AC/DC Converter

LH(05-25)-13Bxx Series

MORNSUN®

5-25W, AC/DC converter

RoHS

FEATURES

- Wide input range: 85~305VAC/120~430VDC
- Low temperature operating range of military grade: -40~70℃
- Conversion efficiency up to 87%
- Meet IEC60950, EN60950 and UL60950 standards
- Over-current, short circuit and over- voltage protection

LH(05-25)-13Bxx series -----a compact size power converter offered by Mornsun. It features universal input voltage, taking both DC and AC input voltage, low power consumption, high efficiency, high reliability, safer isolation. It offers good EMC performance, which meet IEC/EN61000-4, CISPR22/EN55022, UL60950 and EN60950 standards, and it's widely used in industrial, office and civil applications. For harsh EMC environment, the application circuit in the datasheet is strongly recommended.

Selection Guide

Certification	Part No.	Output Power	Nominal Output Voltage and Current(Vo/Io)	Efficiency (230VAC, %/Typ.)	Max. Capacitive Load(μF)
UL/CE (pending)	LH05-13B03	4W	3.3V/1250mA	72	4000
	LH05-13B05	5W	5V/1000mA	77	4000
	LH05-13B09		9V/550mA	79	1800
	LH05-13B12		12V/420mA	81	1800
	LH05-13B15		15V/330mA	82	1500
	LH05-13B24		24V/230mA	84	330
	LH10-13B03	6.6W	3.3V/2000mA	70	26000
	LH10-13B05	10W	5V/2000mA	76	9400
	LH10-13B09		9V/1100mA	78	3600
	LH10-13B12		12V/900mA	80	2400
	LH10-13B15		15V/700mA	81	1200
	LH10-13B24		24V/450mA	82	370
	LH15-13B03	9.9W	3.3V/3000mA	74	36000
	LH15-13B05	14W	5V/2800mA	78	20000
	LH15-13B09	15W	9V/1600mA	79	6000
	LH15-13B12		12V/1250mA	82	3000
	LH15-13B15		15V/1000mA	82	3000
	LH15-13B24		24V/625mA	84	900
	LH15-13B48		48V/320mA	85	370
	LH20-13B03	13.5W	3.3V/3500mA	75	48000
	LH20-13B05	17.5W	5V/3500mA	78	12240
	LH20-13B09	20W	9V/2100mA	79	5600
	LH20-13B12		12V/1600mA	83	5400
	LH20-13B15		15V/1300mA	84	2400
	LH20-13B24		24V/850mA	85	1840
	LH25-13B03	13.5W	3.3V/4100mA	75	48000
	LH25-13B05	20.5W	5V/4100mA	78	12240
	LH25-13B09	25W	9V/2500mA	79	5600
	LH25-13B12		12V/2100mA	83	5400
	LH25-13B15		15V/1600mA	84	2400
	LH25-13B24		24V/1100mA	85	1440
	LH25-13B48		48V/500mA	87	800

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range	AC input		85	--	305	VAC
	DC input		120	--	430	VDC
Input frequency			47	--	63	Hz
Input current	115VAC	LH05 models	--	--	0.125	A
		LH10 models	--	--	0.26	
		LH15 models	--	--	0.37	
		LH20/LH25 models	--	--	0.6	
	230VAC	LH05 models	--	--	0.08	
		LH10 models	--	--	0.16	
		LH15 models	--	--	0.22	
		LH20/LH25 models	--	--	0.34	
Inrush current	115VAC	LH05/LH10/LH15 models	--	10	--	
		LH20/LH25 models	--	15	--	
	230VAC	LH05/LH10 models	--	15	--	
		LH15 models	--	20	--	
		LH20/ LH25 models	--	30	--	
Leakage current			0.3mA RMS typ./230VAC/50Hz			
Recommended External Input Fuse(Special package series include fuse)	LH05 models		1A/300V, slow fusing			
	LH10/LH15 models		2A/300V, slow fusing			
	LH20/ LH25 models		3.15A/300V, slow fusing			

