DC/DC Converter

VCB48_EBO-400W(F/H)R3-N Series

MORNSUN®

400W, isolated DC-DC converter

Wide input and regulated single output



Patent Protection RoHS

EN62368-1 BS EN62368-1

FEATURES

- Wide input voltage range: 36-75VDC
- High efficiency up to 95%
- I/O isolation test voltage 1500VDC
- Operating ambient temperature range:-40℃ to +85℃
- Input under-voltage protection, over–voltage, over-current protection, output short circuit, over-temperature protection
- Industry standard package: 1/8 brick
- Meet EN62368 standards

VCB48_EBO-400W(F/H)R3-N series is a high performance product designed for the field of communication power supply, the output power can reach 400W, no minimum load requirements, with a wide voltage input of 36 - 75VDC, allowing the operating temperature up to 85℃. It features input under-voltage, output over-voltage, output over-current, output short-circuit, over-temperature protection, remote control and compensation, output-voltage regulation and other functions, by adding additional circuits to meet CISPR32/EN55032 CLASS B. It is widely used in battery powered equipment, industrial control, electric power, instrumentation, communication, intelligent robots and other fields.

Selection Guide

Certification	Part No.①	Input Voltage (VDC)		Output		Full Load Efficiency(%) Min./Typ.	Max. Capacitive Load(μF)	Mix. Capacitive Load(μF)
		Nominal (Range)	Max.②	Voltage (VDC)	Current (mA) Max./Min.			
EN/BS EN	VCB4810EBO-400WR3-N	48 (36-75)	80	10.8	16500	93.0/95.0	10000	470
					33000	92.5/94.5		
	VCB4812EBO-400W(F/H)R3-N			12	16500	93.0/95.0		
					33000	92.5/94.5		

Note:
① Suffix "F" means the product with aluminum base, "H" for the heat sink package;
② The input voltage should not exceed this value, otherwise permanent and unrecoverable damage may be caused;
③ In order to ensure the stability of output voltage, the output side of the product must be externally connected with a minimum capacitive load.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load / no-load)	Nominal input voltage	--	8731/90	8919	mA
Reflected Ripple Current	Nominal input voltage	--	150	--	
Surge Voltage (1sec. max.)		-0.7	--	100	VDC
Start-up Voltage		--	--	36	
Input Under-voltage Protection		30	32	--	
Start-up time	Nominal input voltage & constant resistance load	--	--	100	ms
Input Filter		LC filter			
Hot Plug		Unavailable			
Ctrl①	Module turn-on	Ctrl pin pulled low to GND (0-1.2VDC)			
	Module turn-off	Ctrl pin open or pulled high (TTL 3.5-12VDC)			
	Input current during shutdown	--	10	20	mA
	Respond Time	--	30	50	ms

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

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Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	Room temperature, nominal input voltage, 5%Io-100%Io	--	--	±2	%
	Room temperature, nominal input voltage, 0%Io-5%Io	--	±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(2.5A/us), nominal input voltage	--	--	400	μs
Transient response deviation		--	±2	±5	%
Temperature Coefficient	Full load	--	--	±0.03	%/℃
Ripple & Noise①	nominal input voltage, 100% load	--	--	200	mVp-p
Trim		90	--	110	%Vo
Sense		--	--	105	
Over-temperature Protection	Product surface max. temperature	--	130	--	℃
Over-voltage Protection	Input voltage range	110	125	130	%Vo
Over-current Protection		110	140	170	%Io
Short-circuit Protection		Hiccup, continuous, self-recovery			

①The "Tip and barrel method" is used for ripple and noise test, please refer to Wide Input Voltage DC-DC Converter Application Guide 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	Input-output	1500	--	--	VDC
Insulation Resistance	Input-output resistance at 500VDC		1000	--	--	MΩ
Isolation Capacitance	Input-output, 100KHz/0.1V		--	--	6000	pF
Operating Temperature	See temperature derating curves		-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	℃
	Wave soldering,10 seconds		255	260	265	
Shock and Vibration Test			10-150Hz, 5G, 0.75mm. along X, Y and Z			
Switching Frequency	PWM mode		--	370	--	KHz
MTBF	MIL-HDBK-217F @25℃		--	2000	--	K hours

