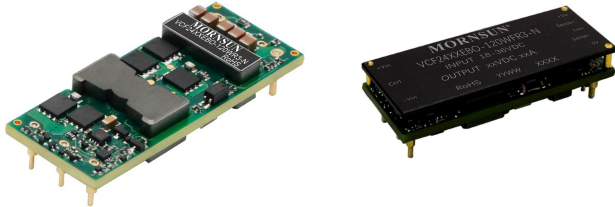


120W isolated DC-DC converter
Ultra-wide input and regulated single output



Patent Protection RoHS



FEATURES

- Ultra-wide input voltage range: 18-36VDC
- High efficiency up to 92%
- I/O isolation test voltage 2.25k VDC
- Operating ambient temperature range: -40°C to +105°C
- Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection
- International standard package: 1/8 brick

VCF24_EBO-120W(F)R3-N series are isolated 120W DC-DC products with 2:1 input voltage. They feature efficiency up to 92%, 2250VDC isolation, operating temperature of -40 °C to +85 °C, Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection, they are ideally and widely used in applications such as industrial control, electric power, instruments and communications fields.

Selection Guide

| Certification | Part No. ① | Ctrl Logic ② | Input Voltage (VDC) | | Output | | Full Load Efficiency(%) ④Min./Typ. | Max. Capacitive Load(μF) |
|---------------|------------------------|--------------|---------------------|--------|---------------|--------------------------|---------------------------------------|--------------------------|
| | | | Nominal (Range) | Max. ③ | Voltage (VDC) | Current (mA) (Max./Min.) | | |
| -- | VCF2405EBO-120W(F)R3-N | N | 24 (18-36) | 40 | 05 | 24.0/0 | 90/92 | 10000 |
| | VCF2412EBO-120W(F)R3-N | N | 24 (18-36) | 40 | 12 | 10.0/0 | 90/92 | 5000 |
| | VCF2415EBO-120W(F)R3-N | N | 24 (18-36) | 40 | 15 | 8.0/0 | 90/92 | 4000 |
| | VCF2424EBO-120W(F)R3-N | N | 24 (18-36) | 40 | 24 | 5.0/0 | 89/91 | 3000 |

Note:
 ① "F" is the package with heat dissipation plate. If it is applied to the occasion with higher heat dissipation requirements, we can choose the module with heat dissipation plate;
 ② "N" means Ctrl is negative.
 ③ Exceeding the maximum input voltage may cause permanent damage;
 ④ Efficiency is measured in 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 | -- | 5495/20 | 5618/30 | mA |
| Reflected Ripple Current | | -- | 100 | -- | |
| Surge Voltage (1sec. max.) | | -0.7 | -- | 50 | VDC |
| Start-up Voltage | | -- | -- | 18 | |
| Input Under-voltage Protection | | 14 | 15 | -- | |
| Startup time | Nominal input voltage and constant resistance load | -- | -- | 100 | ms |
| Input Filter | | PI filter | | | |
| Hot Plug | | Unavailable | | | |
| Input anti-reverse connection protection | | Unavailable | | | |
| Ctrl ① | Module on | Ctrl pin pulled low to GND (0-1.2VDC) | | | |
| | Module off | Ctrl pin open or pulled high TTL | | | |
| | Input current when off | -- | 3 | 10 | mA |
| Ctrl start 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 | 5%-100% load | -- | ±0.5 | ±0.75 | |
| Transient Recovery Time | 25% load step change | -- | 200 | 400 | μs |
| Transient Response Deviation | 25% load step change | 5V output | ±6 | ±10 | % |
| | | Others | ±3 | ±5 | |
| Temperature Coefficient | Full load | -- | -- | ±0.03 | %/°C |
| Ripple & nominal ^① | 20MHz bandwidth, nominal input voltage, 5%-100% load | -- | 120 | 150 | mVp-p |
| Trim | | 90 | -- | 110 | % |
| Sense | | -- | -- | 105 | |
| Over-temperature Protection | Max. Case Temperature | -- | 135 | -- | °C |
| Over-voltage Protection | | 110 | 125 | 160 | %Vo |
| Over-current Protection | Input voltage range | 110 | 140 | 170 | %Io |
| Short-circuit Protection | | Continuous, self-recovery | | | |

注:

①Under 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.

②The overtemperature protection temperature of a package with a heat dissipation plate depends on the temperature of the internal components.

