



LHXX-10XXX SERIES

5-25W, AC-DC CONVERTER

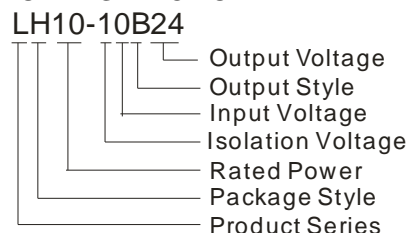
LH---- are high efficiency green power modules with various packaging provided by Mornsun. The features of this series are: wide input voltage, DC and AC all in one, high efficiency, high reliability, low loss, safety isolation etc. They are widely used in industrial, office and civil equipments. EMC and safety standards meet international standards IEC61000 UL60950 and IEC60950, and Multi-certificate is in processing.

RoHS  USE235235

PRODUCT FEATURES

1. Universal Input :85 ~ 264VAC,50/60Hz
2. AC and DC all in one (input from the same terminal)
3. Low Ripple and Noise
4. Overload protection and short circuit protection
5. High efficiency, High power density
6. Low loss, green power
7. Multiple models available
8. industrial level specifications
9. 3 years warranty

MODEL SELECTION



PRODUCT PROGRAM

Approval	Model	Package	Power	Output (Vo1/Io1)	Output (Vo2/Io2)	Ripple and Noise (Typ.)	Efficiency (%) (Typ.)
UL/CE	LH05-10B03	48.5X36X20.5mm	4W	3.3V/1250mA		50mV	70
UL/CE	LH05-10B05		5W	5V/1000mA			76
UL/CE	LH05-10B09			9V/550mA			
UL/CE	LH05-10B12			12V/420mA			
UL/CE	LH05-10B15			15V/330mA			
UL/CE	LH05-10B24			24V/230mA			
	LH05-10A05		5W	+5V/500mA	-5V/500mA		76
	LH05-10A12			+12V/210mA	-12V/210mA		
	LH05-10A15			+15V/160mA	-15V/160mA		
	LH05-10A24			+24V/100mA	-24V/100mA		
	LH05-10C0505-01	5W	5V/800mA	±5V/100mA	76		
	LH05-10C0512-01		5V/600mA	±12V/100mA			
	LH05-10C0515-01		5V/600mA	±15V/80mA			
	LH05-10C0524-01		5V/600mA	±24V/50mA			
	LH05-10D0505-01	5W	5V/900mA	5V/100mA	76		
	LH05-10D0512-01		5V/750mA	12V/100mA			
	LH05-10D0515-01		5V/700mA	15V/100mA			
	LH05-10D0524-01		5V/600mA	24V/100mA			
UL/CE	LH10-10B03	55X45X21.0mm	6.6W	3.3V/2000mA		50mV	70
UL/CE	LH10-10B05		10W	5V/2000mA			78
UL/CE	LH10-10B09			9V/1100mA			
UL/CE	LH10-10B12			12V/900mA			
UL/CE	LH10-10B15			15V/700mA			
UL/CE	LH10-10B24			24V/450mA			
UL/CE	LH10-10A05		10W	+5V/1000mA	-5V/1000mA		78
UL/CE	LH10-10A12			+12V/450mA	-12V/450mA		
UL/CE	LH10-10A15			+15V/350mA	-15V/350mA		
UL/CE	LH10-10A24			+24V/200mA	-24V/200mA		
	LH10-10C0505-04*	10W	5V/1200mA	±5V/400mA	78		
	LH10-10C0512-02		5V/1000mA	±12V/200mA			
	LH10-10C0515-02		5V/900mA	±15V/200mA			
	LH10-10C0524-01*		5V/1000mA	±24V/100mA			
UL/CE	LH10-10D0505-02	10W	5V/1800mA	5V/200mA	78		
UL/CE	LH10-10D0512-02		5V/1500mA	12V/200mA			
UL/CE	LH10-10D0515-02		5V/1400mA	15V/200mA			
UL/CE	LH10-10D0524-02		5V/1000mA	24V/200mA			