Mechanical Specifications

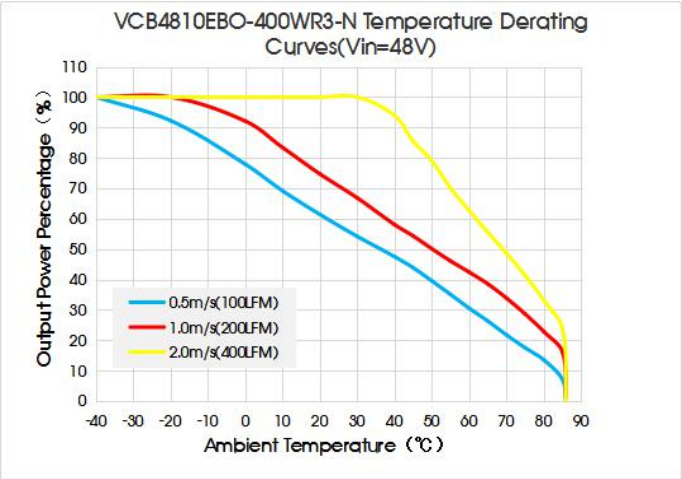
Shell Material	Aluminium alloy casing	
Size	VCB48_EBO-400WR3	58.42 x 22.86 x 14.30mm
	VCB48_EBO-400WFR3	58.42 x 22.86 x 16.80 mm
	VCB48_EBO-400WHR3	58.42 x 22.86 x 29.50 mm
Weight	VCB48_EBO-400WR3	30.5g(Typ.)
	VCB48_EBO-400WFR3	42g(Typ.)
	VCB48_EBO-400WHR3	61g(Typ.)
Cooling Method	Natural air cooling or forced air cooling	

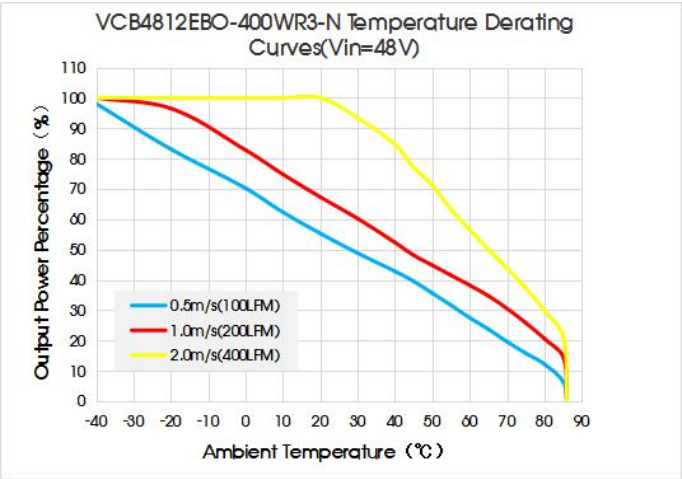
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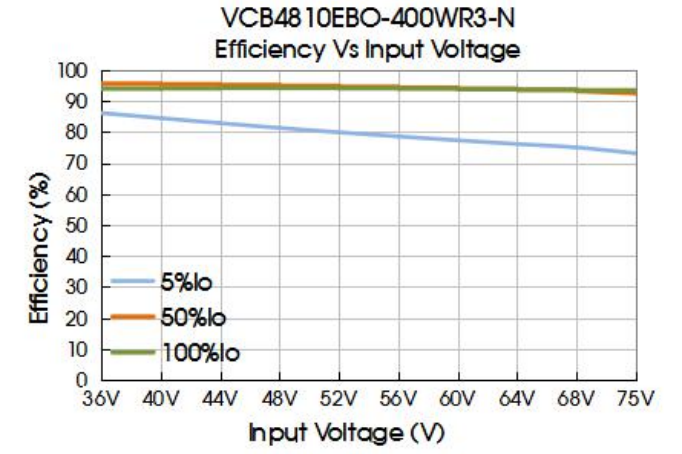
Electromagnetic Compatibility (EMC)

