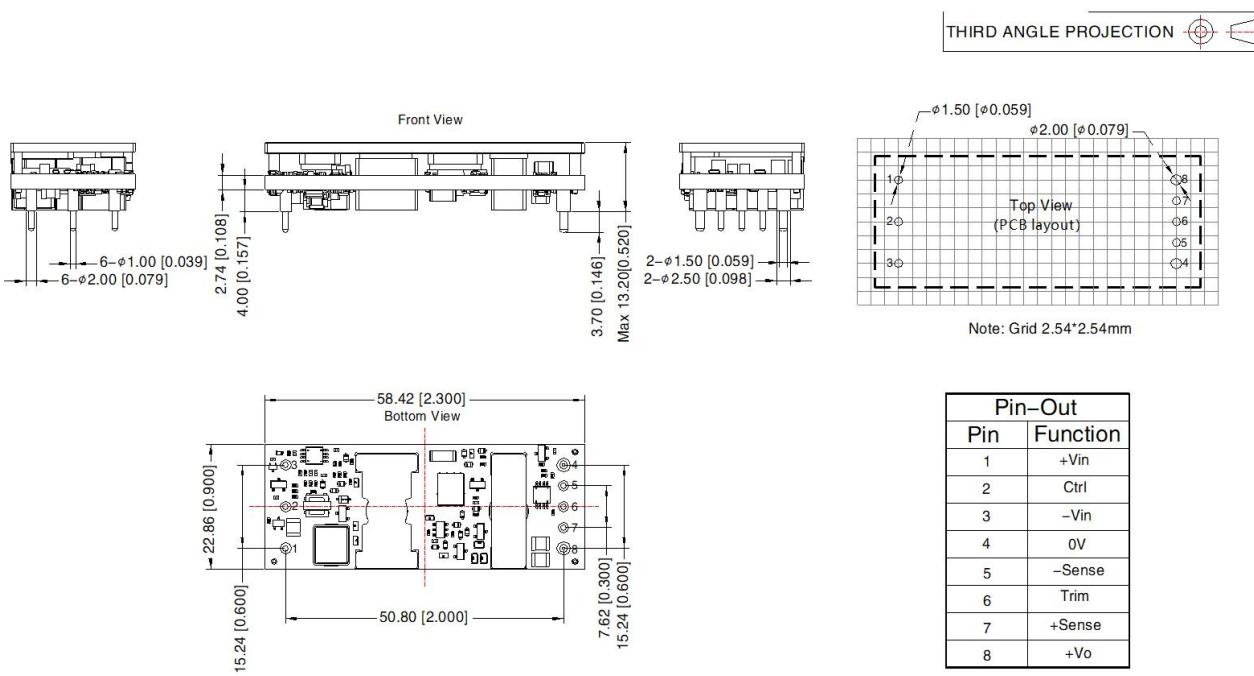
www.mornsun-power.com.