Approval	Model	Package	Power	Output (Vo1/Io1)	Output (Vo2/Io2)	Ripple and Noise (Typ.)	Efficiency (%) (Typ.)			
UL/CE	LH15-10B03	62x45x22.5mm	9.9W	3.3V/3000mA		50mV	73			
UL/CE UL/CE UL/CE UL/CE UL/CE UL/CE	LH15-10B05 LH15-10B09 LH15-10B12 LH15-10B15 LH15-10B24 LH15-10B48		15W	5V/2800mA 9V/1600mA 12V/1250mA 15V/1000mA 24V/625mA 48V/320mA			80			
	LH15-10A05 LH15-10A12 LH15-10A15			+5V/1500mA +12V/650mA +15V/500mA	-5V/1500mA -12V/650mA -15V/500mA					
	LH15-10C0505-05 LH15-10C0512-02 LH15-10C0515-02 LH15-10C0524-01*			5V/2000mA 5V/2000mA 5V/1800mA 5V/2000mA	±5V/500mA ±12V/200mA ±15V/200mA ±24V/100mA					
	LH15-10D0505-08 LH15-10D0512-04 LH15-10D0515-03* LH15-10D0524-02			5V/2200mA 5V/2000mA 5V/2000mA 5V/2000mA	5V/800mA 12V/400mA 15V/300mA 24V/200mA					
UL/CE UL/CE UL/CE UL/CE UL/CE	LH20-10B03 LH20-10B05 LH20-10B12 LH20-10B15 LH20-10B24			70x48x23.5mm	20W	3.3V/4100mA 5V/3500mA 12V/1600mA 15V/1300mA 24V/850mA			50mV	82
	LH20-10A05 LH20-10A12 LH20-10A15					+5V/2000mA +12V/830mA +15V/650mA		-5V/2000mA -12V/830mA -15V/650mA		
	LH20-10C0505-05* LH20-10C0512-04 LH20-10C0515-03 LH20-10C0524-02	5V/2500mA 5V/2000mA 5V/2000mA 5V/2000mA	±5V/500mA ±12V/400mA ±15V/300mA ±24V/200mA							
	LH20-10D0505-10* LH20-10D0512-06 LH20-10D0515-05* LH20-10D0524-03	5V/3000mA 5V/2500mA 5V/2500mA 5V/2500mA	5V/1000mA 12V/600mA 15V/500mA 24V/300mA							
UL/CE UL/CE UL/CE UL/CE UL/CE	LH25-10B05 LH25-10B12 LH25-10B15 LH25-10B24 LH25-10B48	70x48x23.5mm	25W	5V/4100mA 12V/2100mA 15V/1600mA 24V/1100mA 48V/500mA		50mV	85			

Remarks :

- Ripple and Noise were measured by the method of parallel lines;
- Unless otherwise specified, all specifications above are measured at rated input voltage and rated output load, Ta=25°C, humidity < 75%;
- All specifications stated in this datasheet are subject to the above listed models only. For specifications of non-standard models, please contact our technical support team.
- Model numbers marked with "*" are in developing.

INPUT SPECIFICATIONS			
Input voltage range		85 ~ 264VAC, 120 ~ 370VDC	
Input frequency		47 ~ 63Hz	
Input current	LH05 models LH10 models LH15 models LH20 models LH25 models	110VAC 120mA , typ 230mA , typ 250mA , typ 330mA , typ 420mA , typ	230VAC 70mA , typ 120mA , typ 140mA , typ 180mA , typ 230mA , typ
Inrush current	LH05 models LH10 models LH15 models LH20/LH25 models	110VAC 10A, typ 10A, typ 10A, typ 16A, typ	230VAC 20A, typ 20A, typ 20A, typ 30A, typ
External input fuse(recommended)	LH05 models LH10/LH15 models LH20/LH25 models	1A/250V 2A/250V 3.15A/250V	slow blow slow blow slow blow