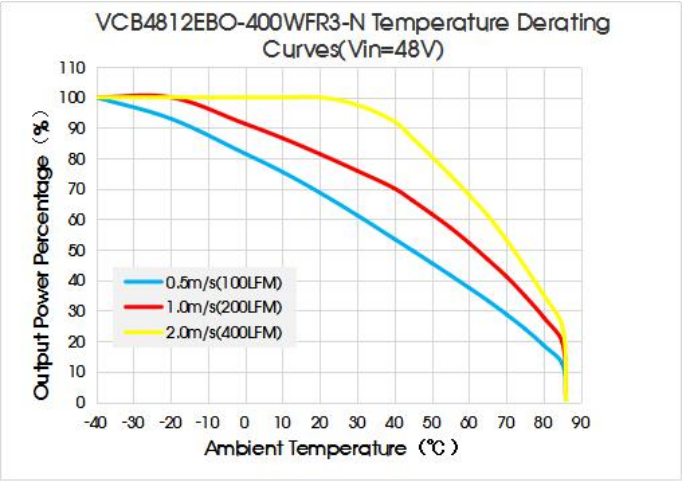
EMI	CE	CISPR32/EN55032 CLASS B (See Fig. 6 for recommended circuits)	
	RE	CISPR32/EN55032/EN50121-3-2 CLASS B (See Fig. 6 for recommended circuits)	
EMS	ESD	IEC/EN61000-4-2 Contact ±6KV, Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3 10V/m	perf.Criteria A
	EFT	IEC/EN61000-4-4 ±2KV (See Fig. 6 for recommended circuits)	perf.Criteria A
	Surge	IEC/EN61000-4-5 line to line ±2KV (See Fig. 6 for recommended circuits)	perf.Criteria B
	CS	IEC/EN61000-4-6 10Vr.m.s (See Fig. 6 for recommended circuits)	perf.Criteria A