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Main circuit	--	±2	--	%
Line Regulation	Full load	--	±0.5	--	
		--	±1.5	--	
Load Regulation	10%-100% load	--	±1	--	
Output Ripple & Noise*	20MHz bandwidth (peak-peak value)	--	50	100	mV
Temperature Drift Coefficient	Main circuit	--	±0.02	--	%/℃
Short Circuit Protection		Continuous, self-recovery			
Over-current Protection		≥110%Io self-recovery			
Over-voltage Protection	3.3 / 5VDC Output	≤7.5VDC			
	9VDC Output	≤12VDC			
	12 / 15VDC Output	≤20VDC			
	24VDC Output	≤30VDC			
	48VDC Output	≤60VDC			
Min. Load	Single output models	0	--	--	%
Hold-up Time	115VAC input	--	15	--	ms
	230VAC input	--	80	--	

Note: *Parallel line test method is adopted to test the ripple and noise, please see *AC-DC Converter Application Notes* for specific operation methods.

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-output	Test time: 1min	3000	--	--	VAC
Operating Temperature			-40	--	+70	℃
Storage Temperature			-40	--	+105	
Storage Humidity			--	--	95	%RH

Welding Temperature	Wave-soldering	260±5℃; time:5~10s			
	Manual-welding	360±10℃; time:3~5s			
Switching Frequency	LH05 models	--	66	132	kHz
	LH10 models	--	100	--	
	LH15/LH20/LH25 models	--	65	--	
Power Derating	-40℃ to -10℃	2	--	--	%/℃
	50℃ to +70℃ (LH25-13Bxx)	3	--	--	
	55℃ To +70℃ (Others)	4	--	--	
Safety Standard	IEC60950/EN60950/UL60950				
Safety-regulated Certification	EN60950/UL60950(pending)				
Safety Class	LH15-13Bxx	CLASS II			
	Others	CLASS I			
Hot Plug	Unavailable				
MTBF	MIL-HDBK-217F@25℃ > 300,000 h				

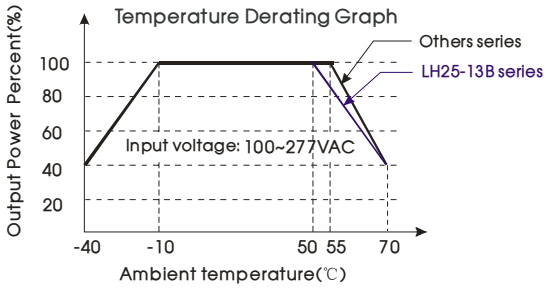
Physical Specifications

Casing Material	Black flame-retardant and heat-resistant plastic (UL94-V0)
Package Dimensions	Refer to the Dimensions
Weight	Refer to the Dimensions
Cooling method	Free air convection

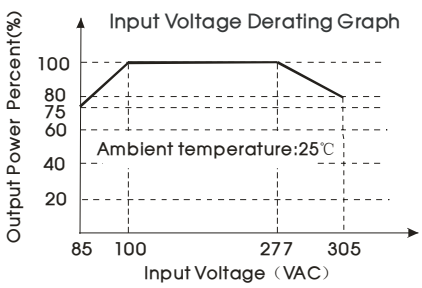
EMC Specifications

EMI	Conducted Disturbance	CISPR22/EN55022, CLASS B	
	Radiated Emission	CISPR22/EN55022, CLASS B	
EMS	Electrostatic Discharge	IEC/EN61000-4-2 Contact ±6KV/Air ±8KV	Perf. Criteria B
	Radiation Immunity	IEC/EN61000-4-3 10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4 ±2KV	perf. Criteria B
		IEC/EN61000-4-4 ±4KV (See Fig. 6 for recommended circuit)	perf. Criteria B
	Surge Immunity	IEC/EN61000-4-5 ±1KV/±2KV	perf. Criteria B
		IEC/EN61000-4-5 ±2KV/4KV (See Fig. 6 for recommended circuit)	perf. Criteria B
	Conducted Disturbance immunity	IEC/EN61000-4-6 10 Vr.m.s	perf. Criteria A
	Immunity for Power frequency magnetic field	IEC/EN61000-4-8 10A/m	perf. Criteria A
	Immunities of voltage dip, drop and short interruption	IEC/EN61000-4-11 0%-70%	perf. Criteria B