OUTPUT SPECIFICATIONS

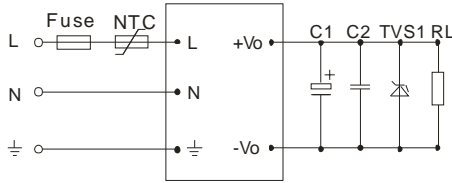
Voltage set accuracy		±2% (main output)
Input variation		±0.5% (main output) ±1.5% (supplement output)
Load variation (10-100%)	Single output models Dual output models (balanced load) Isolated triple output (balanced load) Isolated and separated twin output (balanced load)	±1% ±2% Vo1 ±3% (main output) ±Vo2 ±5% (supplement output) Vo1 ±3% (main output) Vo2 ±5% (supplement output)
Minimum load	single output models Dual output models Isolated and separated twin output Isolated triple output	0% 10% (main output) 10% (main output) 10% (main output)
Ripple& noise(p-p)	20MHz Bandwidth	≤100mV (main output)
Short circuit protection		Continuous, and auto resume
Over current protection		≥110% I _o
Over output voltage protection	3.3 / 5VDC models 9VDC models 12 / 15VDC models 24VDC models 48VDC models	≤6.5VDC ≤12VDC ≤20VDC ≤30VDC ≤60VDC

COMMON SPECIFICATIONS

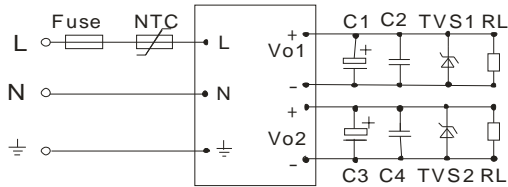
Temperature ranges	Operating : Power derating above 55°C: LH20-10B05 above 50°C: Storage: Case temperature:	-25°C ~ +70 °C 3.75% / °C 2.25% / °C -25°C ~ +105 °C +90°C max
Hold-up time	(Vin=230VAC)	80ms(typ)
Humidity (non condensing)		85%(max)
Temperature coefficient		0.02%/°C (main output) 0.15%/°C (supplement output)
Switching frequency		150kHz max
Efficiency		78% typ
I/O-isolation voltage		3000VAC/1Min
Leakage current		0.3mA RMS typ. 230VAC/50Hz
EMI/RFI conducted		EN55022, level B
EMC compliance	Electrostatic discharge ESD RF field susceptibility Electrical fast transients/bursts on mainsline Surge	IEC/EN 61000-4-2 level 3 6KV/8KV IEC/EN 61000-4-3 IEC/EN 61000-4-4 level 3 2KV IEC/EN 61000-4-5 level 3 1KV / 2KV
Safety standards		IEC60950,EN60950,UL60950
Safety approvals		EN60950, IEC60950,UL60950
Safety Class		CLASS 1 CLASS 2 While LH15)
Case material		UL 94V-0
Install		PCB
MTBF		>200,000h @25°C

TYPICAL APPLICATIONS

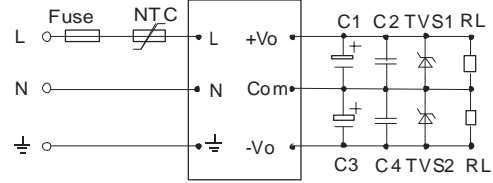
LH**-10B**(single Output)



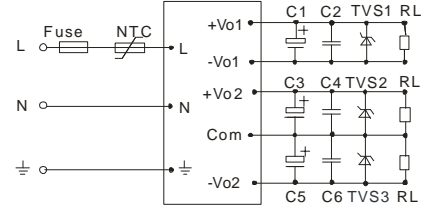
LH**-10D**(Isolate Twin Output)



LH**-10A**(Dual output)



LH**-10C**(Triple Output)



EXTERNAL CAPACITORS TYPICAL VALUE(Unit: mF)

