Descriptions

240W isolated，DC/DC Converter



RoHS 3 Years Warranty

CE Report EN62368-1　UKCA Report BS EN62368-1

Features

- Wide input voltage range: 36-75 VDC
- High efficiency up to 94%
- 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

Applications

- Battery powered equipment
- Industrial control
- Electric power
- Instrumentation
- Communication
- Intelligent robots

Selection Guide

Certification	Part No.①	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Half- Load Efficiency (%) Min./Typ.	Max. Capacitive Load(μF)	Min. Capacitive Load③ (μF)
		Nominal (Range)	Max②	Voltage (VDC)	Current (mA) Max./Min.				
EN/BS EN	DOEB240-B4810(F/H)N	48 (36-75)	80	10.8	22200/0	92/94	93/95	10000	470
	DOEB240-B4812(F/H)N			12	20000/0				
	DOEB240-B4824(F/H)N			24	10000/0	91/93	92/94	4000	
	DOEB240-B4828(F/H)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;
④Product images are for reference only; the actual product shall prevail.

Specifications

Product Specifications	Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Specifications	Input Current (full load / no-load)			--	5319/60	5435/100	mA
	Reflected Ripple Current	DOEB240-B4810(12)(F/H)N		--	200	--	VDC
		DOEB240-B4824(28)(F/H)N		--	150	300	
	Surge Voltage (1sec. max.)			-0.7	--	100	
	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	DOEB240-B4810(12)(F/H)N	Ctrl pin open or pulled high (TTL 3.5-12VDC)			
			DOEB240-B4824(28)(F/H)N	Ctrl pin open or pulled high (TTL 4.5-12VDC)			
		Respond Time		--	30	50	ms
Output Specifications	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 & Noise②	nominal input voltage, 100% load		--	100	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			
General Specifications	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 Temperature③	Soldering spot is 1.5mm away from the case, 10 seconds max.	--	--	+300	℃
		Wave soldering, maximum 10 seconds	255	260	265	
	Shock and Vibration Test		10-150Hz, 5G, 0.75mm. along X, Y and Z			
	Switching Frequency④	PWM mode	--	370	--	KHz
	MTBF	MIL-HDBK-217F@25℃	--	2000	--	K hours
Mechanical Specifications	Shell Material	Aluminium alloy shell				
	Size	DOEB240-B48xxN	58.42 x 22.86 x10.7 mm			
		DOEB240-B48xxFN	58.42 x 22.86 x 13.2 mm			
		DOEB240-B48xxHN	58.42 x 22.86 x 25.9 mm			
	Weight	DOEB240-B48xxN 10.8V/12V/24V	30.5g(Typ.)			
		DOEB240-B48xxN 28V	31.0g(Typ.)			
		DOEB240-B48xxFN	42g(Typ.)			
		DOEB240-B48xxHN	61g(Typ)			
	Cooling Method	Natural air cooling or forced air cooling				

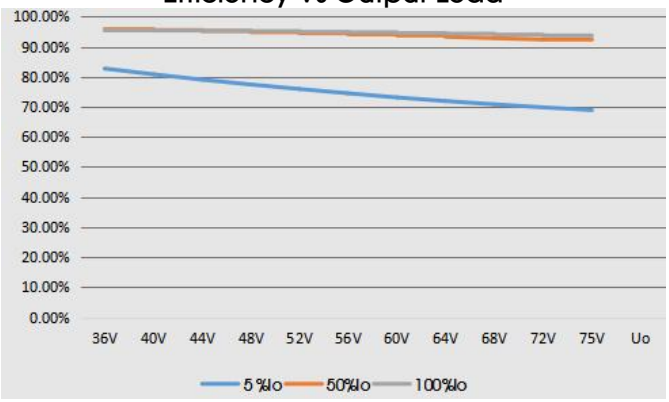
Note:
①The Ctrl pin voltage is referenced to input -Vin.
②The "Tip and barrel method" is used for ripple and noise test, please refer to Wide Input Voltage DC-DC Converter Application Guide for specific information.
③The pin soldering temperature tolerance is not the actual temperature set by the soldering iron but the temperature required for proper solder joints. The actual temperature set by the customer should be determined comprehensively based on factors such as PCB thickness, copper coverage, soldering iron power, and soldering iron tip selection;
④Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

Electromagnetic Compatibility (EMC)

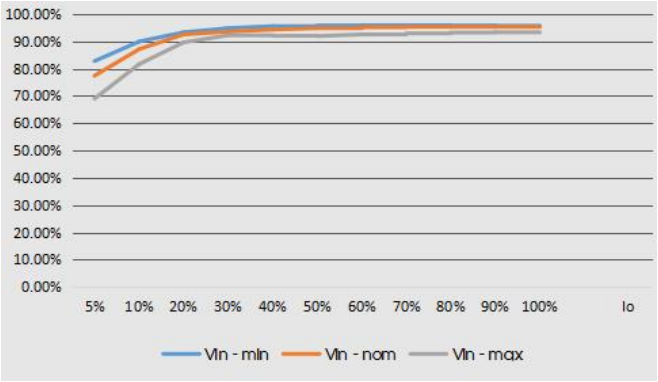
EMI	CE	DOEB240-B4810(12)(F/H)N	CISPR32/EN55032 CLASS B (See Fig. 6 for recommended circuits)	
		DOEB240-B4824(28)(F/H)N	CISPR32/EN55032 CLASS A (See Fig. 7 for recommended circuits) CLASS B (See Fig. 8 for recommended circuits)	
	RE	DOEB240-B4810(12)(F/H)N	CISPR32/EN55032 CLASS B (See Fig. 6 for recommended circuits)	
		DOEB240-B4824(28)(F/H)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	DOEB240-B4810(12)(F/H)N	IEC61000-4-3 10V/m (See Fig. 6 for recommended circuits)	perf. Criteria A
		DOEB240-B4824(28)(F/H)N	IEC61000-4-3 10V/m (See Fig. 8 for recommended circuits)	
	EFT	DOEB240-B4810(12)(F/H)N	IEC61000-4-4 ±2KV (See Fig. 6 for recommended circuits)	perf. Criteria A
		DOEB240-B4824(28)(F/H)N	IEC61000-4-4 ±2KV (See Fig. 8 for recommended circuits)	
	Surge	DOEB240-B4810(12)(F/H)N	IEC/EN61000-4-5 line to line ±2KV (See Fig. 6 for recommended circuits)	perf. Criteria B
		DOEB240-B4824(28)(F/H)N	IEC/EN61000-4-5 line to line ±2KV (See Fig. 8 for recommended circuits)	
	CS	DOEB240-B4810(12)(F/H)N	IEC61000-4-6 10Vr.m.s (See Fig. 6 for recommended circuits)	perf. Criteria A
		DOEB240-B4824(28)(F/H)N	IEC61000-4-6 10Vr.m.s (See Fig. 8 for recommended circuits)	

