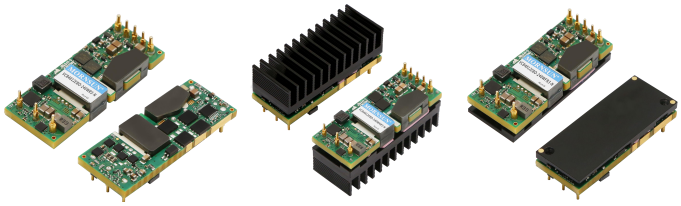
DC/DC Converter

VCB48_EBO-240W(F/H)R3-N Series

MORNSUN®

240W isolated DC-DC converter
Wide input and regulated single output



EN62368-1 BS EN62368-1 Patent Protection RoHS

FEATURES

- Wide input voltage range: 36-75 VDC
- High efficiency up to 95%
- I/O isolation test voltage 1500 VDC
- 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-240W(F/H)R3-N series is a high performance product designed for the field of communication power supply, the output power can reach 240W, no minimum load requirements, with a wide voltage input of 36-75VDC, allowing the perating 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.	Half- Load Efficiency(%) Min./Typ.	Max. Capacitive Load(μF)	Mix. Capacitive Load③ (μF)
		Nominal (Range)	Max.②	Voltage (VDC)	Current (mA) Max./Min.				
EN/BS EN	VCB4810EBO-240W(F/H)R3-N	48 (36-75)	80	10.8	22200/0	92/94	93/95	10000	470
	VCB4812EBO-240W(F/H)R3-N			12	20000/0				
--	VCB4824EBO-240W(F/H)R3-N			24	10000/0	91/93	92/94	4000	
	VCB4828EBO-240W(F/H)R3-N			28	8600/0			3500	

Notes:
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		--	5319/60	5435/100	mA
Reflected Ripple Current	Nominal input voltage	VCB4810(12)EBO-240W(F/H)R3-N	--	200	--	
		VCB4824(28)EBO-240W(F/H)R3-N	--	150	300	
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			
Ctrl ①	Module turn-on		Ctrl pin pulled low to GND (0-1.2VDC)			
	Module turn-off	VCB4810(12)EBO-240W(F/H)R3-N	Ctrl pin open or pulled high (TTL 3.5-12VDC)			
		VCB4824(28)EBO-240W(F/H)R3-N	Ctrl pin open or pulled high (TTL 4.5-12VDC)			
	Respond 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		--	±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	±3	%
Temperature Coefficient	Full load	--	--	±0.03	%/℃
Ripple & Noise①	nominal input voltage, 100% load	--	100	200	mVp-p
Trim	Input voltage range	90	--	110	%Vo
Sense		--	--	105	
Over-temperature Protection	Product surface max. temperature	--	130	--	℃
Over-voltage Protection		110	125	130	%Vo
Over-current Protection		110	140	170	%Io
Short-circuit Protection		Hiccup, continuous, self-recovery			

Note: 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
Operating Temperature	See temperature derating curves		-40	--	+85	℃
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			10-150Hz, 5G, 0.75mm. along X, Y and Z			
Switching Frequency①	PWM mode		--	370	--	KHz
MTBF	MIL-HDBK-217F@25℃		--	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

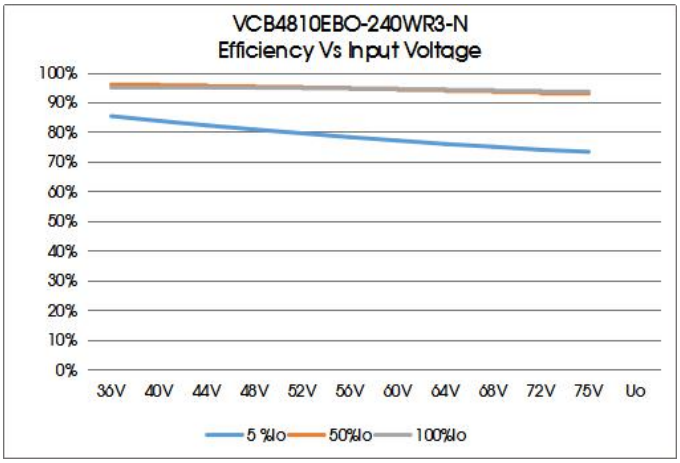
Shell Material	Aluminium alloy shell		
Size	VCB48_EBO-240WR3-N		58.42 x 22.86 x10.7 mm
	VCB48_EBO-240WFR3-N		58.42 x 22.86 x 13.2 mm
	VCB48_EBO-240WHR3-N		58.42 x 22.86 x 25.9 mm
Weight	VCB48_EBO-240WR3-N	10.8V, 12V, 24V Output	30.5g(Typ.)
		28V Output	31.0g(Typ.)
	VCB48_EBO-240WFR3-N		42g(Typ.)
	VCB48_EBO-240WHR3-N		61g(Typ)
Cooling Method	Natural air cooling or forced air cooling		

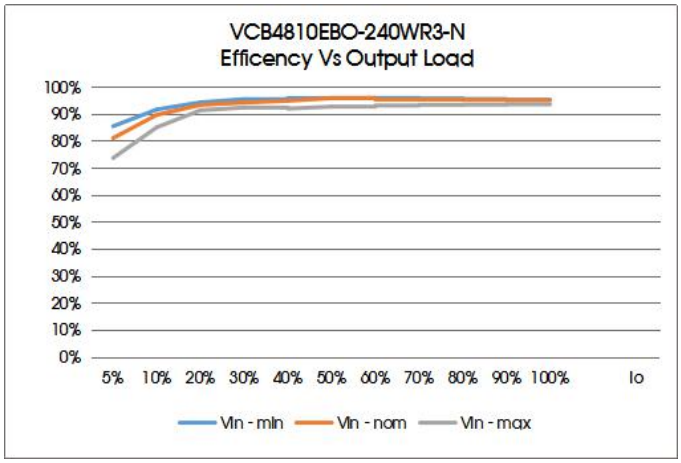
Electromagnetic Compatibility (EMC)