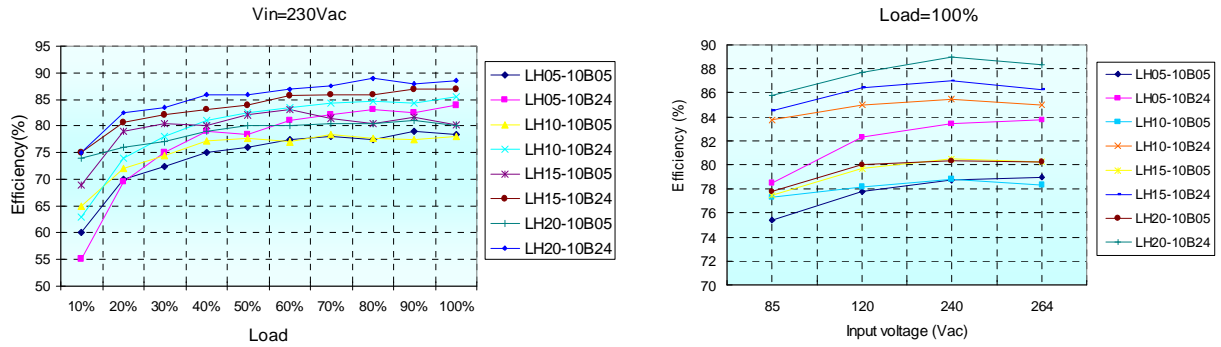
MODEL	C1	C3	C5
LH05-10B03	330		
LH05-10B05	330		
LH05-10B09	120		
LH05-10B12	120		
LH05-10B15	68		
LH05-10B24	68		
LH05-10A05	120	120	
LH05-10A12	68	68	
LH05-10A15	47	47	
LH05-10A24	10	10	
LH05-10C0505-01	220	22	22
LH05-10C0512-01	120	22	22
LH05-10C0515-01	120	22	22
LH05-10C0524-01	120	22	22
LH05-10D0505-01	220	22	
LH05-10D0512-01	220	22	
LH05-10D0515-01	120	22	
LH05-10D0524-01	120	22	
LH10-10B03	470		
LH10-10B05	330		
LH10-10B09	120		
LH10-10B12	120		
LH10-10B15	120		
LH10-10B24	68		
LH10-10A05	220	220	
LH10-10A12	120	120	
LH10-10A15	47	47	
LH10-10A24	33	33	
LH10-10C0505-04	220	120	120
LH10-10C0512-02	220	68	68
LH10-10C0515-02	220	47	47
LH10-10C0524-01	220	47	47
LH10-10D0505-02	220	68	
LH10-10D0512-02	220	68	
LH10-10D0515-02	220	47	
LH10-10D0524-02	220	47	

MODEL	C1	C3	C5
LH15-10B03	680		
LH15-10B05	680		
LH15-10B09	470		
LH15-10B12	220		
LH15-10B15	220		
LH15-10B24	68		
LH15-10B48	33		
LH15-10A05	470	470	
LH15-10A12	220	220	
LH15-10A15	120	120	
LH15-10C0505-05	470	220	220
LH15-10C0512-02	470	120	120
LH15-10C0515-02	470	120	120
LH15-10C0524-01	470	47	47
LH15-10D0505-08	470	470	
LH15-10D0512-04	470	220	
LH15-10D0515-03	470	120	
LH15-10D0524-02	470	47	
LH20-10B03	330		
LH20-10B05	330		
LH20-10B12	220		
LH20-10B15	220		
LH20-10B24	220		
LH20-10A05	470	470	
LH20-10A12	120	120	
LH20-10A15	68	68	
LH20-10C0505-05	330	220	220
LH20-10C0512-04	330	120	120
LH20-10C0515-03	330	120	120
LH20-10C0524-02	330	47	47
LH20-10D0505-10	330	330	
LH20-10D0512-06	330	220	
LH20-10D0515-05	330	220	
LH20-10D0524-03	330	120	
LH25-10B05	330		
LH25-10B12	330		
LH25-10B15	330		
LH25-10B24	120		
LH25-10B48	68		

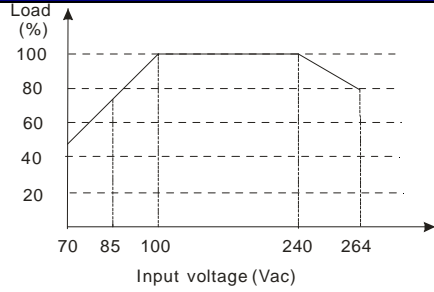
Remark:

- Output filtering capacitors C1, C2 and C3 are electrolytic capacitors. It is recommended to use high frequency and low impedance electrolytic capacitors. For capacitance and current of capacitor please refer to manufacture's datasheet. Voltage derating of capacitor should be 80% or above. C2,C4,C6 are use to filter high frequency noise. TVS is recommended component to protect post-circuits (when converter fails).
- External input NTC is recommended to use 5D-9 (Only LH10 models and LH15 models)