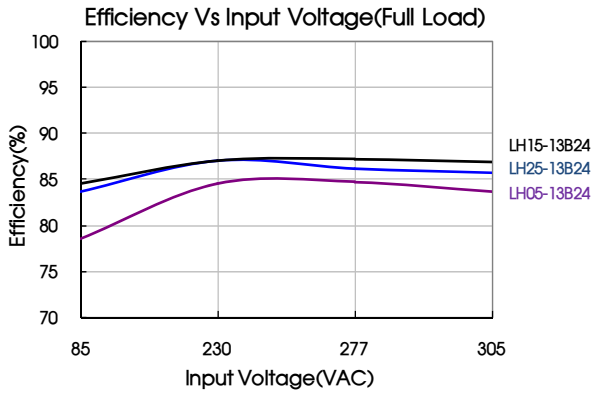
Product Characteristic Curve

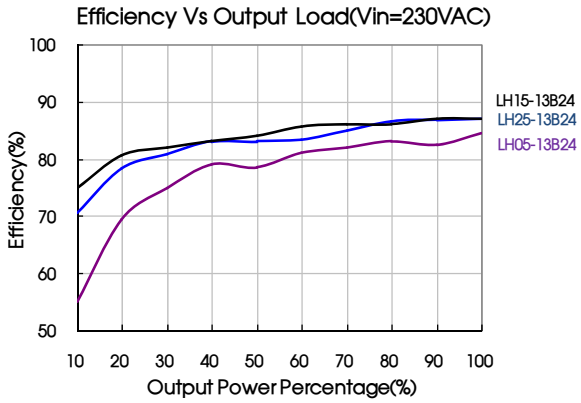


Note: When input 85~100VAC/277~305VAC, it need to be voltage derated on basis of temperature derating.



Note: When input DC, VDC=1.414VAC-20.





Design Reference

1. Typical application circuit

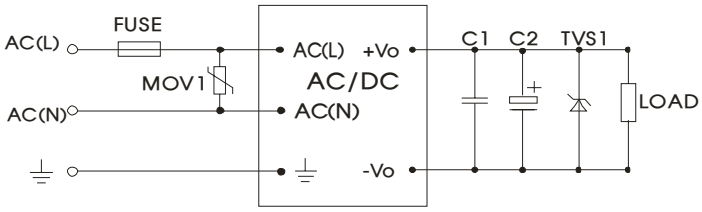


Fig. 1: Typical application circuit

Model	C1(uF)	C2(uF)	TVS1
LH05-13B03	1	330	SMBJ7.0A
LH05-13B05	1	330	SMBJ7.0A
LH05-13B09	1	120	SMBJ12A
LH05-13B12	1	120	SMBJ20A
LH05-13B15	1	68	SMBJ20A
LH05-13B24	1	68	SMBJ30A
LH10-13B03	1	470	SMBJ7.0A
LH10-13B05	1	330	SMBJ7.0A
LH10-13B09	1	120	SMBJ12A
LH10-13B12	1	120	SMBJ20A
LH10-13B15	1	120	SMBJ20A
LH10-13B24	1	68	SMBJ30A
LH15-13B03	1	680	SMBJ7.0A
LH15-13B05	1	680	SMBJ7.0A
LH15-13B09	1	470	SMBJ12A
LH15-13B12	1	220	SMBJ20A

Model	C1(uF)	C2(uF)	TVS1
LH15-13B15	1	220	SMBJ20A
LH15-13B24	1	68	SMBJ30A
LH15-13B48	1	33	SMBJ64A
LH20-13B03	1	330	SMBJ7.0A
LH20-13B05	1	330	SMBJ7.0A
LH20-13B09	1	220	SMBJ12A
LH20-13B12	1	220	SMBJ20A
LH20-13B15	1	220	SMBJ20A
LH20-13B24	1	220	SMBJ30A
LH25-13B03	1	330	SMBJ7.0A
LH25-13B05	1	330	SMBJ7.0A
LH25-13B09	1	330	SMBJ12A
LH25-13B12	1	330	SMBJ20A
LH25-13B15	1	330	SMBJ20A
LH25-13B24	1	120	SMBJ30A
LH25-13B48	1	68	SMBJ64A

Note:
Output filtering capacitor C2 is electrolytic capacitor, it is recommended to apply electrolytic capacitor with high frequency and low resistance. For capacitance and current of capacitor please refer to manufacture's datasheet. Capacitance withstand voltage derating should be 80% or above. C1 is ceramic capacitor, which is used to filter high-frequency noise. TVS is a recommended component to protect post-circuits if converter fails.