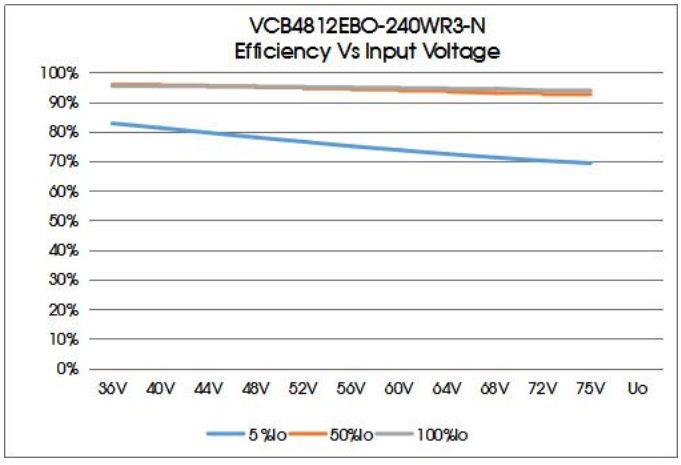
EMI	CE	VCB4810(12)EBO-240W(F/H)R3-N	CISPR32/EN55032 CLASS B (See Fig. 6 for recommended circuits)
		VCB4824(28)EBO-240W(F/H)R3-N	CISPR32/EN55032 CLASS A (See Fig. 7 for recommended circuits)/CLASS B (See Fig. 8 for recommended circuits)
	RE	VCB4810(12)EBO-240W(F/H)R3-N	CISPR32/EN55032 CLASS B (See Fig. 6 for recommended circuits)

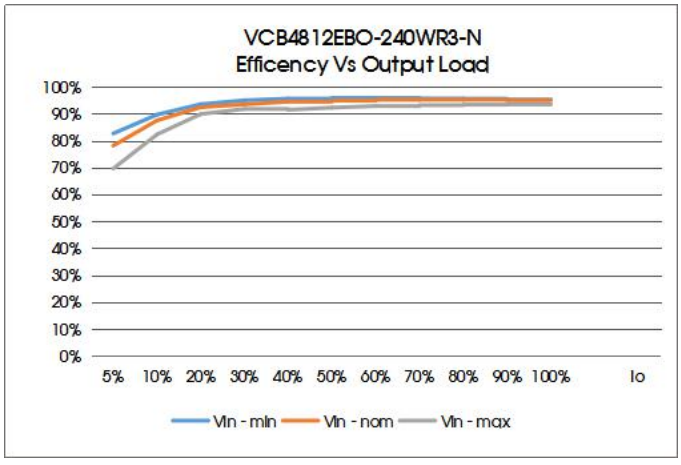
		VCB4824(28)EBO-240W(F/H)R3-N	CISPR32/EN55032 CLASS A (See Fig. 7 for recommended circuits)/CLASS B (See Fig. 8 for recommended circuits)	
EMS	ESD	IEC/EN61000-4-2 Contact ±6KV/Air ±8KV		perf. Criteria B
	RS	VCB4810(12)EBO-240W(F/H)R3-N	IEC61000-4-3 10V/m (See Fig. 6 for recommended circuits)	perf. Criteria A
		VCB4824(28)EBO-240W(F/H)R3-N	IEC61000-4-3 10V/m (See Fig. 8 for recommended circuits)	
	EFT	VCB4810(12)EBO-240W(F/H)R3-N	IEC61000-4-4 ±2KV (See Fig. 6 for recommended circuits)	perf. Criteria A
		VCB4824(28)EBO-240W(F/H)R3-N	IEC61000-4-4 ±2KV (See Fig. 8 for recommended circuits)	
	Surge	VCB4810(12)EBO-240W(F/H)R3-N	IEC/EN61000-4-5 line to line ±2KV (See Fig. 6 for recommended circuits)	perf. Criteria B
		VCB4824(28)EBO-240W(F/H)R3-N	IEC/EN61000-4-5 line to line ±2KV (See Fig. 8 for recommended circuits)	
	CS	VCB4810(12)EBO-240W(F/H)R3-N	IEC61000-4-6 10Vr.m.s (See Fig. 6 for recommended circuits)	perf. Criteria A
		VCB4824(28)EBO-240W(F/H)R3-N	IEC61000-4-6 10Vr.m.s (See Fig. 8 for recommended circuits)	