Typical Characteristic Curve

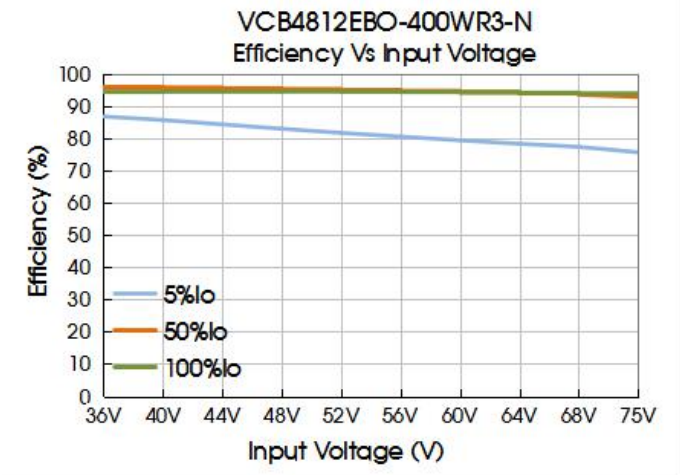


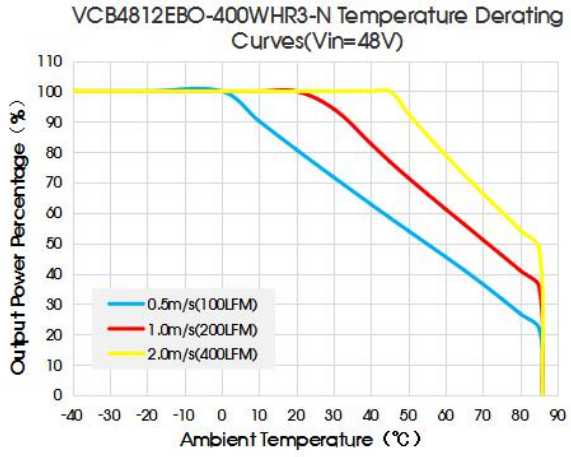


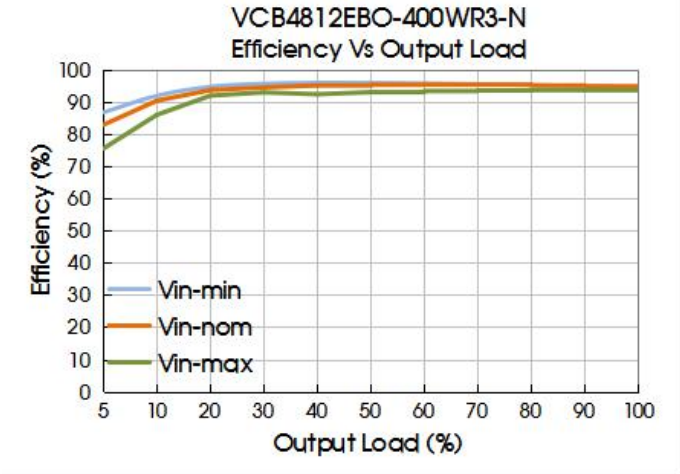




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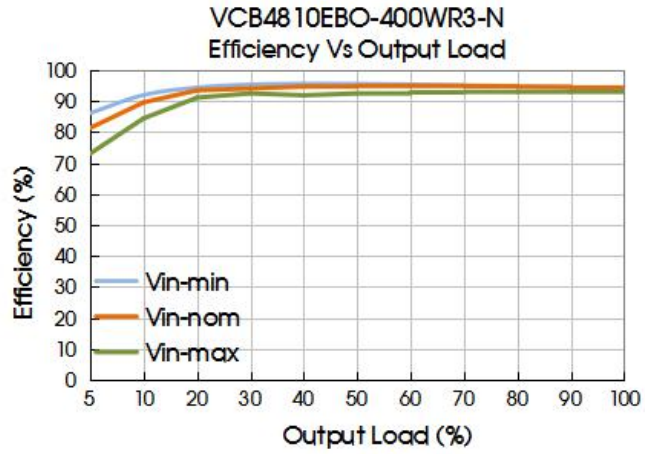


Fig.1

Remote Sense Application

1. Remote Sense Connection if not used

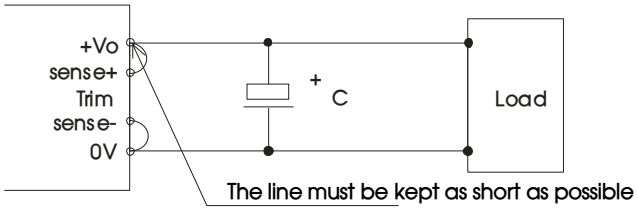


Fig.2

Note：

(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.

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2. Remote Sense Connection used for Compensation

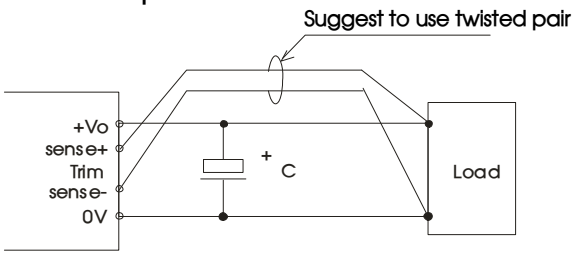


Fig.3

Note:

(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.