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 |
| Operating Temperature | See temperature derating curves | -40 | -- | +85 | °C |
| Storage Temperature | | -55 | -- | +125 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Pin Soldering Resistance Temperature | Wave-soldering, 10 seconds | -- | -- | +260 | °C |
| | Soldering spot is 1.5mm away from case for 10 seconds | -- | -- | +300 | |
| Shock And Vibration | | 10-55Hz, 5G, 3minutes period, 60minutes each along X, Y and Z axis | | | |
| Switching Frequency | PWM mode | -- | 270 | -- | kHz |
| Altitude | | Altitude: ≤4000m, Atmospheric pressure: 56-110KPa | | | |
| MTBF | Telcordia SR-332@25°C | 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

| | | |
|----------------|------------------------------------------------------|-------------------------|
| Dimension | VCF24_EBO-120WR3-N | 58.42 x 22.86 x 9.71mm |
| | VCF24_EBO-120WFR3-N | 58.42 x 22.86 x 13.20mm |
| Weight | VCF24_EBO-120WR3-N | 27.0g (Typ.) |
| | VCF24_EBO-120WFR3-N | 35.9g (Typ.) |
| Cooling Method | Free air convection (20LFM) or forced air convection | |

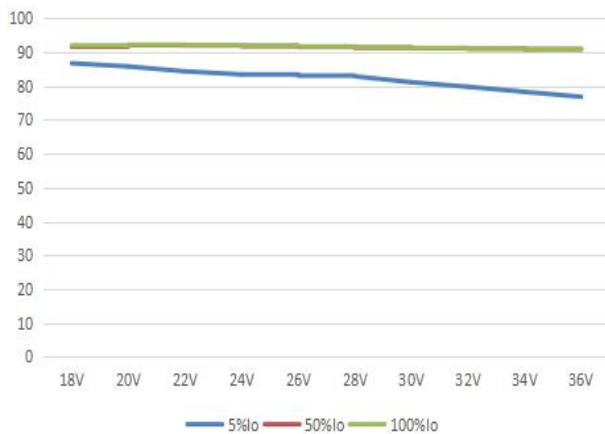
Electromagnetic Compatibility (EMC)

| | | |
|-----|----|-----------------------------------------------------------------------------------------------------------------|
| EMI | CE | CISPR32/EN55032 CLASS A (see Fig. 6-1 for recommended circuit) / CLASS B (see Fig. 6-2 for recommended circuit) |
|-----|----|-----------------------------------------------------------------------------------------------------------------|

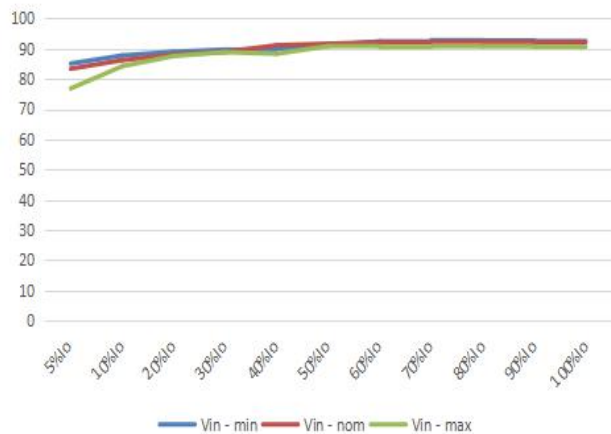
| | | | | |
|-----|-------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------|
| | RE | CISPR32/EN55032 CLASS A (see Fig. 6-1 for recommended circuit) / CLASS B (see Fig. 6-2 for recommended circuit) | | |
| EMS | ESD | IEC/EN61000-4-2 | Contact $\pm 6\text{KV}$ | perf. Criteria B |
| | RS | IEC/EN61000-4-3 | 10V/m | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 | $\pm 2\text{KV}$ (see Fig. 6-1 for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN61000-4-5 | line to line $\pm 2\text{KV}$ (see Fig. 6-1 for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN61000-4-6 | 10 Vr.m.s | perf. Criteria A |