TYPICAL EFFICIENCY CURVE

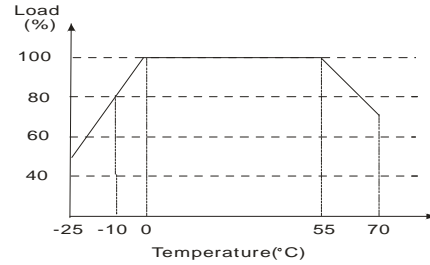


INPUT VOLTAGE VS LOAD

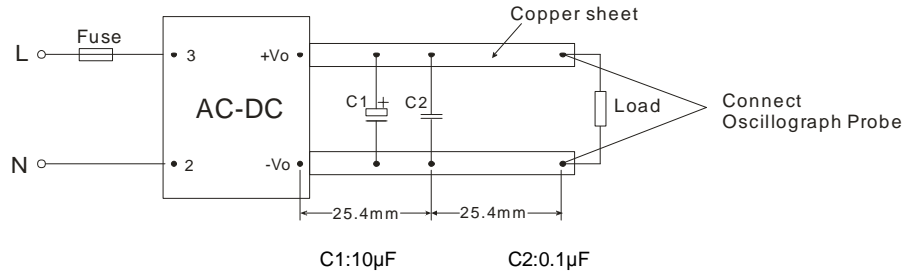


*Note: When input DC, $V_{dc}=1.414V_{ac}-20V_{dc}$.

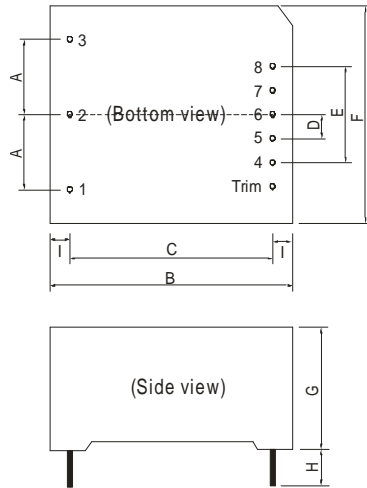
TEMPERATURE VS LOAD



PARALLEL LINES MEASURE



OUTLINE AND DIMENSIONS



Note:
Unit:mm(inch)
Pin section:1.00mm(0.039inch)
Pin Length(H):>6.00mm(>0.236inch)
Pin tolerances: $\pm 0.1\text{mm}$ ($\pm 0.004\text{inch}$)
General tolerances: $\pm 0.5\text{mm}$ ($\pm 0.020\text{inch}$)

First Angle Projection

OUTLINE AND DIMENSIONS

NO.	LH05	LH10	LH15	LH20	LH25
A	12.5	17.5	17.5	20.0	20.0
B	48.5	55.0	62.0	70.0	70.0
C	40.5	47.0	54.0	62.0	62.0
D	4.0	5.0	5.0	5.75	5.75
E	16.0	20.0	20.0	23.0	23.0
F	36.0	45.0	45.0	48.0	48.0
G	20.5	21.0	22.5	23.5	23.5
I	4.0	4.0	4.0	4.0	4.0

FOOTPRINT DETAILS

Pin	LHXX-10B	LHXX-10A	LHXX-10C	LHXX-10D
1	\perp	\perp	\perp	\perp
2	AC(N)	AC(N)	AC(N)	AC(N)
3	AC(L)	AC(L)	AC(L)	AC(L)
4	-Vo	-Vo	-Vo1	-Vo1
5	No Pin	No Pin	+Vo1	+Vo1
6	No Pin	COM	-Vo2	No Pin
7	No Pin	No Pin	COM	-Vo2
8	+Vo	+Vo	+Vo2	+Vo2
Trim	Trim**	No Pin	No Pin	No Pin

There is no Pin 1 \perp on LH15-10BXX.

Trim**:Only For LH20/25-10BXXSeries

MODLES WEIGHT

WEIGHT (TYP)	LH05	LH10	LH15	LH20	LH25
	50g	70g	80g	120g	120g

AC-DC Converter Application Guidelines

1. Foreword

The following guidelines should be carefully read prior to converter use. Improper use may result in the risk of electric shock, damaging the converter, or fire.

1. 1 Risk of Injury

- A. To avoid the risk of burns, do not touch the heat sink or the converter's case.
- B. Do not touch the input terminals or open the case and touch internal components, which could result in electric shock or burns.
- C. When the converter is in operation, keep hands and face at a distance to avoid potential injury during improper operation.