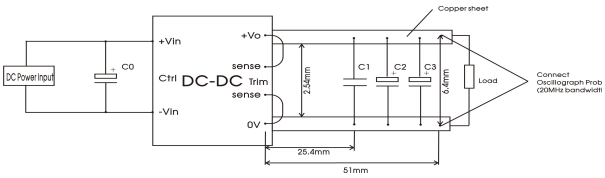


Fig.4

Output voltage \ Capacitors value	C0	C1	C2	C3
10.8VDC	220uF/100V	1μF/50V	10uF/50V	470μF/50V
12VDC				

2. Typical application

We recommended using Mornsun's EMC circuit, otherwise please ensure that at least a 220 μ F 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

Output Voltage \ Capacitance Values	Cout(min.)	Cin
12V	470μF/25V	220 μF/100V

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3. EMC compliance recommended circuit

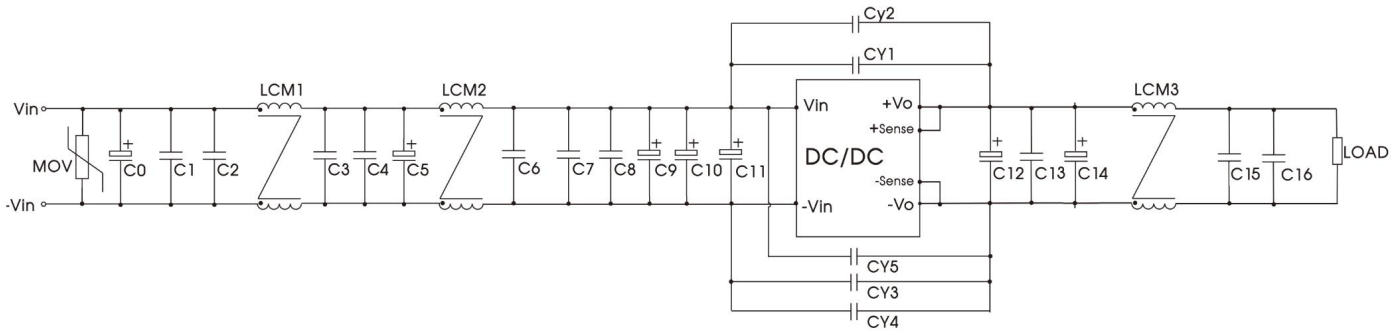
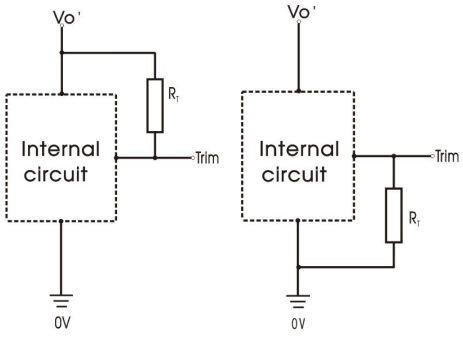


Fig.6

Device	Parameters
MOV	14D101K varistor
C0	680μF/100V electrolytic capacitor
C11	470μF/100V electrolytic capacitor
C12	470uF/63V electrolytic capacitor
C5, C9, C10	100uF/100V electrolytic capacitor
C14	470uF/35V solid-state capacitor
C1, C2, C3, C4, C6, C7, C8, C13, C15, C16	4.7μF/100V ceramic capacitance
LCM1	4.0mH, recommended to use MORNSUN P/N: FL2D-70-402
LCM2	1.0mH, recommended to use MORNSUN P/N: FL2D-90-102
LCM3	100uH±35, recommended to use MORNSUN P/N: FL2D-A0-101
CY1, CY2, CY3, CY5	1nF/400VAC safety standard Y capacitor
CY4	2.2nF/400VAC safety standard Y capacitor

4. Trim function for output voltage adjustment (open if unused)

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Trim up Trim down

TRIM resistor connection (dashed line shows internal resistor network)

Fig.7

Calculating Trim resistor values:

Trim up

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

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

5. Reflection ripple current test

The input reflected ripple current should be tested according to the peripheral circuit in Fig. 8.