Characteristic Curve

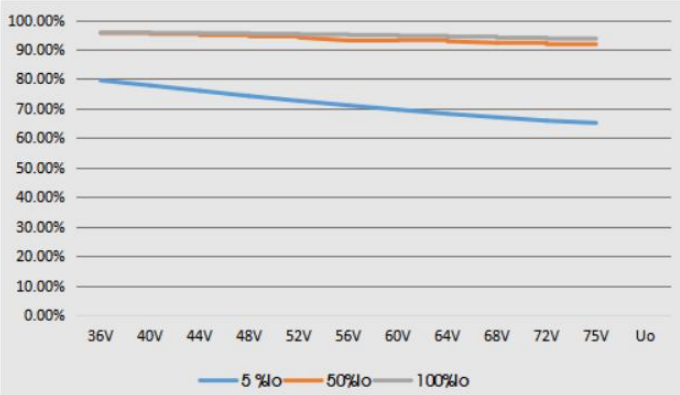
DOEB240-B4810N
Efficiency Vs Output Load



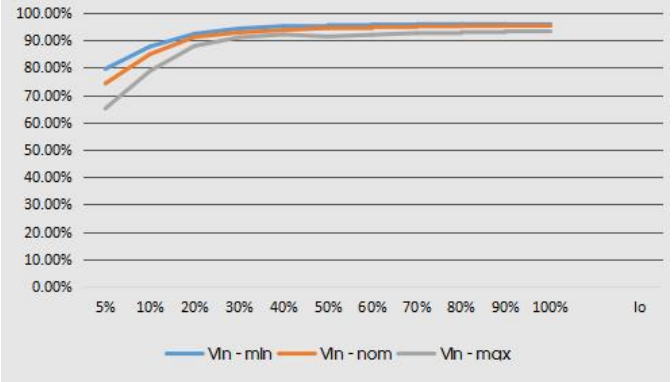
DOEB240-B4810N
Efficiency Vs Intput Voltage



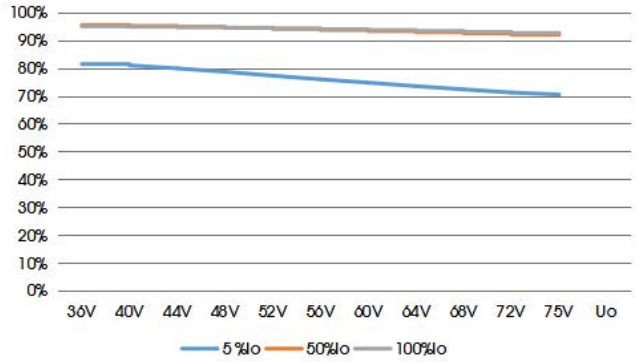
DOEB240-B4812N
Efficiency Vs Output Load



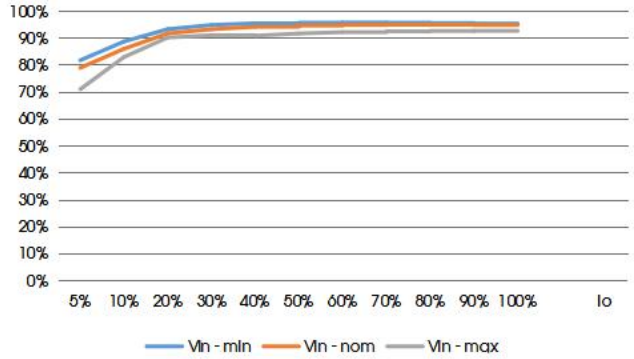
DOEB240-B4812N
Efficiency Vs Intput Voltage



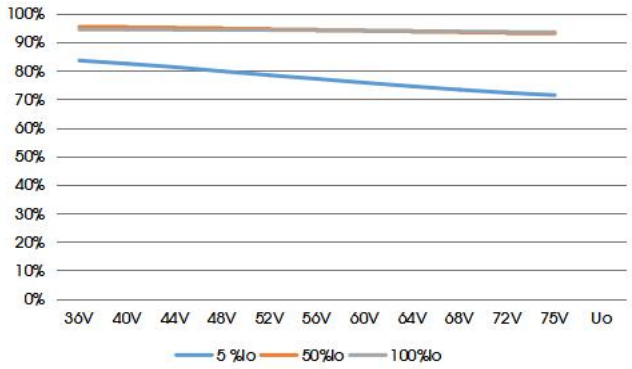
DOEB240-B4824N
Efficiency Vs Output Load



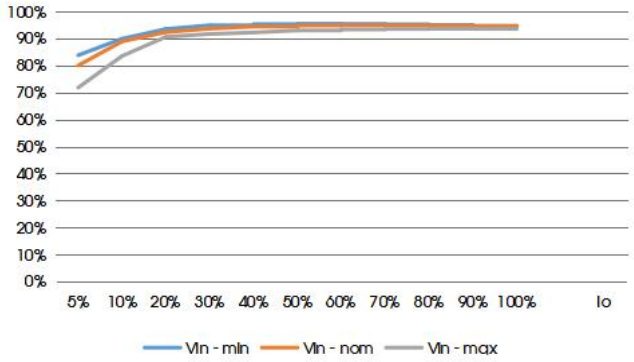
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Efficiency Vs Output Load