VCF4803EBO-50WR3-N Dimensions and Recommended Layout



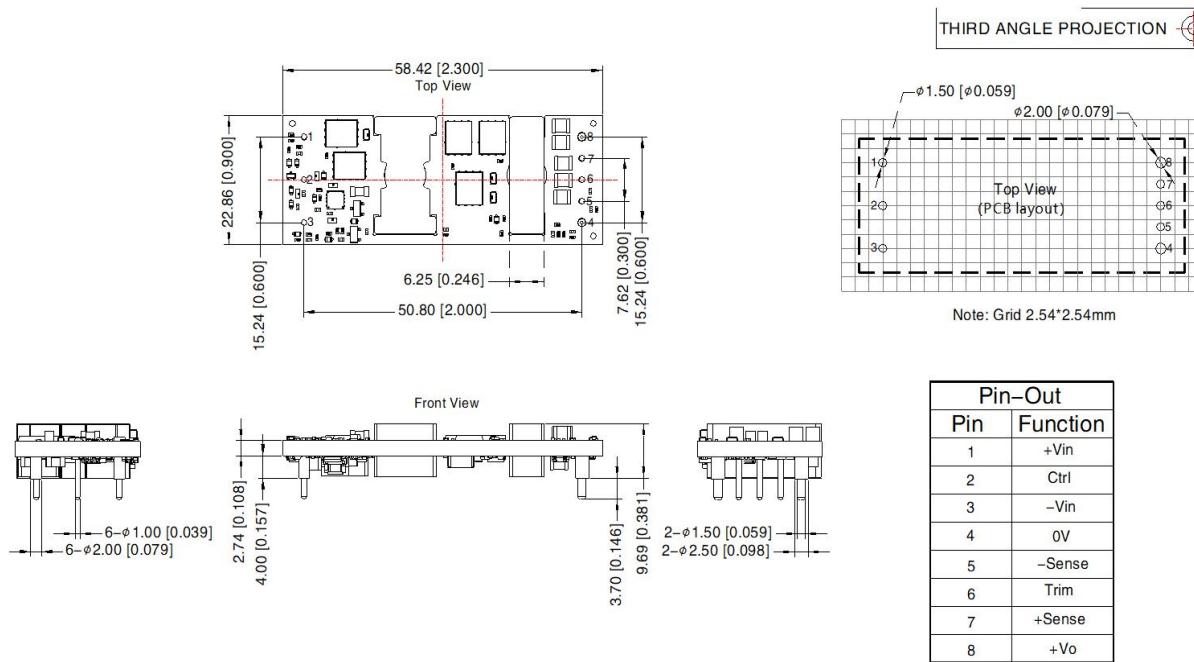
Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
PIN1/2/3/5/6/7: φ 1.0mm; PIN4/8: φ 1.5mm
The layout of the device is for reference only, please refer to the actual product

VCF4803EBO-50WFR3-N Dimensions and Recommended Layout



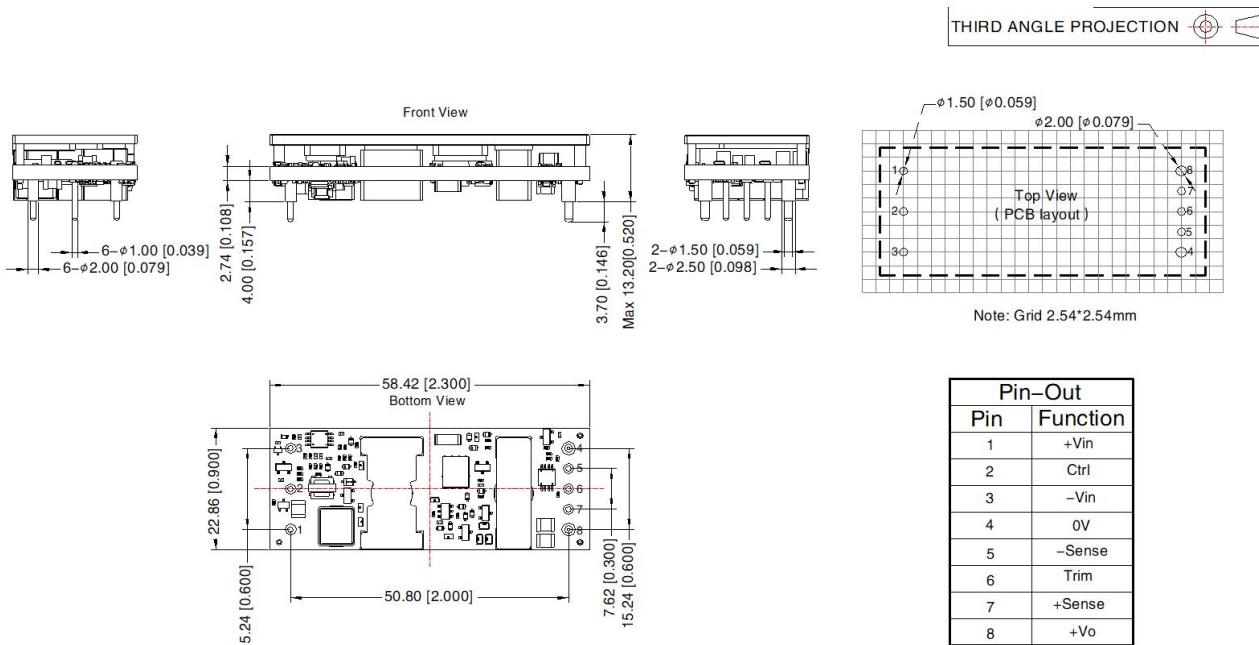
Note:
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Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
PIN1/2/3/5/6/7: φ 1.0mm; PIN4/8: φ 1.5mm
The layout of the device is for reference only, please refer to the actual product