2. EMC solution-recommended circuit

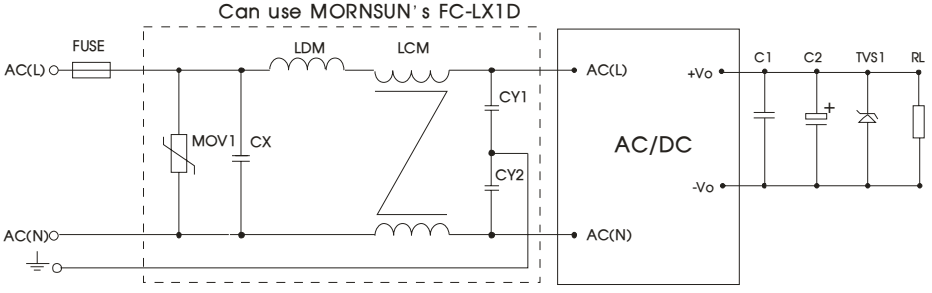


Fig 2: EMC Recommended circuit with higher requirements

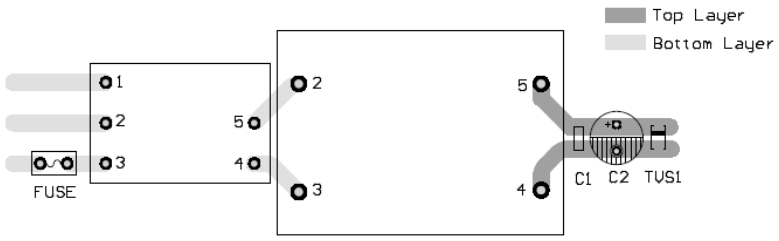
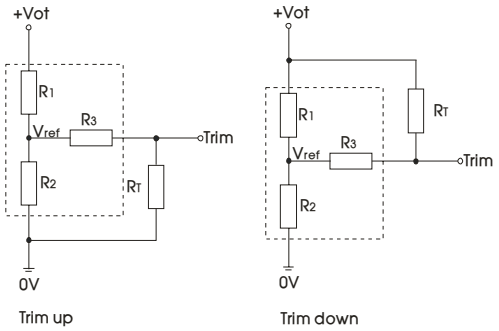


Fig 3: Recommended EMC circuit-PCB layout

Suggestions for safety regulation and wiring width: wire width≥3mm, distance between wires≥6mm, and distance between wire and ground≥6mm

Element model	Recommended value	Element model	Recommended value	
MOV1	S14K350	FC-LX1D	2KV/4KV EMC filter	
CY1 , CY2	1000pF/400VAC	FUSE	LH05	1A/300V slow fusing, necessary
CX	0.1μF/310VAC		LH10/15	2A/300V slow fusing, necessary
LCM	10mH, recommended to use MORNSUN's FL2D-Z5-103		LH20/25	3.15A/300V slow fusing, necessary
LDM	5uH	--	--	

3. Application of Trim and calculation of Trim resistance



Applied circuits of Trim (Part in broken line is the interior of models)

Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{Vref}{Vot - Vref} \cdot R_1$$

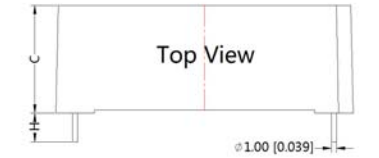
$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{Vot - Vref}{Vref} \cdot R_2$$

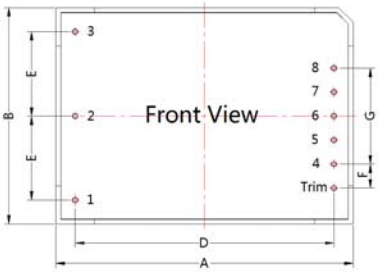
R_T is Trim resistance
a is a self-defined parameter, with no real meaning.