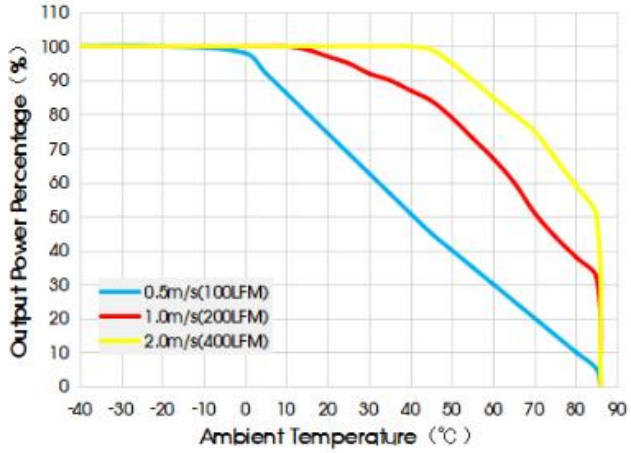
DOEB240-B4828N
Efficiency Vs Output Load



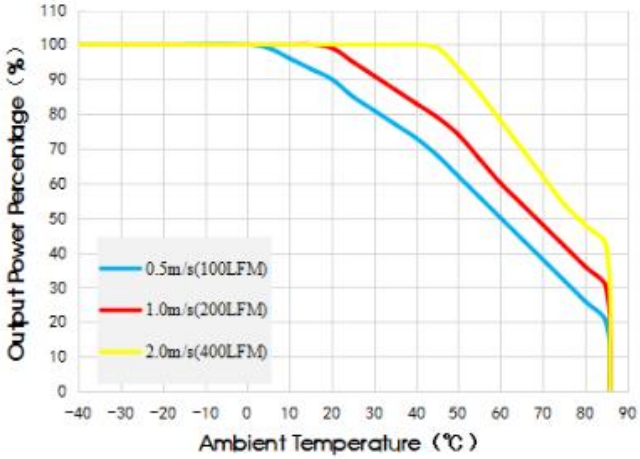
DOEB240-B4828N
Efficiency Vs Output Load



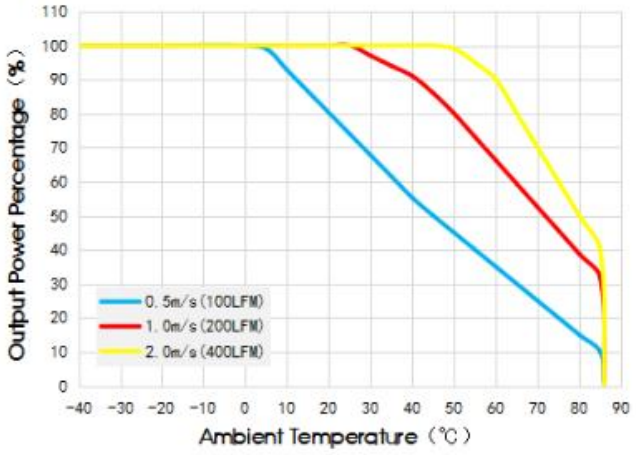
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Temperature Derating Curves (Vin=48V)



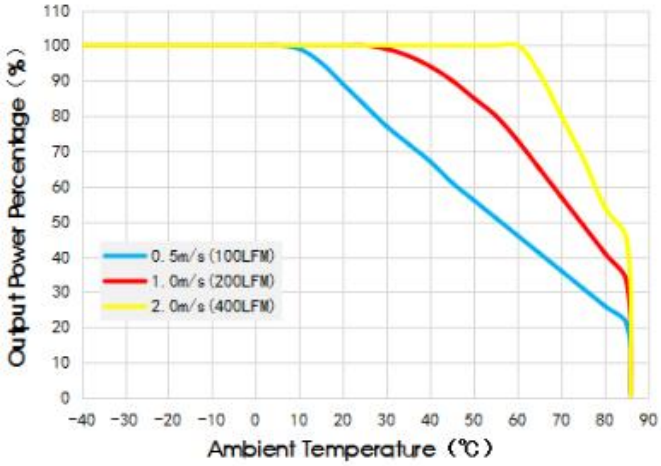
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Temperature Derating Curves (Vin=48V)



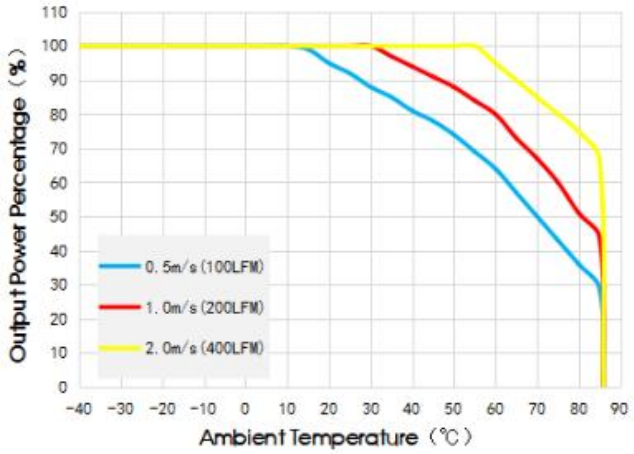
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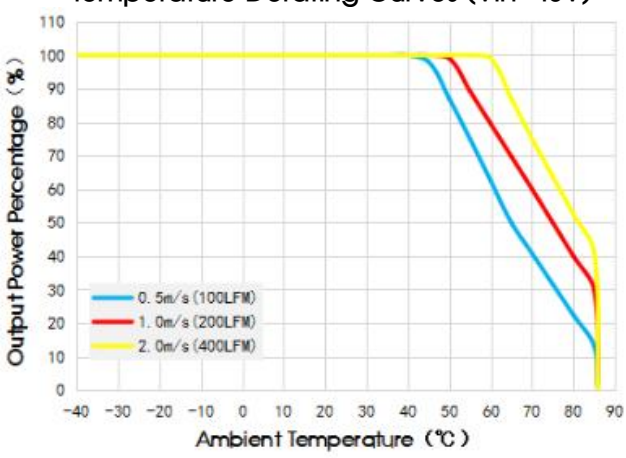
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Temperature Derating Curves (Vin=48V)