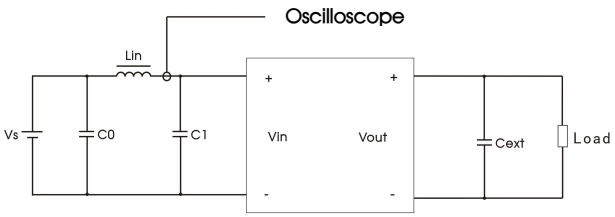
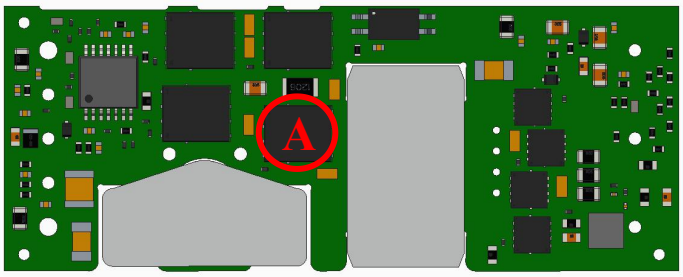


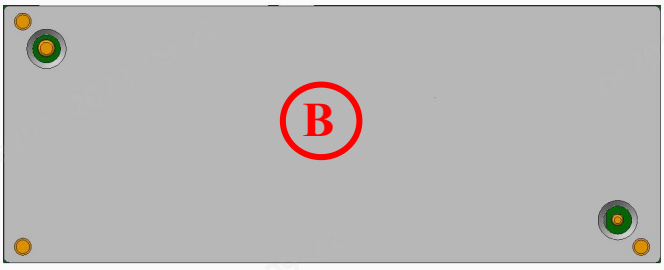
Fig.8

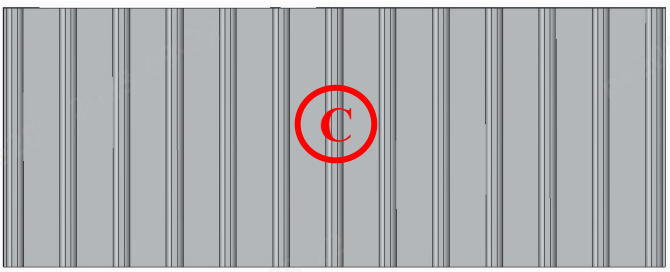
Device	Parameter
C0	220μF/100V
Lin	10uH/15A
C1	470μF/100V
Cext	470μF/63V

6. Recommended solution of thermal test

In the process of application, product thermal design can be evaluated by combining product temperature derating curve; Or determine the stable working range of the product by testing the temperature point in Figure 8. When point A is lower than 125℃, point B is lower than 115 ° C, and point C is lower than 115℃, it is the stable working range of the product.







7. Safety Specification

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The input is considered as safety extra low voltage (ES1/SELV) if one of the following conditions is met.

①The input source provides double or reinforced insulation from the AC mains according to IEC/EN/UL 62368-1;

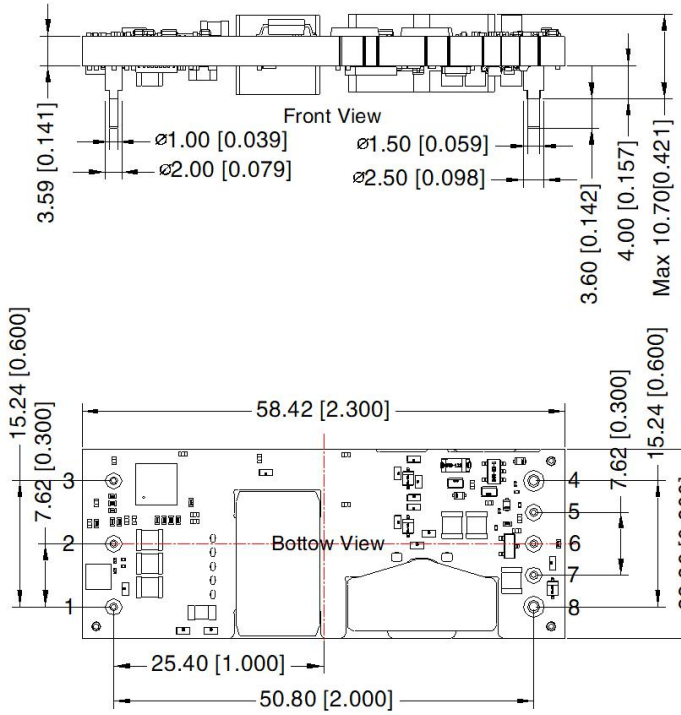
②The input source provides basic or supplementary insulation from the AC mains and product's output is reliably connected to protective earth according to IEC/EN/UL 62368-1;