Typical Characteristic Curve

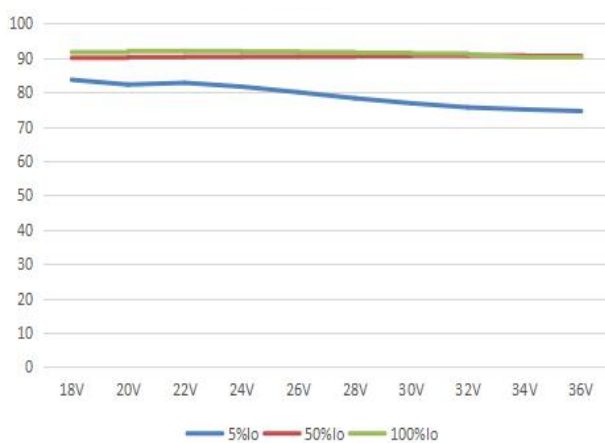
VCF2412EBO-120W(F)R3-N
Efficiency VS Input voltage



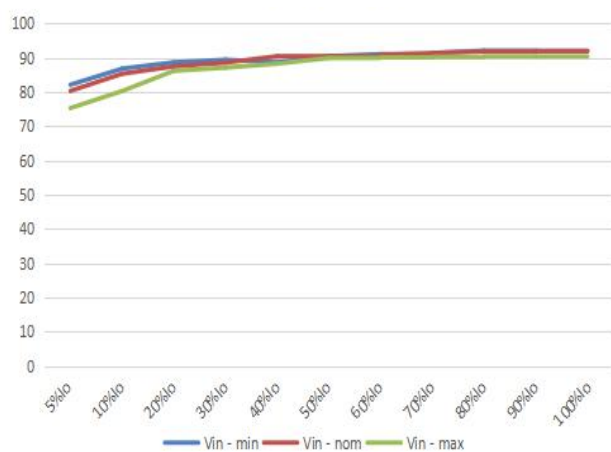
VCF2412EBO-120W(F)R3-N
Efficiency VS Output load

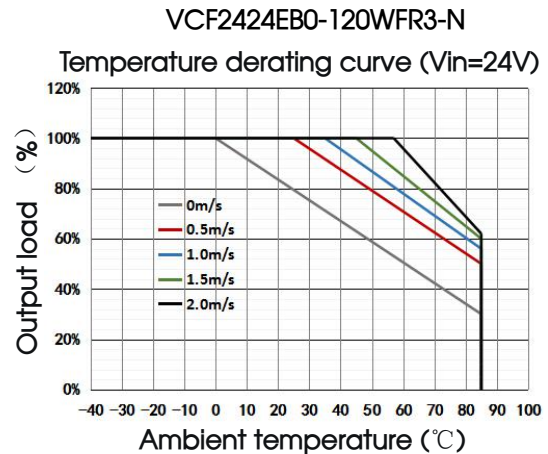
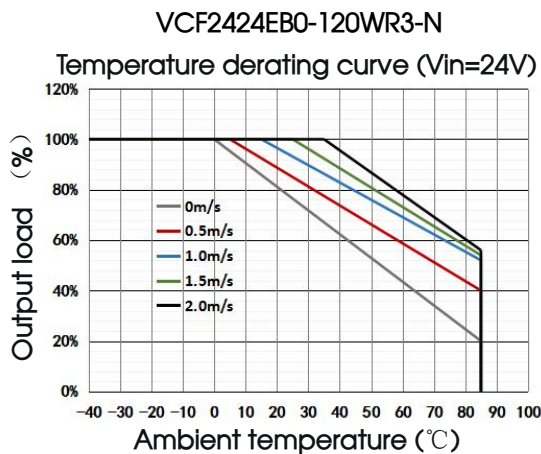
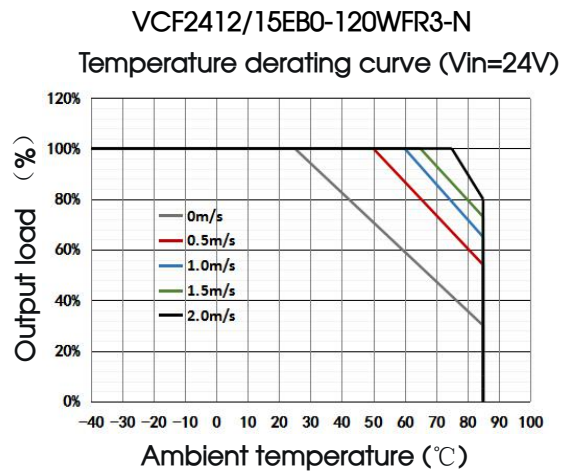
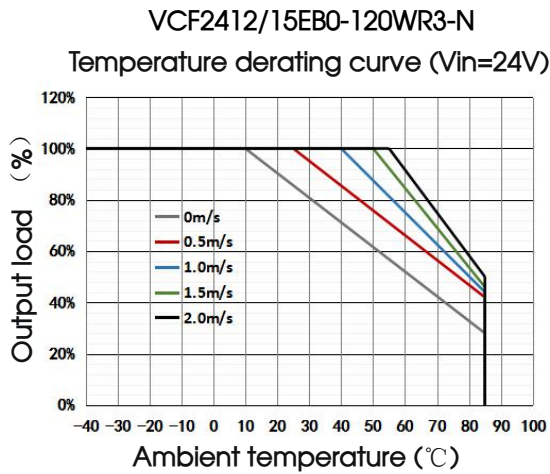
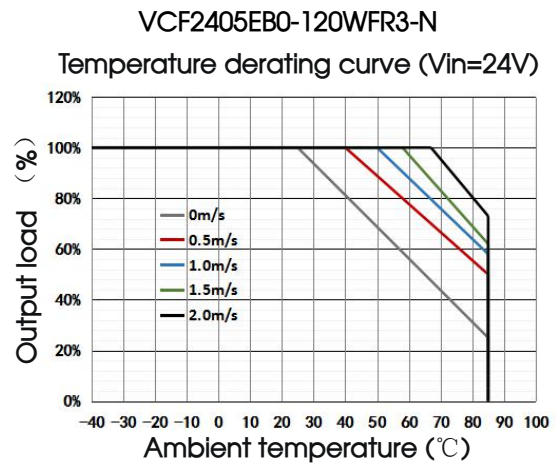
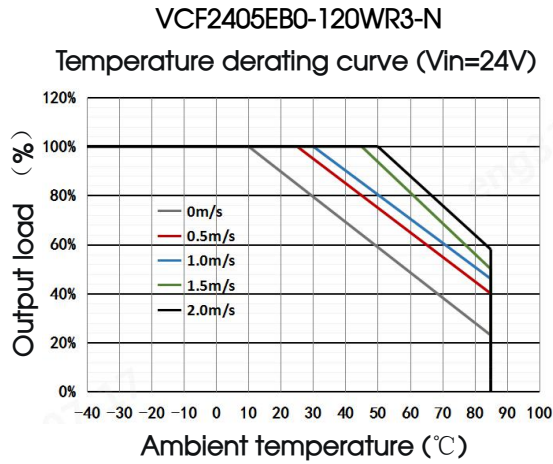