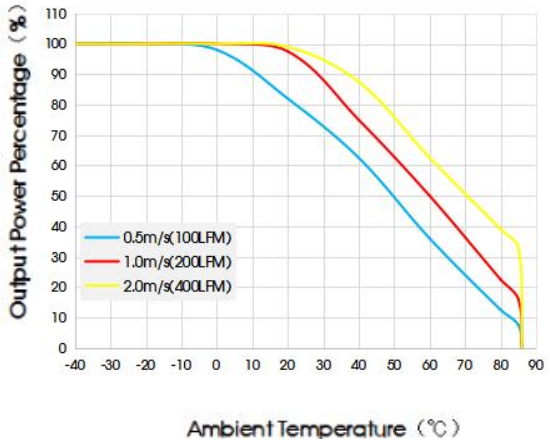
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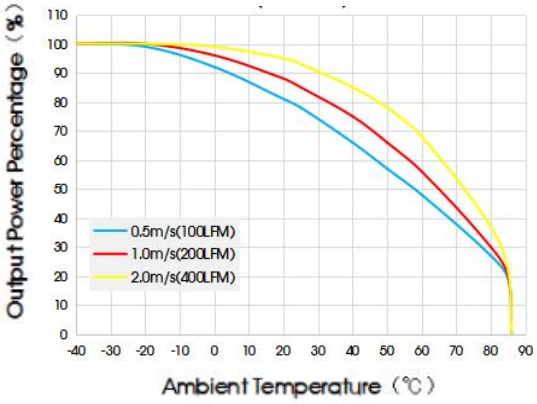
DOEB240-B4812HN
Temperature Derating Curves (Vin=48V)



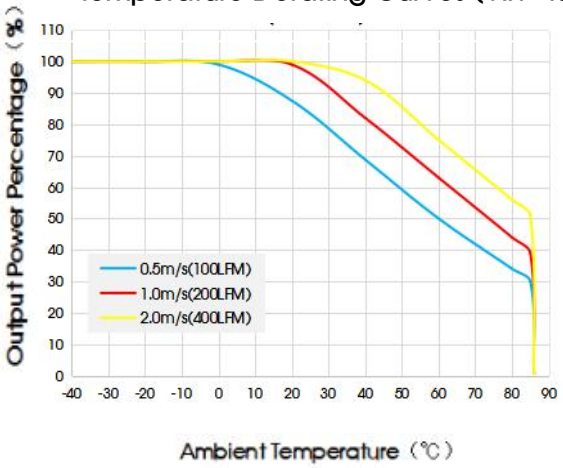
DOEB240-B4824N
Temperature Derating Curves (Vin=48V)



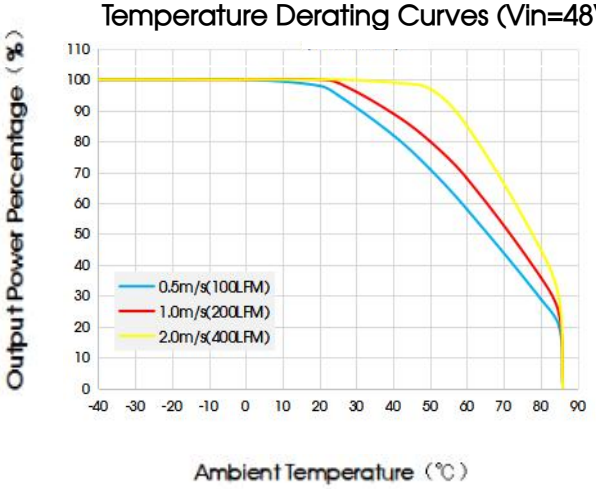
DOEB240-B4828N
Temperature Derating Curves (Vin=48V)



DOEB240-B4824FN
Temperature Derating Curves (Vin=48V)



DOEB240-B4824FN
Temperature Derating Curves (Vin=48V)