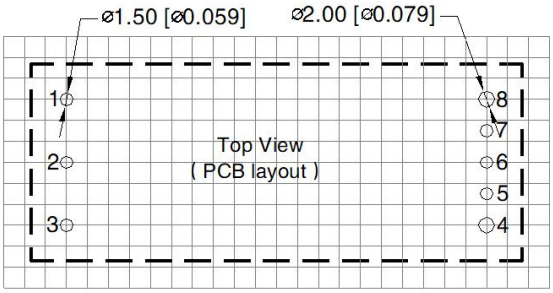
③The input source is reliably connected to protective earth and provides basic or supplementary insulation according to IEC/EN/UL 62368-1 and the maximum input source voltage is 60Vdc.

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

VCB48_EBO-400WR3-N Dimensions and Recommended Layout

THIRD ANGLE PROJECTION





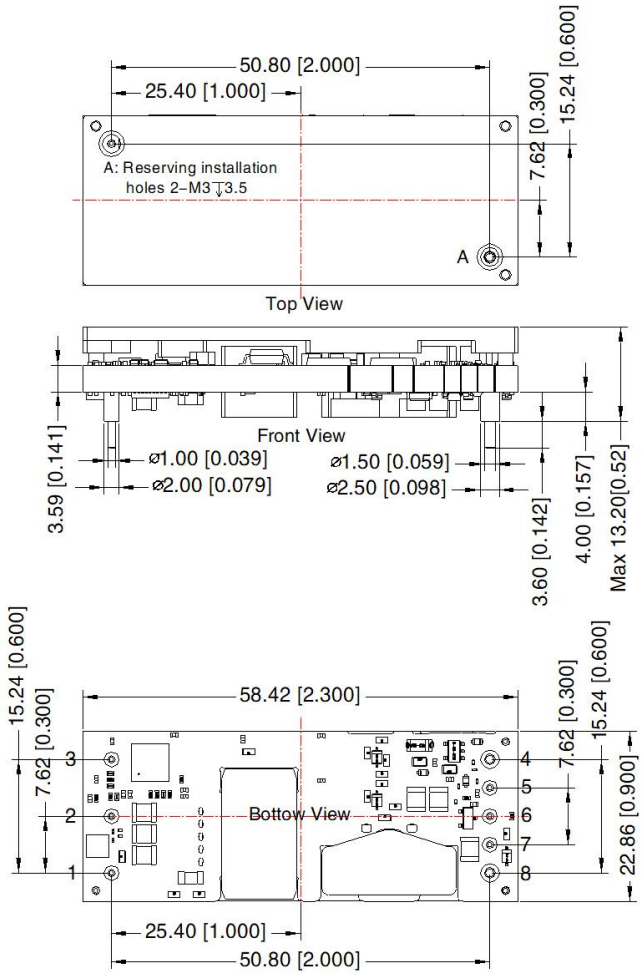
Note: Grid 2.54*2.54mm

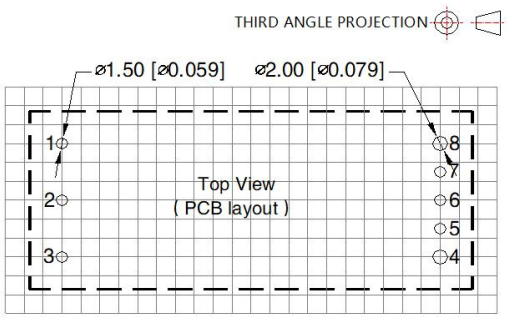
Pin-Out	
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	-Sense
6	Trim
7	+Sense
8	+Vo