1. 2 Installation Advice

- A. Please make sure the input terminals and signal terminals are properly connected in accordance with the stated datasheet requirements.
- B. To ensure safe operation and meet safety standard requirements, install a **slow blow** fuse at input of the converter.
- C. Installation and use of AC/DC converters should be handled by a qualified professional.
- D. AC/DC converters are used in the primary transmission stage of a design and thus, should be installed in compliance with certain safety standards.
- E. Please ensure that the input and output of the converter are incorporated into the design out of the reach of the end user. The end product manufacturer should also ensure that the converter is protected from being shorted by any service engineer or any metal filings.
- F. The application circuits and parameters shown are for reference only. All parameters and circuits are to be verified before completing the circuit design.
- G. These guidelines are subject to change without notice; please check our website for updates.

2. General AC-DC Converter Applications

2.1 Basic Application Circuit

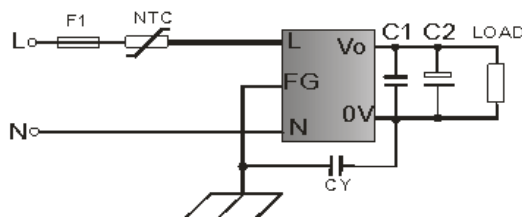


Figure 1. General AC-DC converter applications circuit

In Figure 1, F1 refers to the input fuse. Proper fuse selection should be a safety agency approved, slow blow fuse. Selection of the proper fuse rating is necessary to ensure power converter and system protection (potential failure if the rating is too high) and prevent false fuse blowing (which could happen if the rating is too low). Below is the formula to calculate the proper rating:

$$I = 3 \times V_{o1} \times I_{o1} / \eta / V_{in(\min.)}$$

V_{o1} = output voltage

I_{o1} = output current;

η = the converter's efficiency;

$V_{in(\min)}$ = the minimum input voltage

Further circuit notations:

- ◆ **NTC** is a thermistor.
- ◆ **CY** and **CX** are safety capacitors.
- ◆ **C1** is a high frequency ceramic capacitor or polyester capacitor, 0.1 μ F/50V.
- ◆ **C2** is output filtering high frequency aluminum electrolytic capacitor. Select a 220 μ F rating if the output current is greater than 5A, or a 100 μ F rating if the output current is less than 5A. The insulation voltage should be derated to less than 80% of rated value.

For dual or triple output converters, the circuit of input side remains the same and the outputs should be considered independently in component selection (see Figure 3).

The application circuit shown in Figure 1 is typical application circuit, whereby all MORNSUN products will meet EMI Class B, and Class 3 lightning strike and surge testing (see component datasheets for more details). To comply with more stringent EMC testing, additional filtering should be incorporated. See Figure 2 for a suggested filtering circuit.

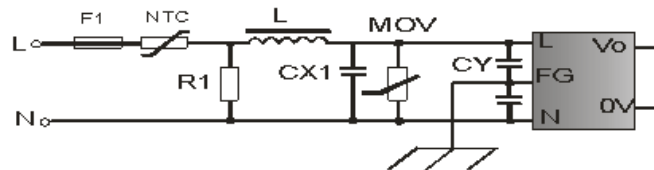


Figure 2. Input filter circuit

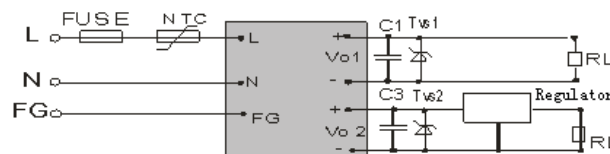


Figure 3. Typical application circuit

For multi-output converters, the main output is typically a fully regulated output. If the end application requires critical regulation on the auxiliary output(s), a linear regulator or other regular should be added after the converter. (Note: Some MORNSUN converters have built in linear regulators; please contact our Technical Department for details).

3. AC-DC Converter Safety Related Design Notes

3.1 Marking Requirements

Wherever, there are fuses, protective grounds, or switches, clear symbols should be indicated according safety standards. Touchable dangerous high voltage and energy sources should be marked with “**Caution!**” indications.