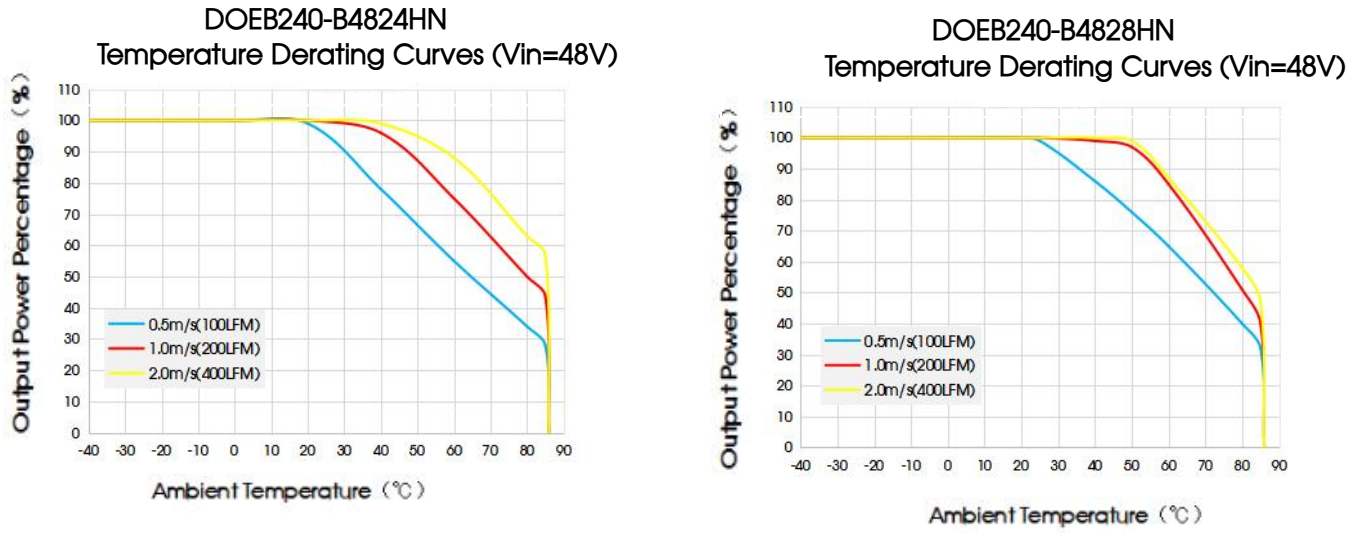


Fig. 1

Remote Sense Application

1. Remote Sense Connection if not used

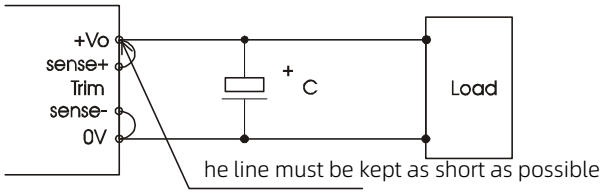


Fig. 2

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

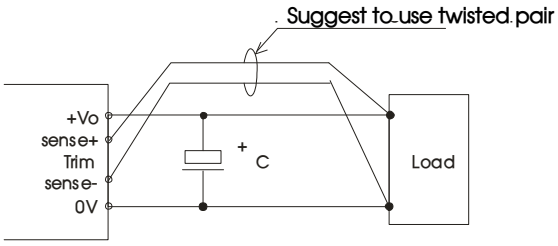


Fig. 3

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 wairs 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.

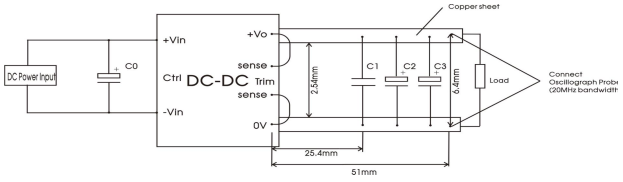


Fig. 4

Output voltage \ Capacitors value	C0	C1	C2	C3
10.8VDC	220uF/100V	1uF/25V	10uF/50V	470uF/350V
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. DOEB240-B4810(12)(F/H)N EMC

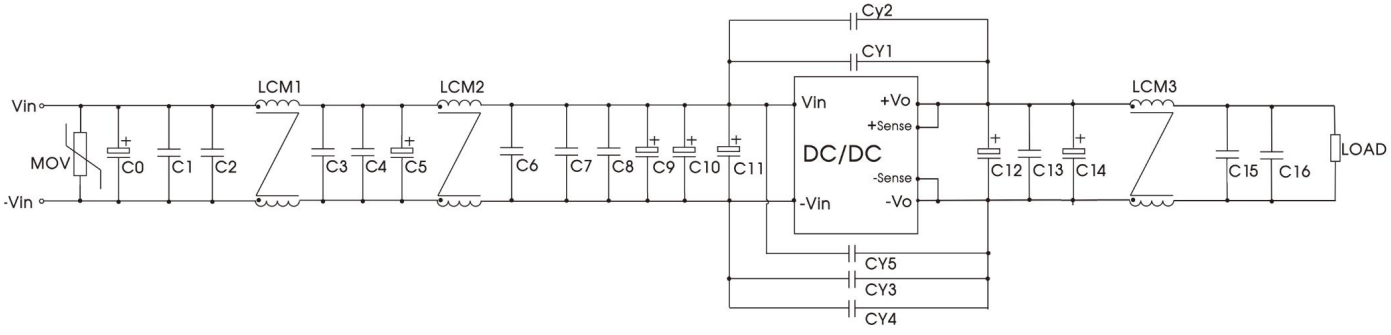


Fig. 6

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
LCM2	1.0mH
LCM3	100uH±35
CY1, CY2, CY3, CY5	1nF/400VAC safety standard Y capacitor
CY4	2.2nF/400VAC safety standard Y capacitor

2.DOEB240-B4824(28)(F/H)N EMC

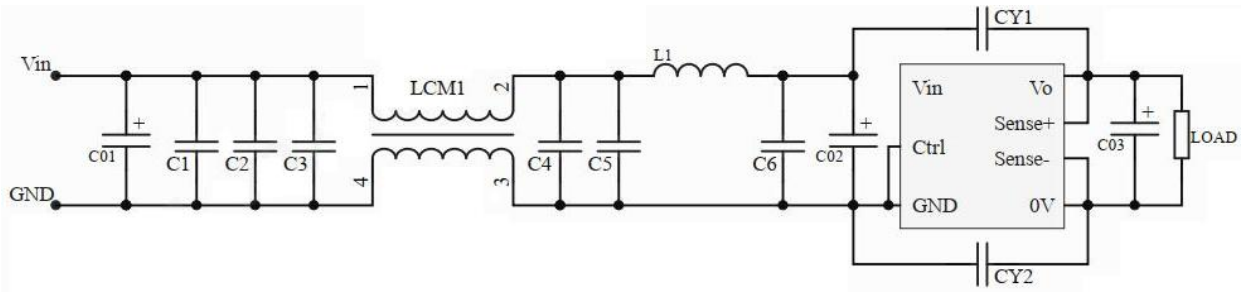


Fig 7

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
L1	1.5uH
CY1、CY2	1nF/400VAC