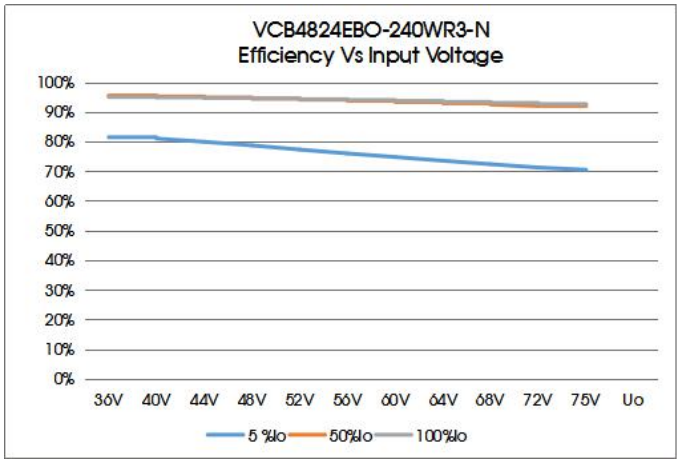
Typical Characteristic Curve

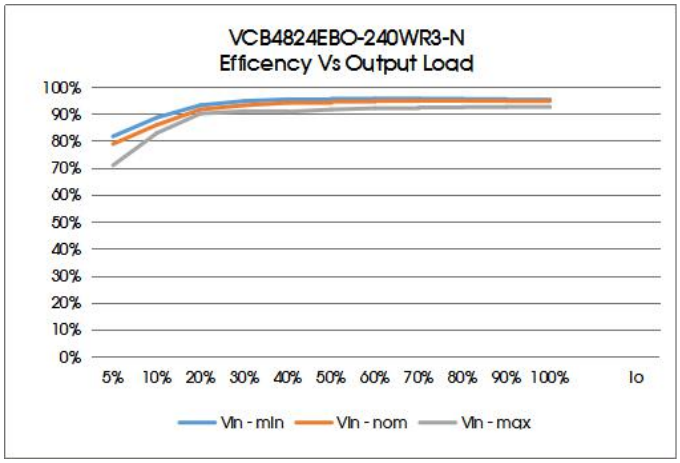


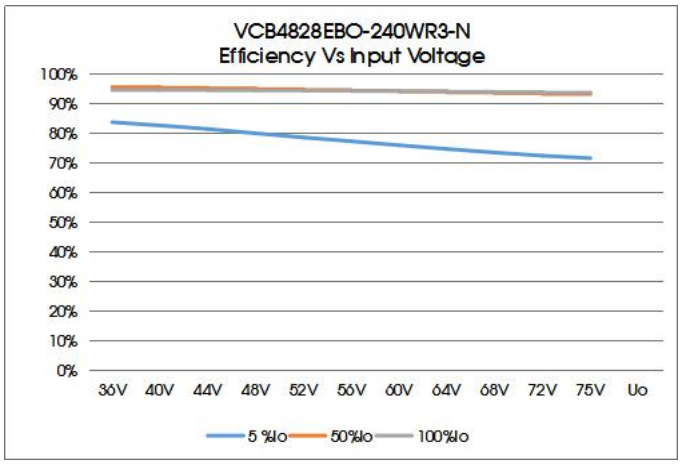


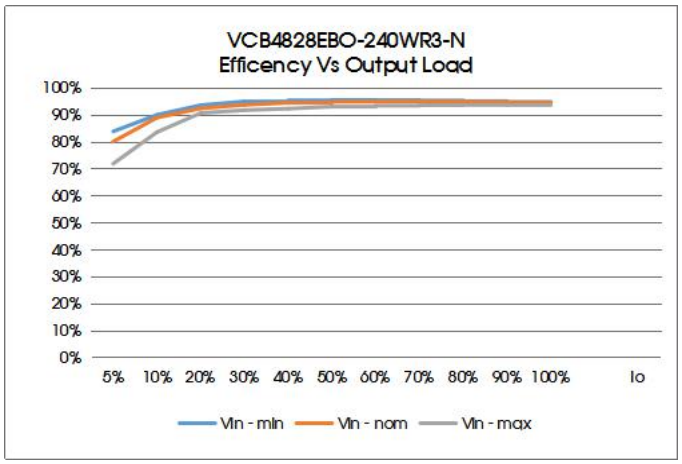


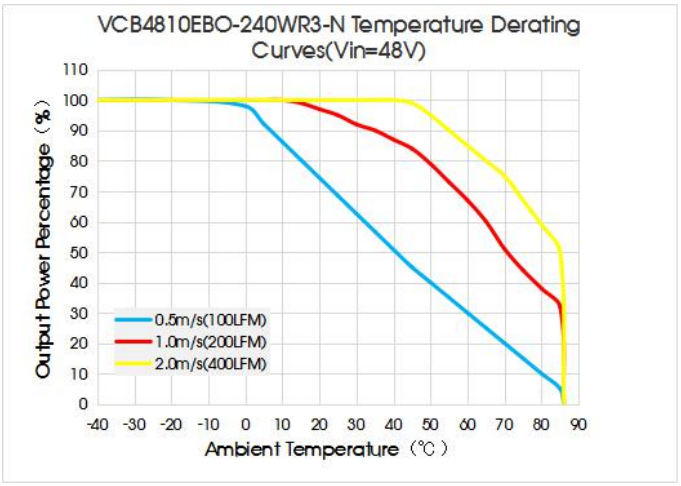


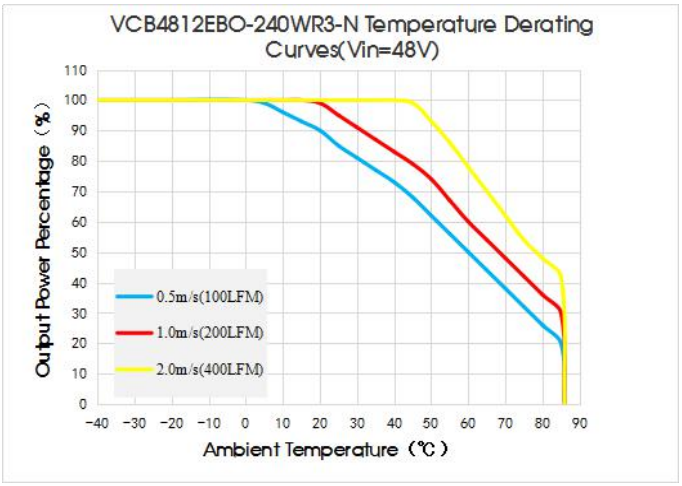


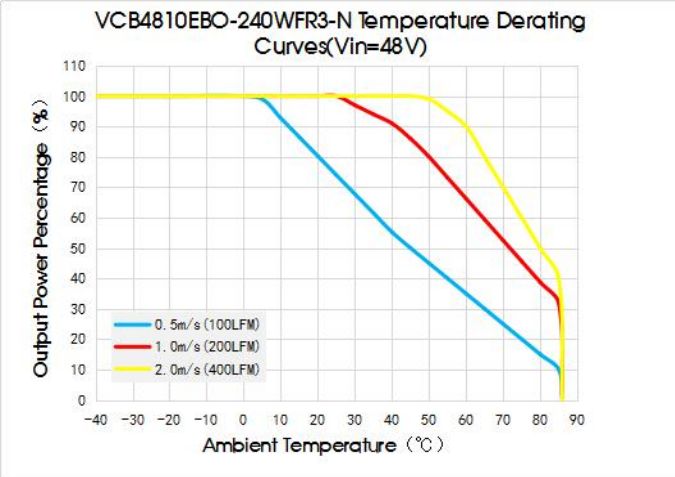


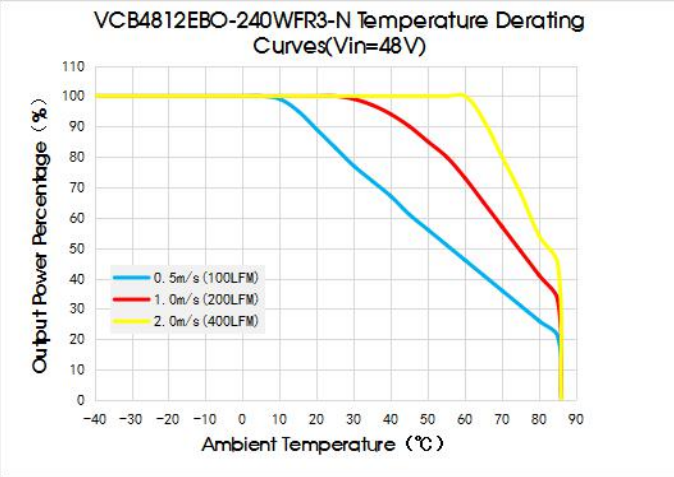


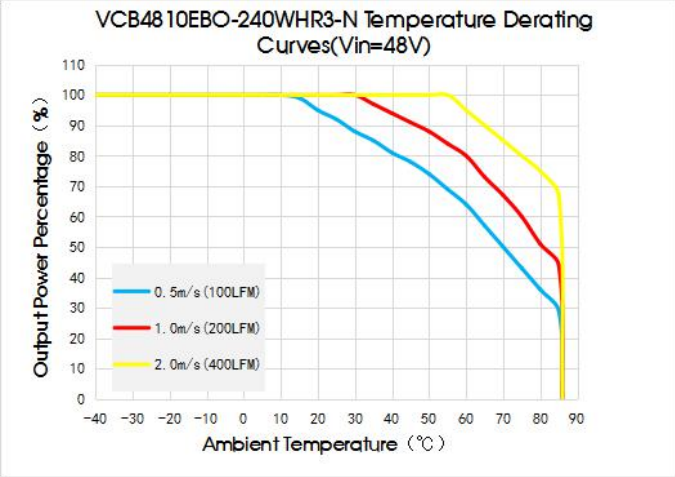


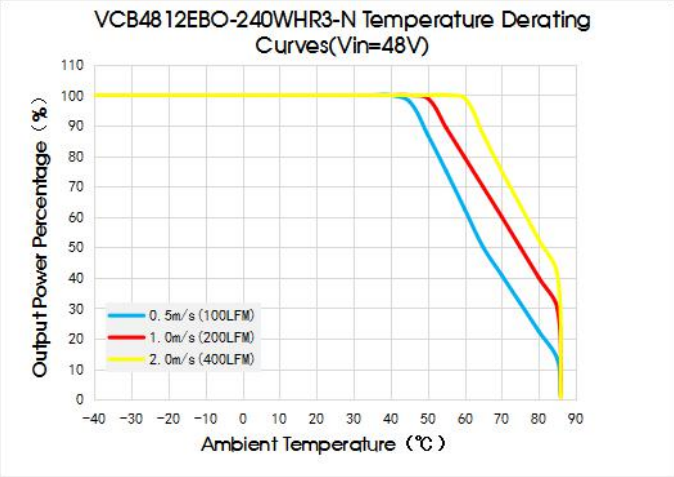


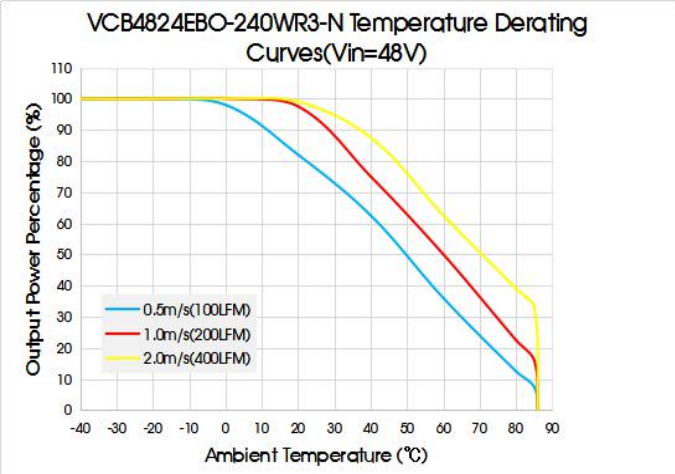


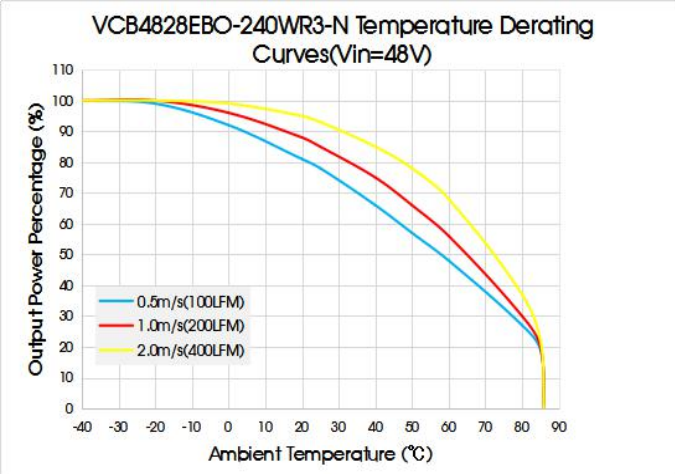


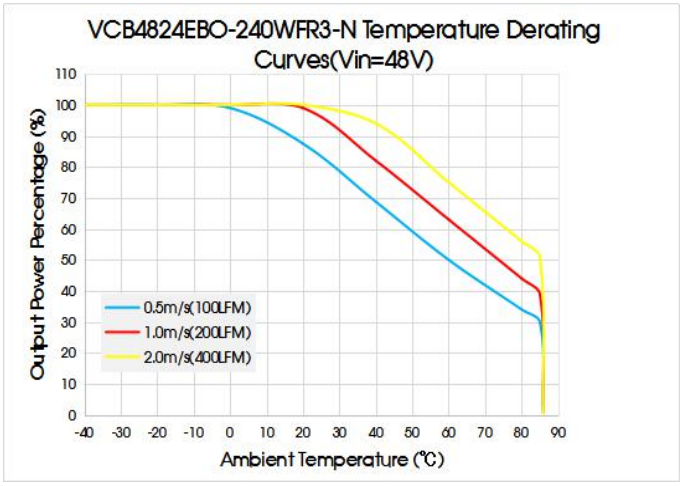


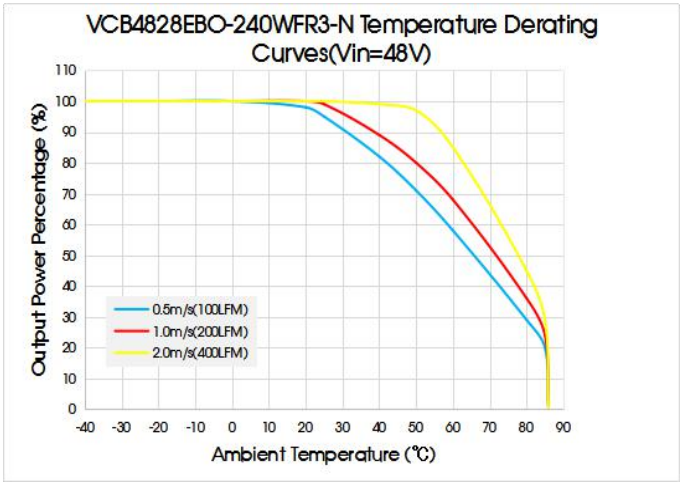