VCF4805/12/24/28EBO-50WR3-N Dimensions and Recommended Layout



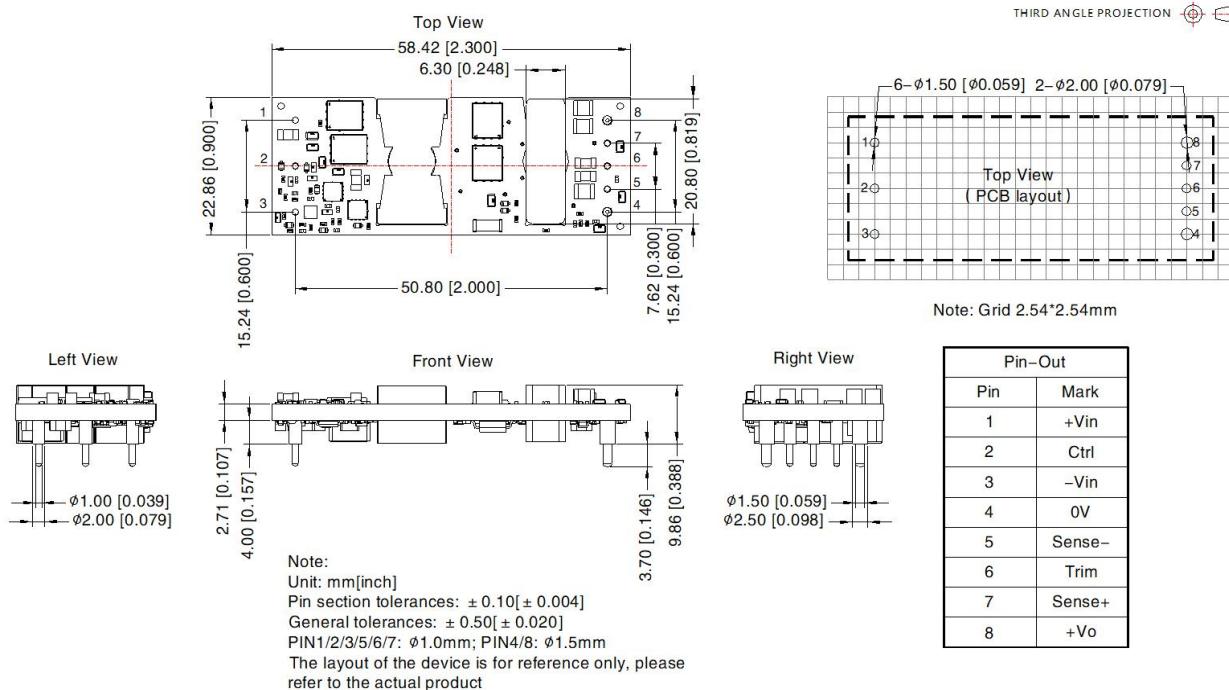
Note:
Unit: mm[inch]
Pin section tolerances: $\pm 0.10 [\pm 0.004]$
General tolerances: $\pm 0.50 [\pm 0.020]$
PIN1/2/3/5/6/7: $\phi 1.0\text{mm}$; PIN4/8: $\phi 1.5\text{mm}$
The layout of the device is for reference only, please refer to the actual product