VCF2415EBO-120W(F)R3-N
Efficiency VS Input voltage



VCF2415EBO-120W(F)R3-N
Efficiency VS Output load





Remote Sense Application

1. Remote Sense Connection if not used

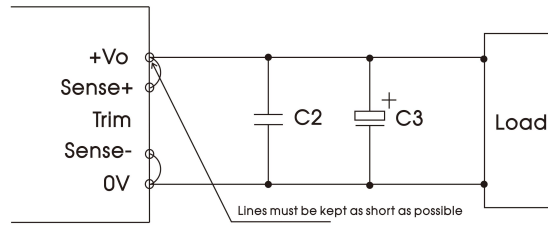


Fig. 2

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

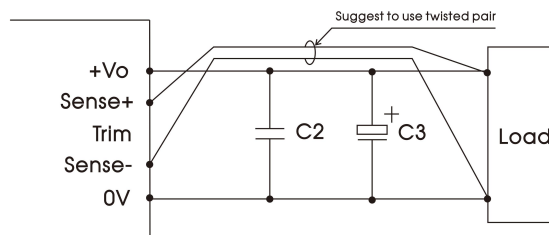


Fig. 3

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.

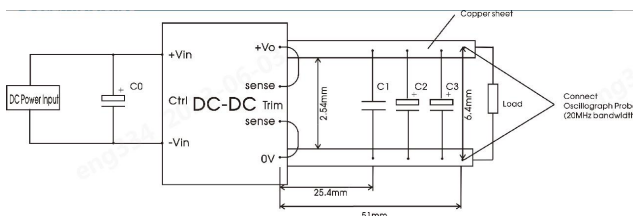


Fig. 4

| Capacitors value | C0 | C1 | C2 | C3 |
|------------------|----------------|---------|----------|-----------|
| Output voltage | | | | |
| 05VDC | 100µF/ 100V | 1µF/50V | 10µF/50V | 330µF/63V |
| 12VDC | | | | |
| 15VDC | | | | |
| 24VDC | | | | |

2. Typical application

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

We recommended 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.