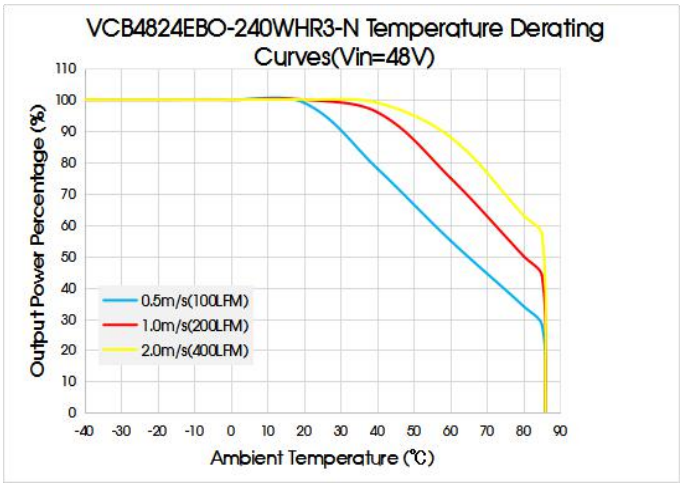












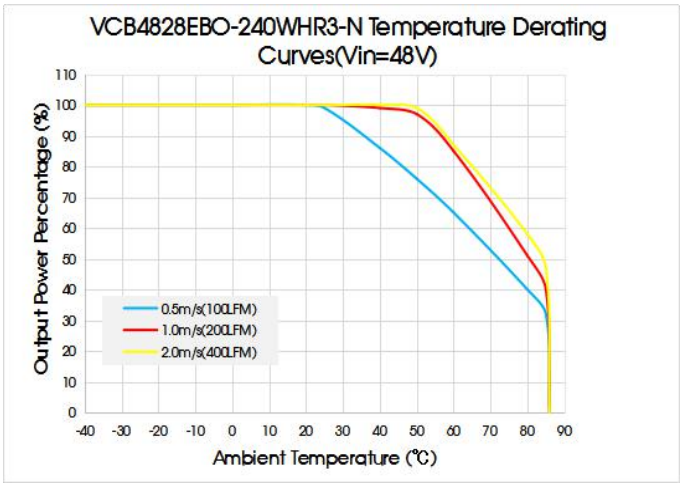


Fig. 1

Remote Sense Application

1. Remote Sense Connection if not used

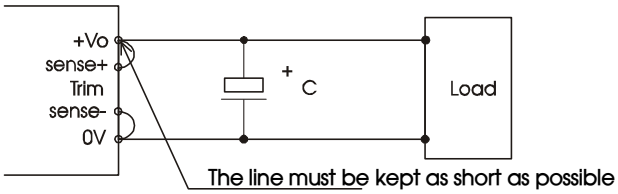


Fig. 2

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

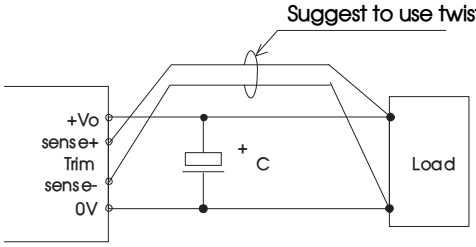


Fig. 3

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.

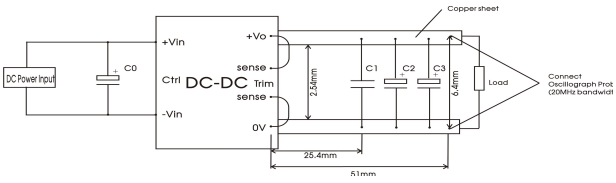


Fig. 4

Output voltage \ Capacitors value	C0	C1	C2	C3
10.8VDC	220uF/100V	1μF/50V	10uF/50V	470μF/50V
12VDC				
24VDC				
28VDC				

2. Typical application