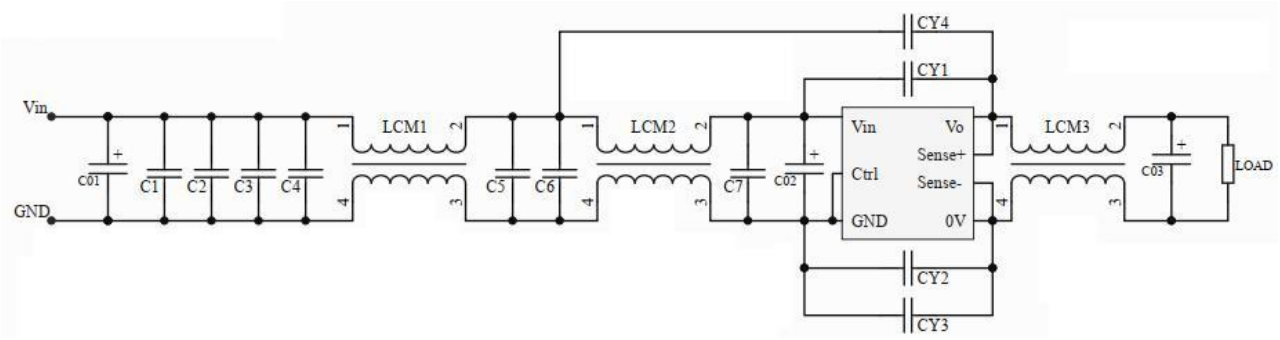
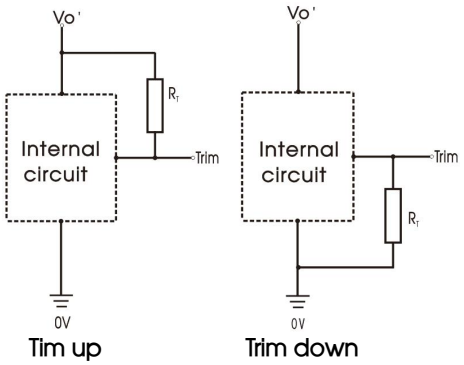


Fig 8

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
CY1、CY2、CY3	1nF/400VAC
CY4	2.2nF/400VAC

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



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 determine the stable working range of the product by testing the temperature points in Figure 10. When point A is below 125℃, it is the stable working range of the DOEB240-B4810/12N product. When point B is below 125℃, it is the stable working range of the DOEB240-B4824N product. When point C is below 125℃, it is the stable working range of the DOEB240-B4828N product. The product stable operating range of DOEB240-B48xxFN is below 115 ° C; When the E point is below 115℃, it is the stable operating range of DOEB240-B48xxHN products.