3.2 Input Cable Requirements:

Input cables of L, N and E should be brown, blue and yellow/green cables, respectively. Ensure that the ground cable (yellow & green cable) of Type I devices (those that rely on basic insulation and protection ground to avoid electric shock) are securely connected to the ground, and the earth resistance is lower than 0.1Ω

3.3 Clearance and Creepage

For Type I devices, ensure:

- ◆ L and N are in front of the fuse.
- ◆ The clearance distance between the input and the metal case is above 2mm and creepage is above 2.5mm.

For Type II devices (those that rely on strengthened insulation or double insulation to avoid electric shock) ensure:

- ◆ L and N are in front of the fuse
- ◆ The clearance distance between the input and the metal case is above 2mm and creepage is above 2.5mm.
- ◆ The clearance between the input and the metal case or SELV is above 4mm, and creepage of that is above 5mm.

3.4 Input energy

If the input capacitor is large, a discharge resistor may be added to ensure that, after disconnect, the voltage held between Input L, N, and the protective ground will be discharged to 37% of its maximum value or below. In Figure 2, R1 is the discharge resistor.

4. Heat Dissipation in AC/DC Converter Module Applications

Trends toward higher density in AC/DC module designs make heat dissipation an important concern. The effect of heat on the electrolytic capacitor is of particular concern, as the life of such capacitors can be drastically reduced when operated in a constant high temperature environment, leading to a higher potential for failure. Proper handling of heat will increase the life of the converter and surrounding components, thus lowering risk of failures. Some

suggestions for handling dissipated heat are summarized, below:

(1) Ambient Air Cooling

For miniature and high power density converters, free air cooling is recommended, mainly due to cost and space concerns.

- ◆ Heat dissipates to the ambient air through the converter case or exposed surfaces. Heat may also dissipate to ambient air if there is a gap between the converter and the PCB.
- ◆ Heat dissipates from the converter case and exposed surfaces to PCB by radiation.
- ◆ Heat conducts through terminals (pins) to PCB.

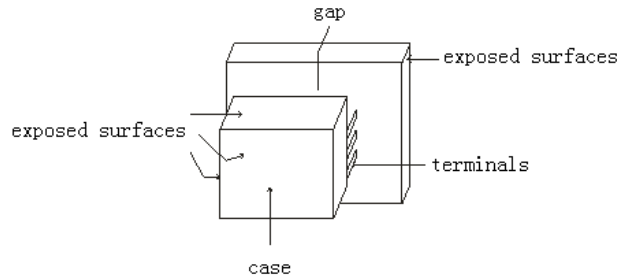


Figure 4. converter assembled on PCB

In such applications, please pay particular attention to:

- A. Air Flow - Because the heat dissipation is mainly through convection and radiation, the converter needs an environment with good air flow. It may be helpful to design heat dissipation venting holes throughout the end product, near the converter's location. For best convection cooling, ensure that air flow is not blocked by large components
- B. Layout of Heat Generating Components - In most applications, the AC/DC converter is usually not the only heat generating component. It is recommended to keep a good distance between each heat generating component to minimize heat dissipating clusters.
- C. PCB Design - The PCB, which the power converter is assembled on, is not only a base to mount the converter, but also acts as a heat sink for it, therefore heat dissipation should be considered in PCB layout. We recommend extended the area of the main copper loop and decrease the component density on the PCB to improve the ambient environment.

(2) Heat Sinks

When free air convection is not sufficient enough, we recommend the use of a heat sink for further cooling. As the converters are filled with heat conductive silicon or epoxy, the heat distribution in converter is even and it radiates from the converter to the air. The efficiency of this convection is dependent on the size of the surface area of the converter. The use of heat sinks is a practical method to add surface area and improve the convection. There are many kinds of heat sinks available in the market. MORNSUN recommends considering the following factors in selecting a heat sink:

- ◆ The heat sink should be made of a good heat conducting material, such as aluminum and copper.
- ◆ The larger the surface area, the better the radiation. Therefore, heat sinks usually have a ridged surface or special coatings to make a larger surface area.
- ◆ Use the longest and thickest possible heat sink for best convection.

Heat sinks are best attached to the converter's surface, where the difference in temperature between the surface and the ambient is largest. The use of heat conductive material between the heat sink and the converter's surface to make a better contact and to improve heat conductance is suggested. To avoid case distortion, please do not affix the heat sink too firmly to the converter case.