We recommended using Mornsun's EMC circuit, otherwise please ensure that at least a 220μF 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/10.8V/24V/28V	470μF	220 μF

3. EMC compliance recommended circuit

(1) VCB4810(12)EBO-240W(F/H)R3-N EMC compliance recommended circuit

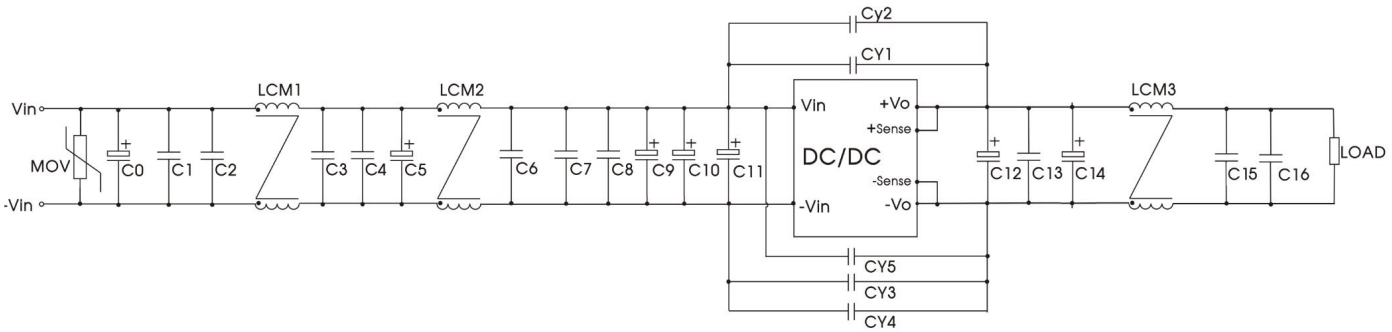


Fig. 6

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

(2) VCB4824(28)EBO-240W(F/H)R3-N EMC compliance recommended circuit

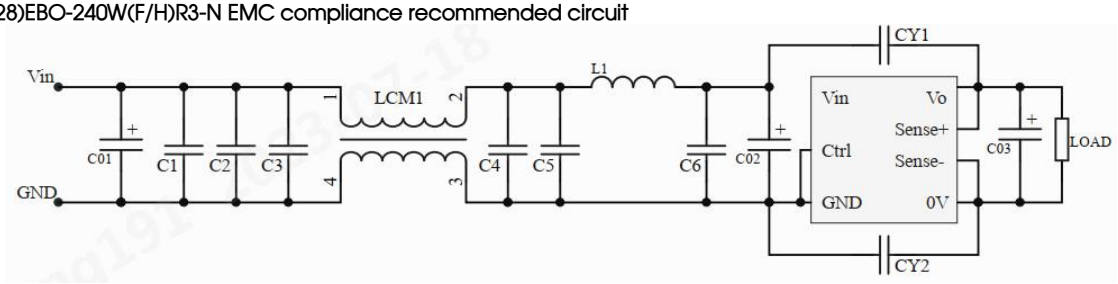


Fig. 7

Device	Parameters
C01	470uF/100V
C02	1000uF/100V
C03	470uF/50V
C1、C2、C3、C4、C5	2.2uF/100V
C6	0.1uF/100V
LCM1	2.0mH, recommended to use MORNSUN P/N: FL2D-A2-202
L1	1.5uH
CY1、CY2	1nF/400VAC