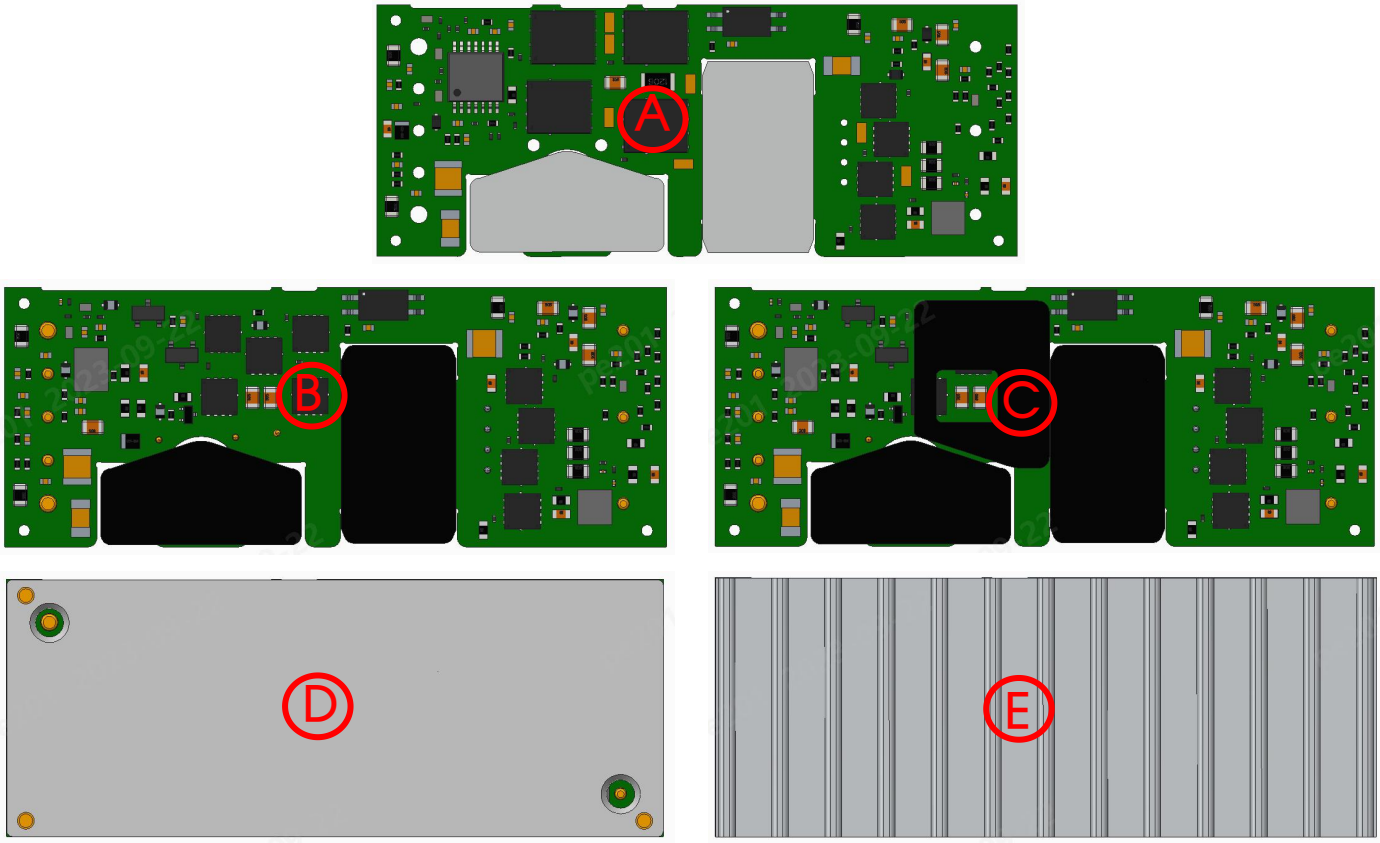


Fig.10

6. Reflection ripple current test

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

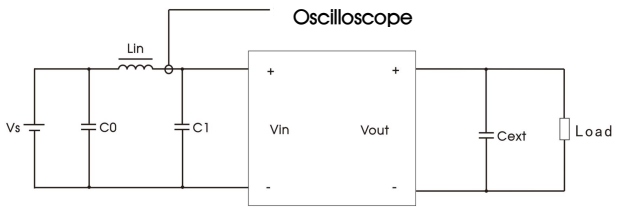


Fig. 11

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

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

When the input satisfies one of the following conditions, the input is considered to be a safe extra low voltage (ES1/SELV).

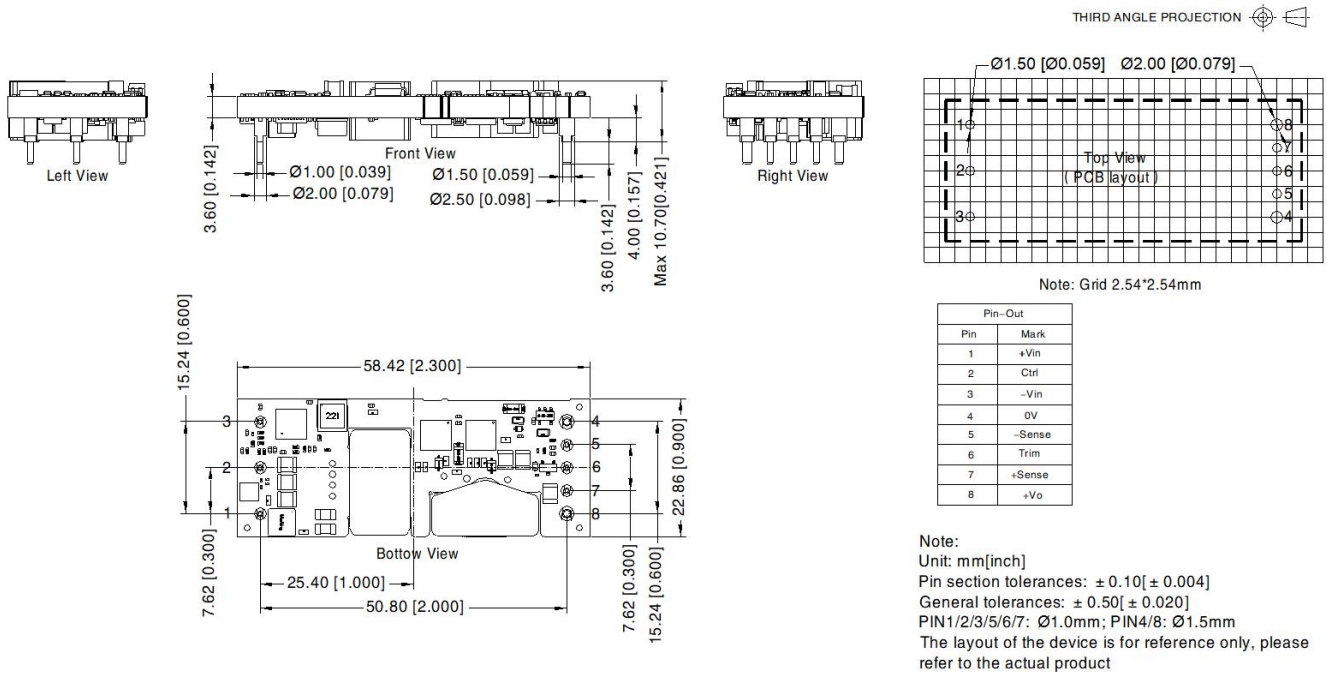
①The input power supply is double-insulated or reinforced from the AC power source as required by IEC/EN/UL 62368-1;

②The input source is insulated from the AC mains, and the output of the product is reliably connected to the protective ground, in accordance with IEC/EN/UL 62368-1;

③The input source is reliably connected to the protective ground and is provided with basic or supplementary insulation according to IEC/EN/UL 62368-1 with an input source voltage of up to 60Vdc.