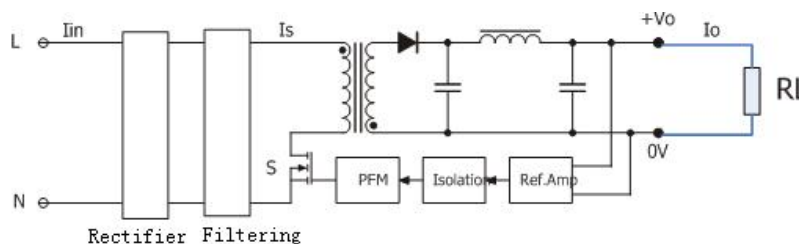
(3) Forced Air Cooling

In some systems, where a heat sink does not effectively reduce the ambient temperature, a fan is used to improve the heat radiation. Fans can lower the surface temperature of the converter, but large fans also occupy extra space in the system. It is important to select a suitable fan size, where the speed of the fan will determines how effective it is. The faster the speed, the better the effect on reducing radiated heat. As high speed will also cause increased noise, there is a need to balance the choice between the how effective the fan is against how much audible noise it generates.

A long, rectangular shaped AC/DC converter should use a horizontal fan, and channeled heat sinks should use vertical fans, in order to encourage air flow through the channels.

5. Input Under Voltage Impact

5.1 Block Diagram of AC/DC Converter

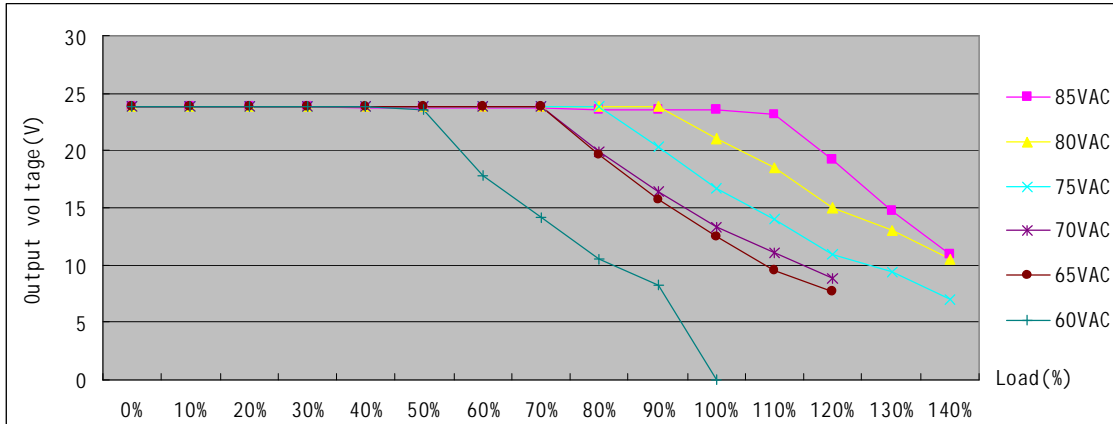


5.2 Impact to Converter Reliability

The input voltage range of MORNSUN's AC/DC converters is 85~264VAC or 120~370VDC. When the converter is operated within the rated input voltage range, the output current can be used up to the maximum rated specification. The total output power is $I_o \times V_o$.

If the converter is operated with an input voltage that is under the rated voltage, offering the same output power of $I_o \times V_o$, causes the current (I_s) at the transistor (S) to be increased. Long term operation under this condition will damage the transistor (S).

5.3 Input Voltage vs Load Capability (LD03-00B24)



Load	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
85VAC	23.85	23.82	23.79	23.77	23.74	23.71	23.68	23.65	23.61	23.58	23.57	23.19	19.2	14.7	11
80VAC	23.83	23.82	23.82	23.83	23.82	23.82	23.81	23.81	23.81	23.8	21	18.5	15	13	10.5
75VAC	23.83	23.83	23.83	23.83	23.82	23.82	23.82	23.81	23.77	20.29	16.65	14.02	10.98	9.39	7.04
70VAC	23.83	23.83	23.83	23.83	23.82	23.82	23.81	23.79	19.96	16.44	13.32	11.14	8.79		
65VAC	23.83	23.83	23.83	23.83	23.82	23.82	23.82	23.8	19.6	15.67	12.46	9.57	7.65		
60VAC	23.83	23.83	23.83	23.83	23.82	23.51	17.86	14.13	10.52	8.28	0				