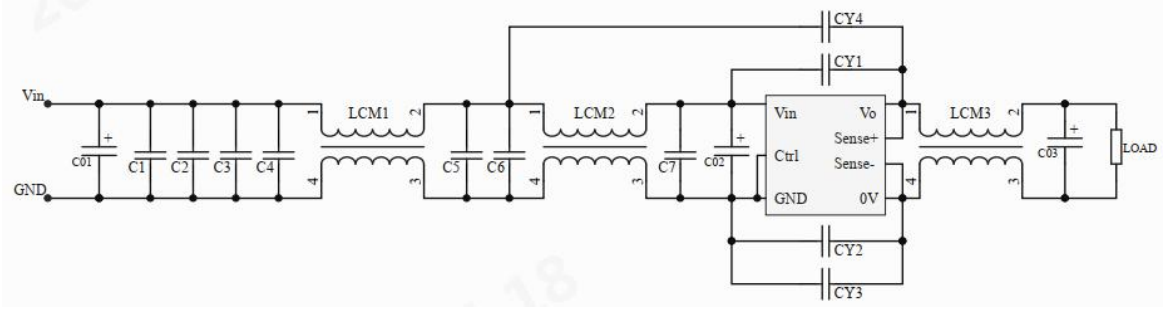
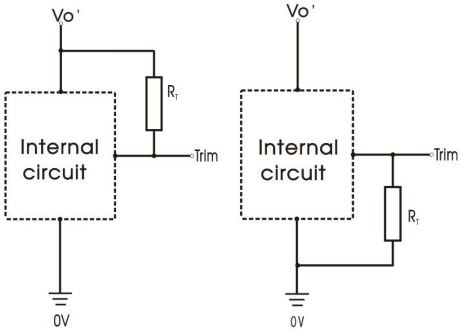


Fig. 8

Device	Parameters
C01	470uF/100V
C02	1000uF/100V
C03	470uF/50V
C1	0.33uF/275V

C7	0.1uF/100V
C2、C3、C4、C5、C6	2.2uF/100V
LCM1、LCM2	2.0mH, recommended to use MORNSUN P/N: FL2D-A2-202
CY1、CY2、CY3	1nF/400VAC
CY4	2.2nF/400VAC

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



Tim up Trim down

TRIM resistor connection (dashed line shows internal resistor network)

Fig. 9

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

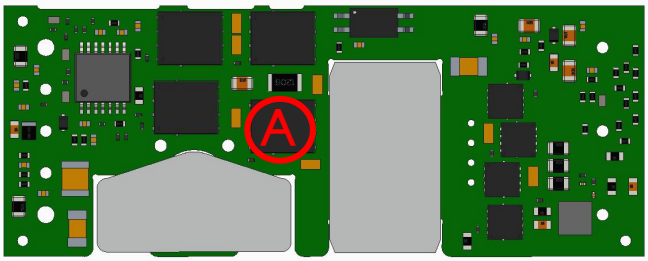
$$\Delta\% = \left| \frac{V_{nom} - V_{out}}{V_{nom}} \right| \times 100$$

V_{nom} = nominal output voltage

V_{out} = desired output voltage

5. Recommended solution for thermal test

During the application process, the thermal design of the product can be evaluated in combination with the product temperature derating curve, or the stable working range of the product can be determined by testing the temperature at point A in Figure 10. It is an safe operating area for VCB4810/12EBO-240WR3-N if the temperature lower than 125℃ at point A. It is an safe operating area for VCB4824EBO-240WR3-N if the temperature lower than 125℃ at point B. It is an safe operating area for VCB4828EBO-240WR3-N if the temperature lower than 125℃ at point C. It is an safe operating area for VCB48_EBO-240WFR3-N if the temperature lower than 115℃ at point D. It is an safe operating area for VCB48_EBO-240WHR3-N if the temperature lower than 115℃ at point E.



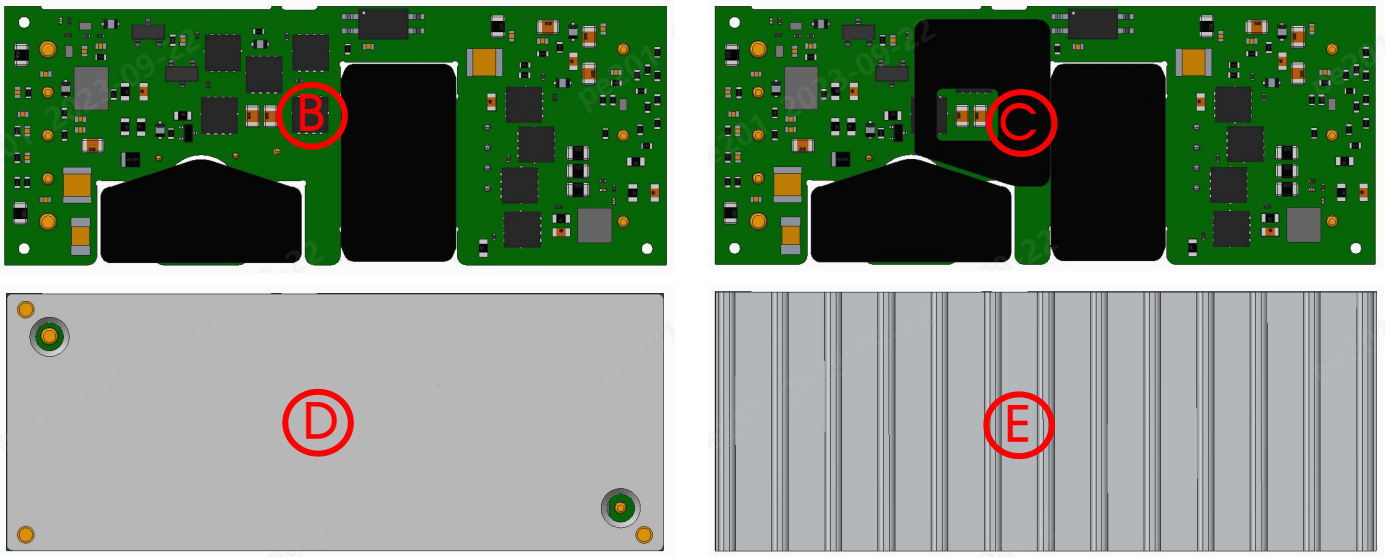


Fig.10

6. Reflection ripple current test

The input reflected ripple current should be tested according to the peripheral circuit in Fig. 11.

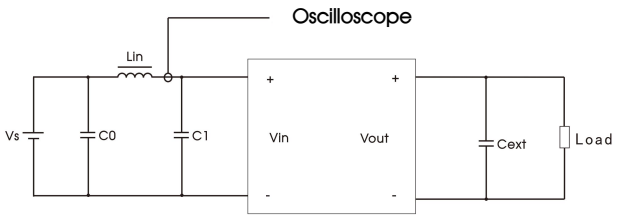


Fig. 11

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

7. Safety Specification

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;