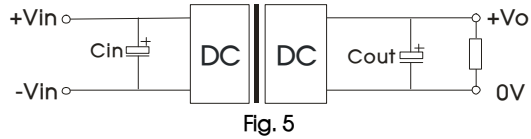


Fig. 5

| Vout (VDC) | Cin | Cout |
|------------|------------|-----------|
| 05 | 100uF/100V | 330uF/63V |
| 12 | | |
| 15 | | |
| 24 | | |

3. EMC compliance recommended circuit

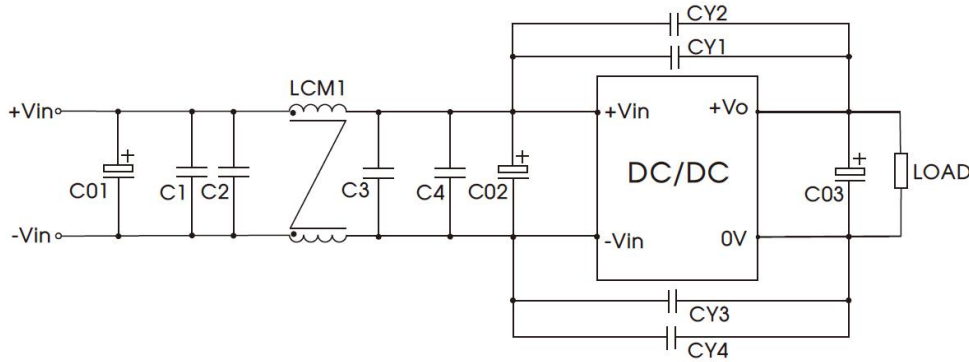


Fig.6-1

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

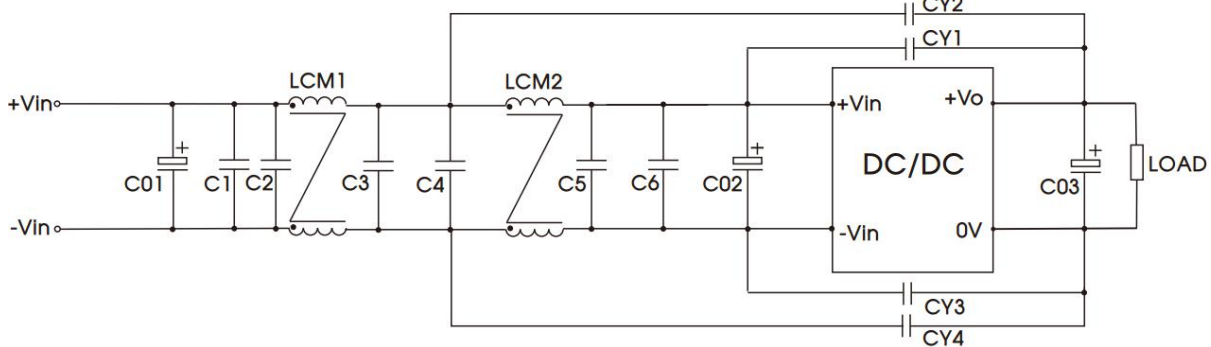
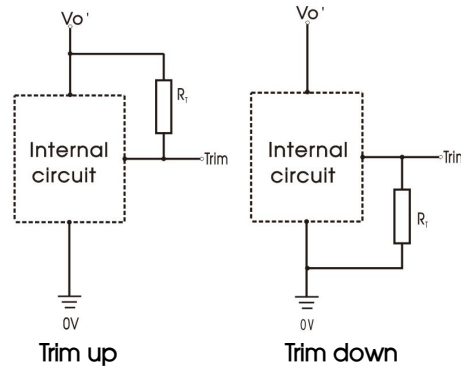


Fig.6-2

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

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



TRIM resistor connection (dashed line shows internal resistor network)

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

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

Note:

RT = 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

When the output voltage is 12V, the up-regulated voltage is +10%, 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 -10%, 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 by combining the product temperature derating curve, or the stable working interval of the product can be determined by the temperature of the thermal test point in Figure 7. When the temperature at point A is lower than 130°C, it is the stable operating range of VCF24_EBO-120WR3-N. When the temperature of point B and point C is lower than 115°C, the product with heat dissipation plate is in the stable operating range.