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

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VCB48_EBO-400WFR3-N Dimensions and Recommended Layout





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

installation position	Screw specification	Twisting force (Max)
A	M3	0.4N・m

Sign Interpretation
2-M3↧3.5
3.5mm Deep hole
Metric thread size
2 places in total

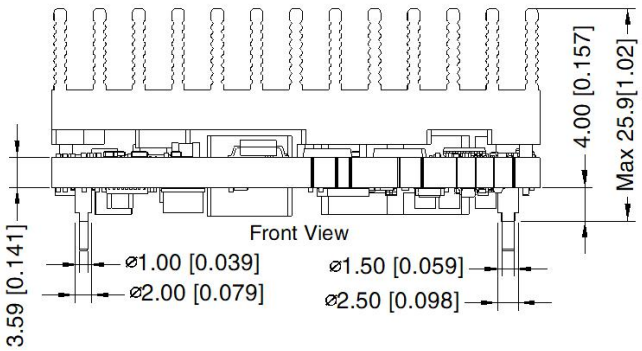
Warning: The length of the screw for mounting the reserved hole must not exceed the hole depth, otherwise, the

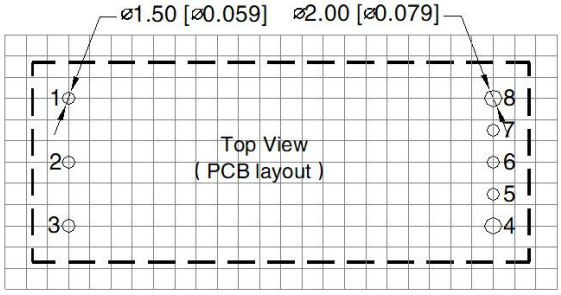
Note:
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General tolerances: ±0.50[±0.020]
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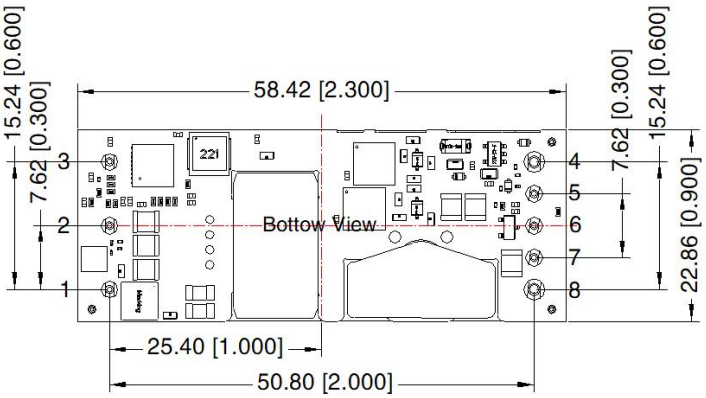
VCB48_EBO-400WHR3-N Dimensions and Recommended Layout

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	

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

Note:

1. For the packaging information, please refer to the Product Shipping Packaging Information. Package number: VCB48_EBO-400WR3\VCB48_EBO-400WFR3: 58210192 ;VCB48_EBO-400WHR3: 58210190;
2. The maximum capacitive load is tested in the input voltage range and under full load condition;
3. Unless otherwise stated, all indicators in this manual are in Ta=25℃, humidity & LT; 75%RH, nominal input voltage and output rated load measured;
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. The products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified companies.

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