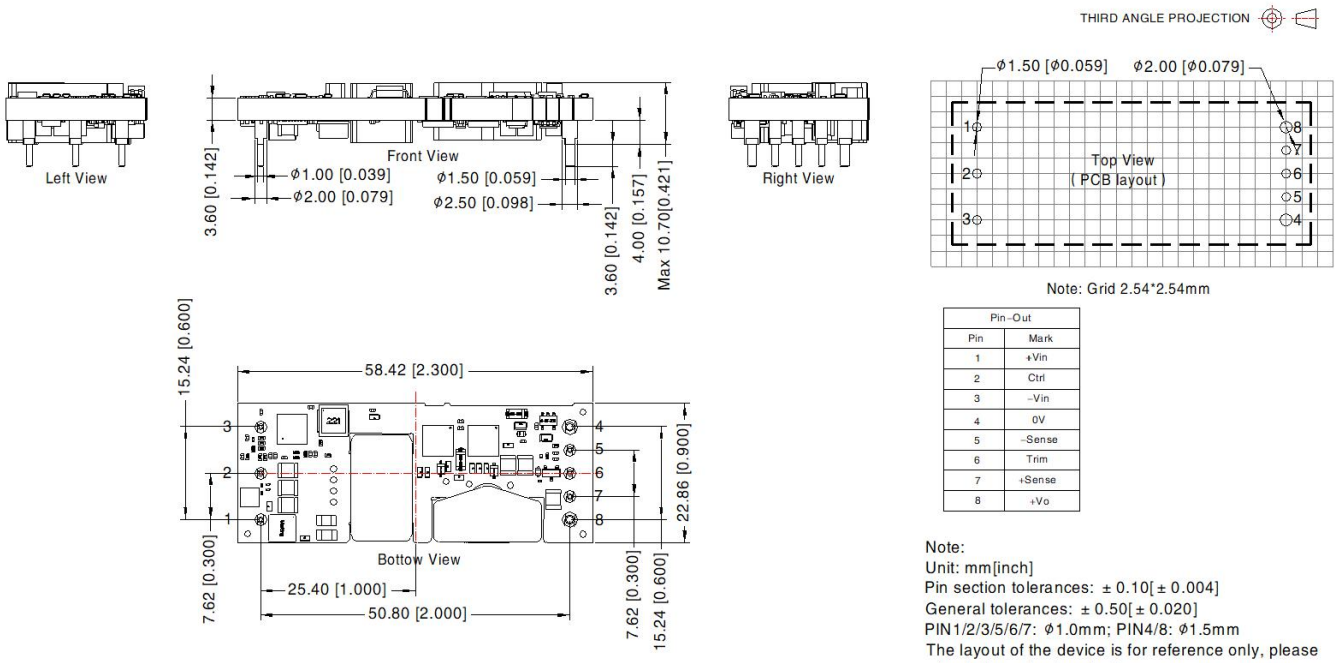
②The input source provides basic or supplementary insulation from the AC mains and product's output is reliably connected to protective earth according to IEC/EN/UL 62368-1;

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

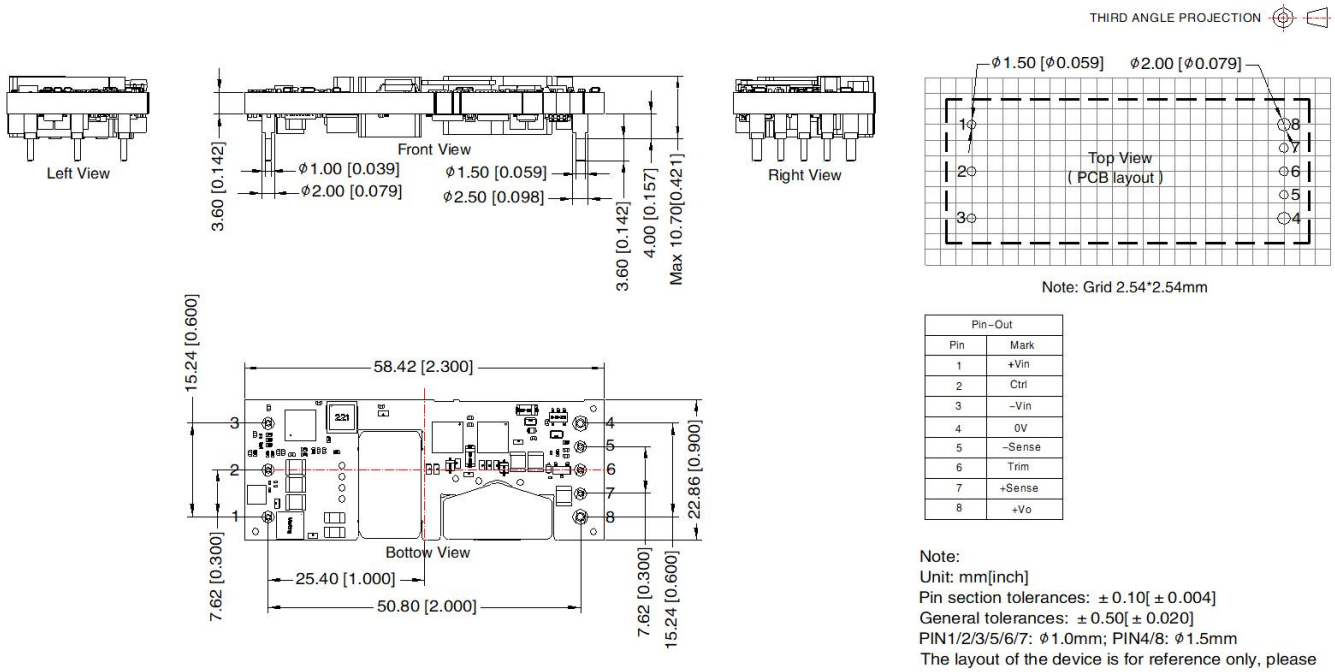
VCB4810/12/24EBO-240WR3-N Dimensions and Recommended Layout



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: Ø1.0mm; PIN4/8: Ø1.5mm
The layout of the device is for reference only, please refer to the actual product