VCF4805/12/24/28EBO-50WFR3-N Dimensions and Recommended Layout

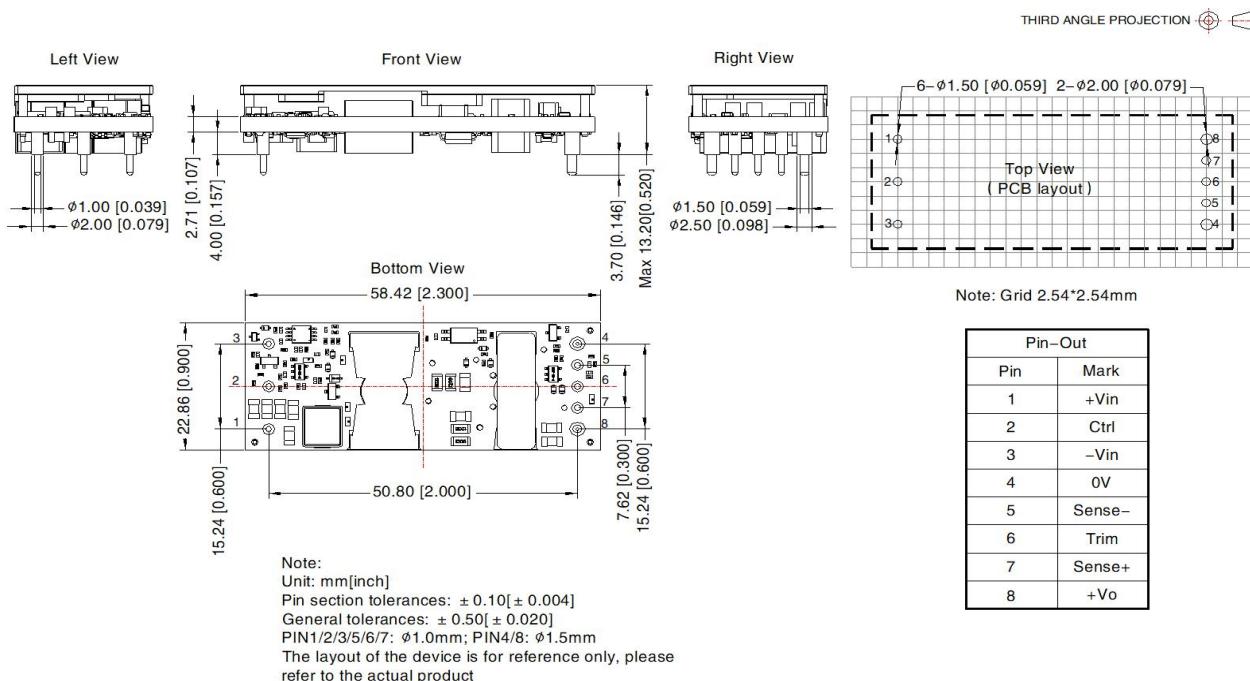


Note:
Unit: mm[inch]
Pin section tolerances: $\pm 0.10 [\pm 0.004]$
General tolerances: $\pm 0.50 [\pm 0.020]$
PIN1/2/3/5/6/7: $\phi 1.0\text{mm}$; PIN4/8: $\phi 1.5\text{mm}$
The layout of the device is for reference only, please refer to the actual product

VCF4848EBO-50WR3-N Dimensions and Recommended Layout



VCF4848EBO-50WFR3-N Dimensions and Recommended Layout



Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210119(VCF48_EBO-50WR3-N), 58210152(VCF48_EBO-50WFR3-N);
2. We suggest to use module at load of over 10%, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
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 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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