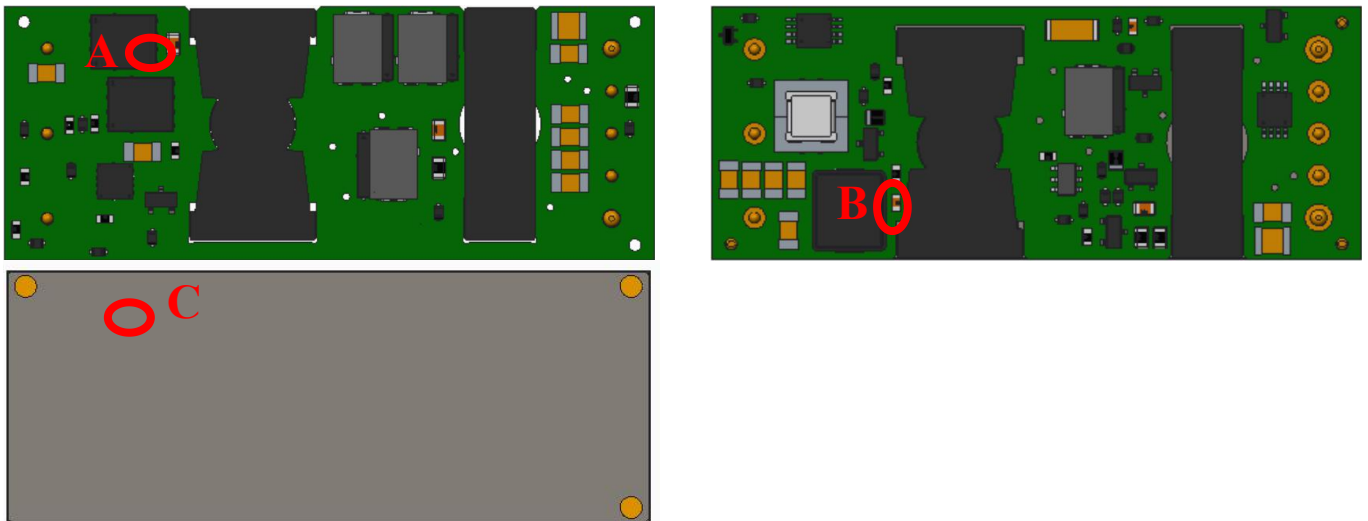

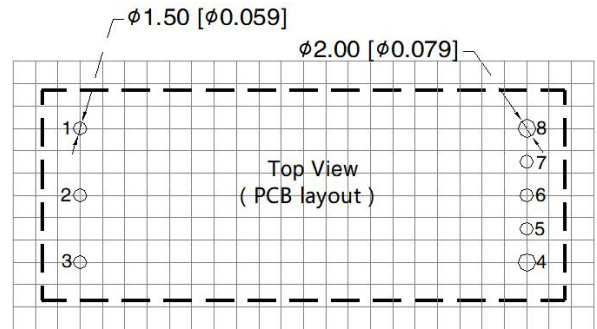
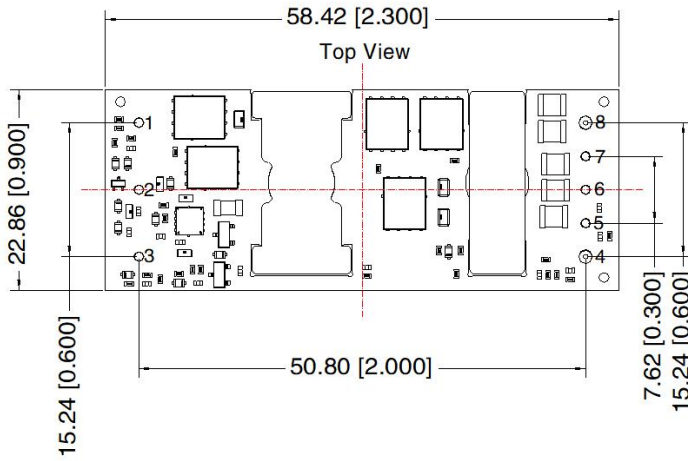