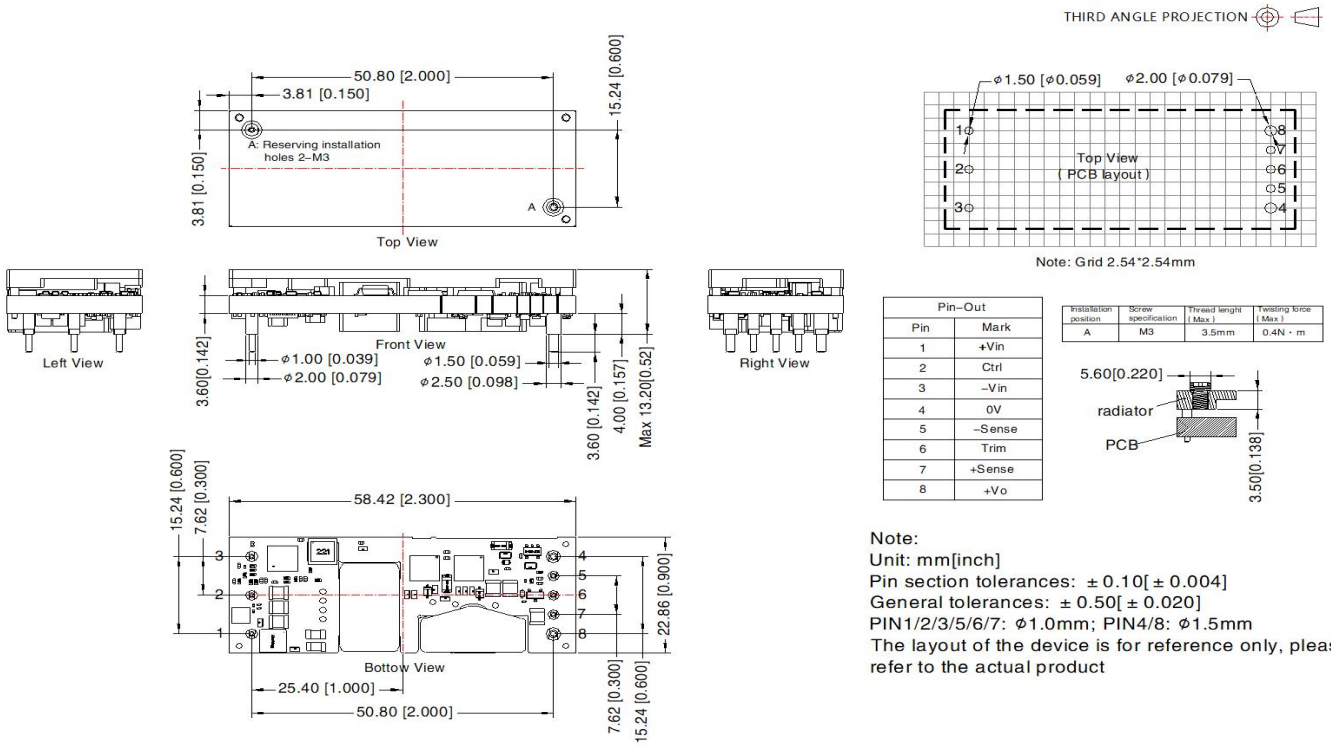
VCB4828EBO-240WR3-N Dimensions and Recommended Layout



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: Ø1.0mm; PIN4/8: Ø1.5mm
The layout of the device is for reference only, please refer to the actual product

VCB48_EBO-240WFR3-N Dimensions and Recommended Layout

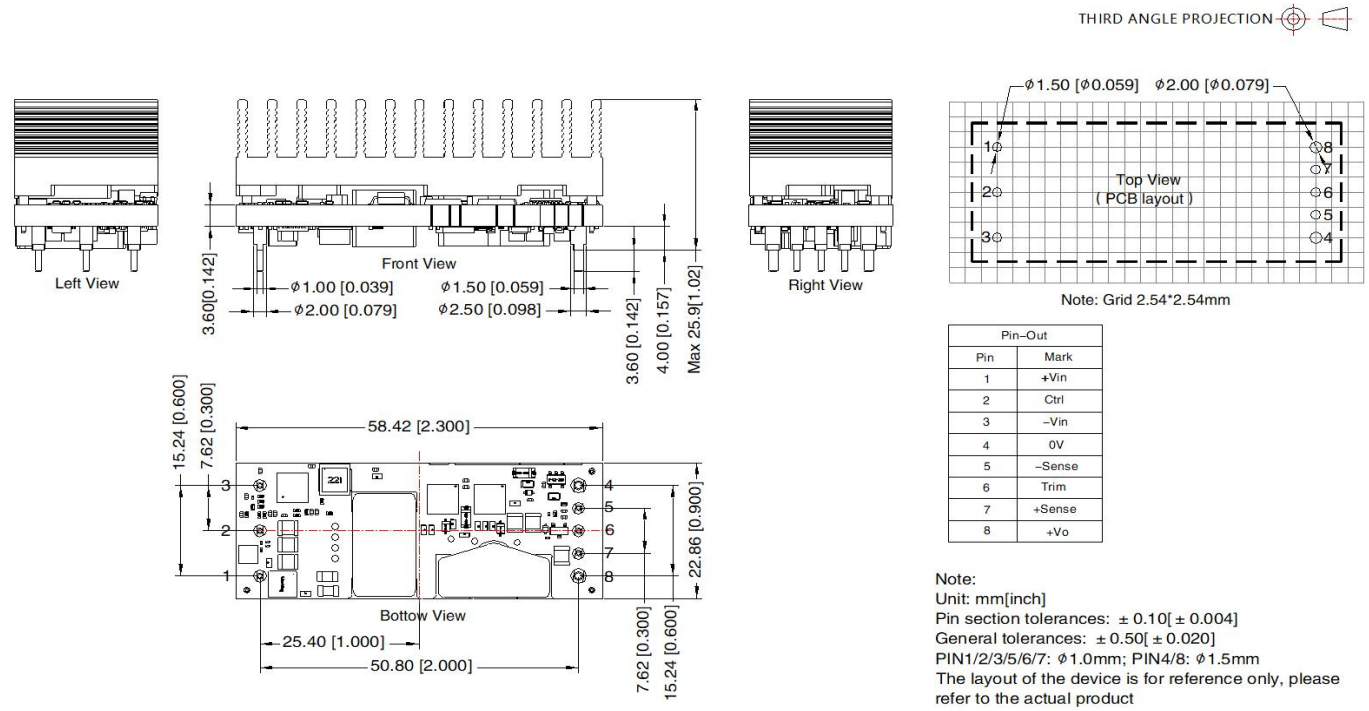


Pin-Out	
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	-Sense
6	Trim
7	+Sense
8	+Vo

Installation position	Screw specification	Thread lenght (Max)	Twisting force (Max)
A	M3	3.5mm	0.4N · m

Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
PIN1/2/3/5/6/7: ø1.0mm; PIN4/8: ø1.5mm
The layout of the device is for reference only, please refer to the actual product

VCB48_EBO-240WHR3-N Dimensions and Recommended Layout



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: ø1.0mm; PIN4/8: ø1.5mm
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: 58210192(VCB48_EBO-240W(F)R3-N), 58210190(VCB48_EBO-240WHR3-N);
2. It is recommended to use at more than 10% load, the ripple index of the product may exceed the specification of the product will not be affected;
3. If the product works below the minimum required load, the performance of the product cannot be guaranteed to meet all performance;
4. The maximum capacitive load is tested in the input voltage range and under full load condition;
5. Unless otherwise stated, all indicators in this manual are in Ta=25℃, humidity & LT; 75%RH, nominal input voltage and output rated load measured;
6. All index test methods in this manual are in accordance with the company's enterprise standards;
7. We can provide product customization service, please contact our technicians directly for specific information;
8. The product involves laws and regulations: see "Product Features" and "EMC Features";
9. After scrapping, our products shall be classified and stored in accordance with ISO14001 and relevant environmental laws and regulations, and handed over to qualified units.

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