8. The product does not support the use of output parallel liter power

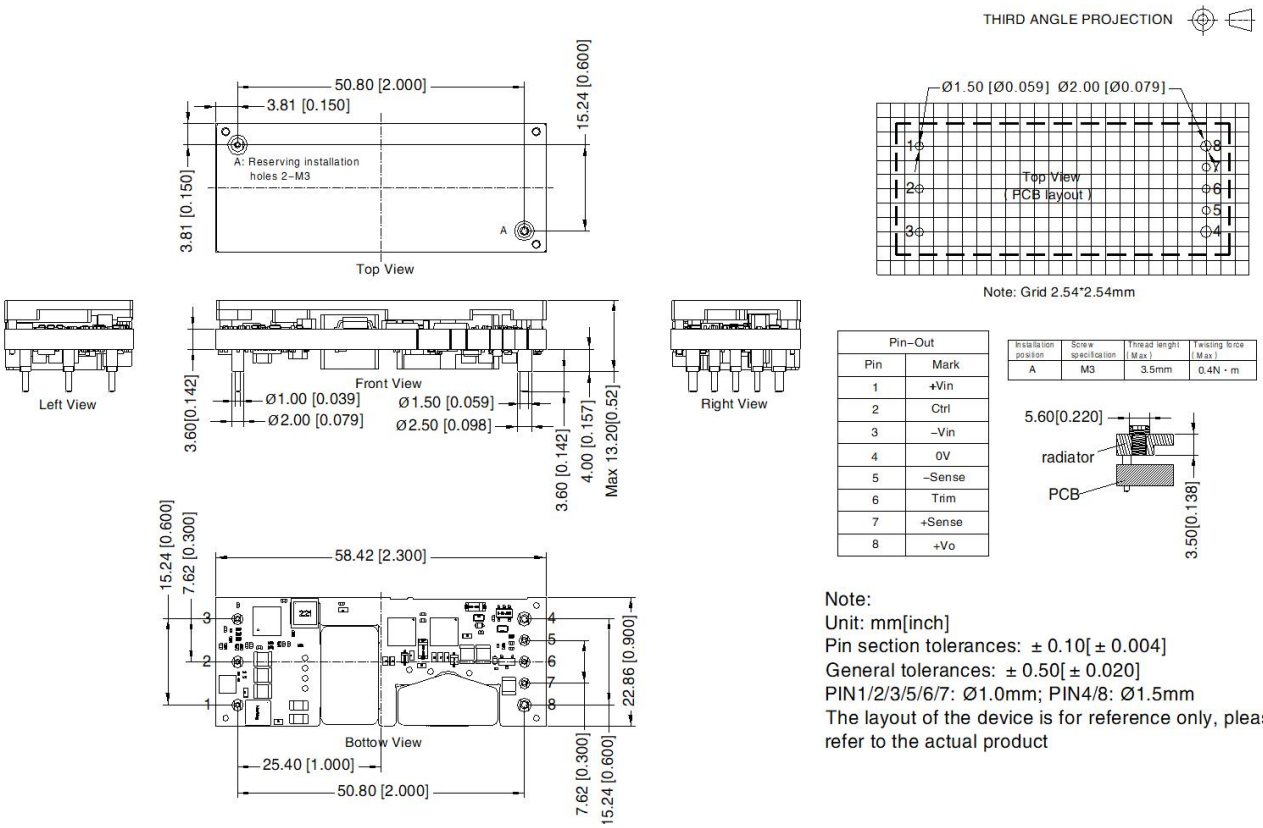
DOEB240-B48xxN Dimensions and Recommended Layout



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

DOEB240-B48xxFN Dimensions and Recommended Layout

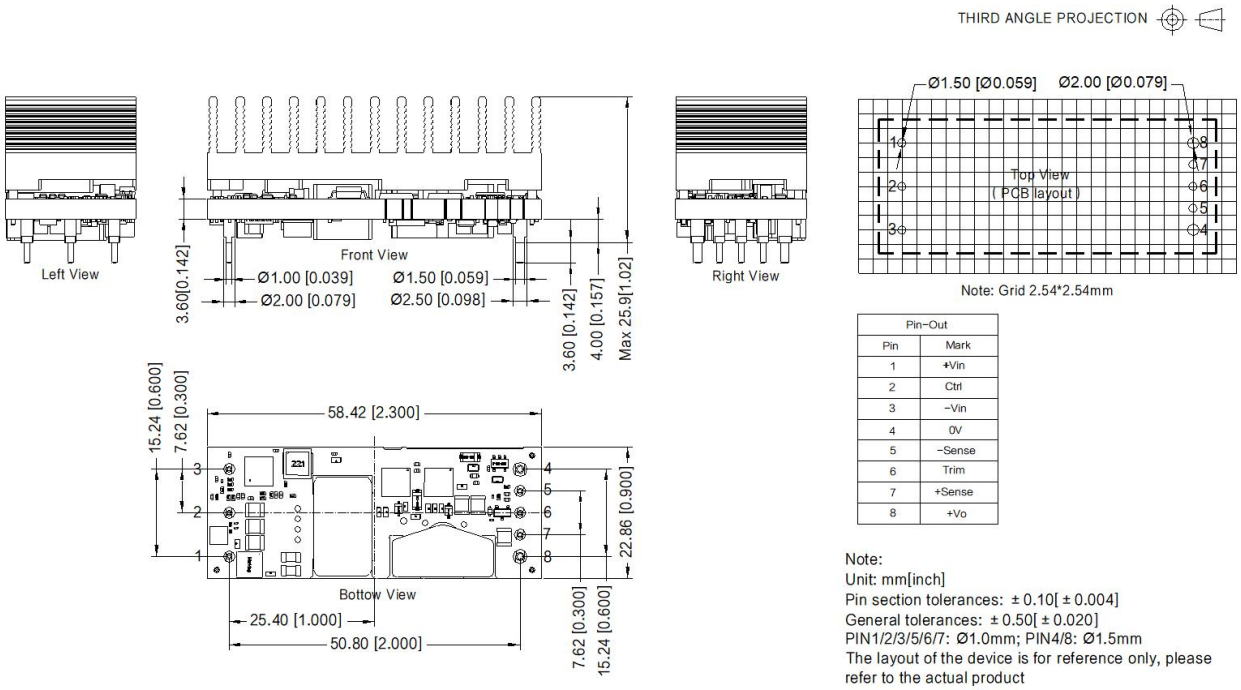


Pin-Out	
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	-Sense
6	Trim
7	+Sense
8	+Vo

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

DOEB240-B48xxHN 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. It is recommended to use it at more than 10% load, if it is lower than 10% load, the ripple index of the product may exceed the specification, but it does not affect the reliability of the product;
2. If the product works below the minimum required load, it cannot be guaranteed that the product performance meets all the performance indicators in this manual;
3. The maximum capacitive load is tested in the input voltage range and under full load condition;
4. Unless otherwise stated, all indicators in this manual are in Ta=25℃, humidity & LT; 75%RH, nominal input voltage and output rated load measured;
5. All index test methods in this manual are in accordance with the company's enterprise standards;
6. Our company can provide product customization, specific needs can directly contact our technical personnel;
7. The product involves laws and regulations: see "Product Features" and "EMC Features";
8. 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;
9. The image certification marks are for reference only; please refer to the selection table for actual specifications. Certification is based on the physical mark or packaging label.