Fig. 7

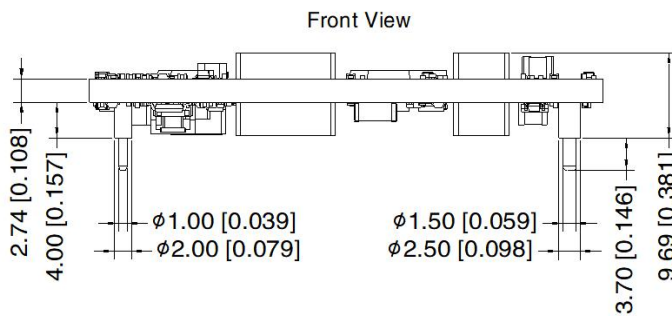
- The products do not support parallel connection of their output
- For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

VCF24_EBO-120WR3-N Dimensions and Recommended Layout

THIRD ANGLE PROJECTION 



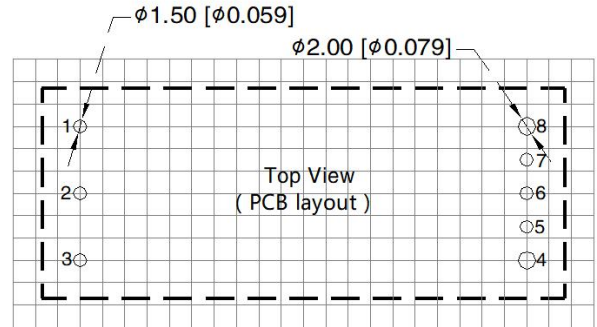
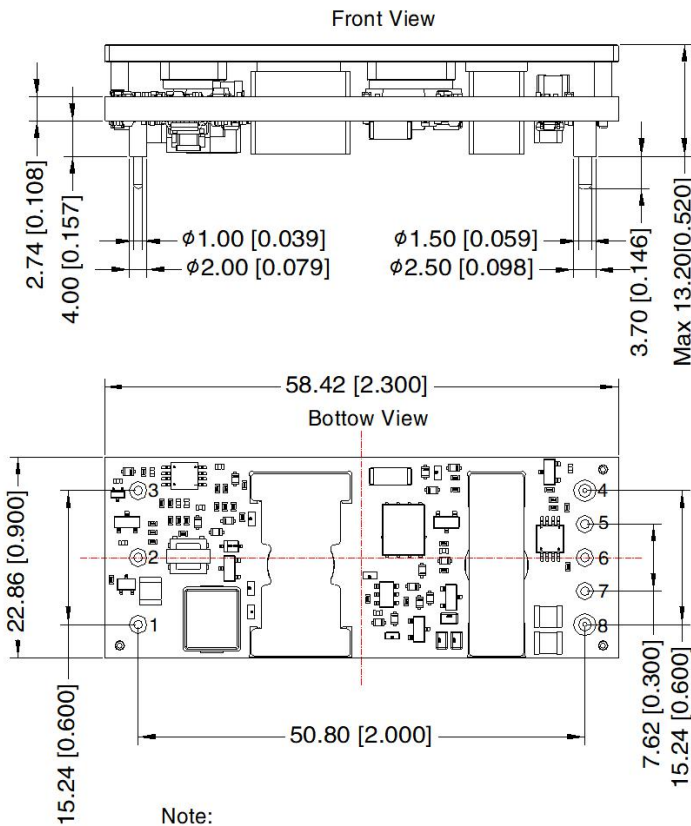
Note: Grid 2.54*2.54mm



| Pin-Out | |
|---------|--------|
| Pin | Mark |
| 1 | +Vin |
| 2 | Ctrl |
| 3 | -Vin |
| 4 | 0V |
| 5 | -Sense |
| 6 | Trim |
| 7 | +Sense |
| 8 | +Vo |

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

VCF24_EBO-120WFR3-N Dimensions and Recommended Layout



Note: Grid 2.54*2.54mm

| Pin-Out | |
|---------|----------|
| Pin | Function |
| 1 | +Vin |
| 2 | Ctrl |
| 3 | -Vin |
| 4 | 0V |
| 5 | -Sense |
| 6 | Trim |
| 7 | +Sense |
| 8 | +Vo |

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

Notes:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210119(VCF24_EBO-120WR3-N, 58210152(VCF24_EBO-120WFR3-N);
- We suggest to use module at load of over 5%, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
- 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.

Mornsun Guangzhou Science & Technology Co., Ltd.

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