Vout	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)	Vot(V)
3.3V	3.3	1.98	1	1.24	Output voltage after regulation, variation ≤ ±10%
5V	3.3	3.3	1	2.5	
9V	7.5	2.87	1	2.5	
12V	3.83	1	1	2.5	
15V	7.5	1.5	1	2.5	
24V	8.66	1	1	2.5	
48V	68	3.73	1	2.5	

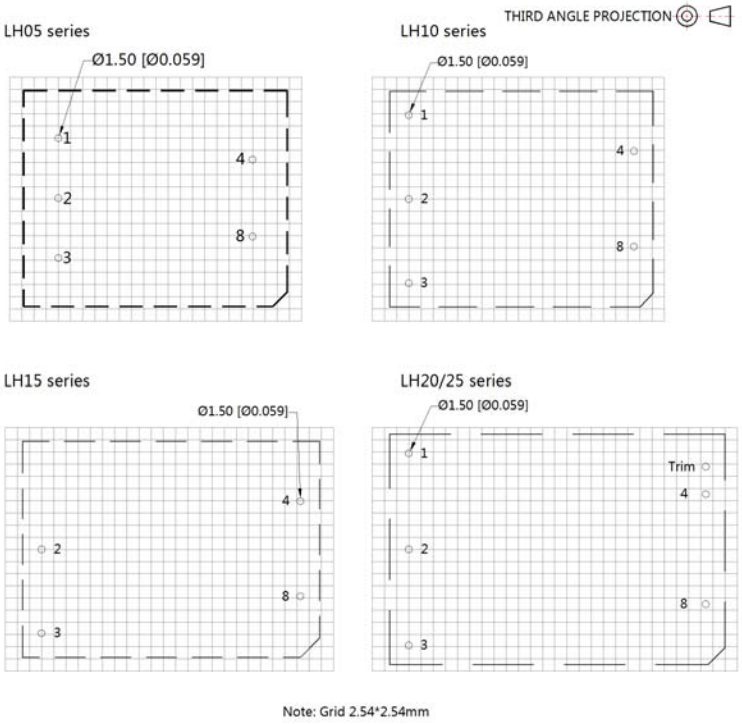
4. For more information please find the application note on www.mornsun-power.com

Dimensions and Recommended Layout





Note:
Unit:mm[inch]
Pin diameter tolerances:±0.10[±0.004]
Pin length(H)≥6.00[0.236]
General tolerances:±0.50[±0.020]



Note: Grid 2.54*2.54mm

Dimensions (Unit: mm)					
NO.	LH05	LH10	LH15	LH20	LH25
A	55.00	55.00	62.00	70.00	70.00
B	45.00	45.00	45.00	48.00	48.00
C	21.00	21.00	22.50	23.50	23.50
D	40.50	47.00	54.00	62.00	62.00
E	12.50	17.50	17.50	20.00	20.00
F	--	--	--	5.75	5.75
G	16.00	20.00	20.00	23.00	23.00

Models Weight					
Weight	LH05	LH10	LH15	LH20	LH25
(Typ.)	75g	75g	85g	120g	120g

Pin Connection	
Pin	LHxx-13Bxx
1	⏚
2	AC(N)
3	AC(L)
4	-Vo
5	No Pin
6	No Pin
7	No Pin
8	+Vo
Trim	Trim**
There is no pin "1" ⏚ on LH15-13Bxx Trim**: only for LH20/25-13Bxx Series.	

Note:

1. Packing Information please refer to 'Product Packing Information'. The Packing bag number of Horizontal package : 58220006;
2. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25°C, humidity<75% when inputting nominal voltage and outputting rated load;
3. All index testing methods in this datasheet are based on our Company's corporate standards;
4. The performance indexes of the product models listed in this manual are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technician for specific information;
5. We can provide product customization service;
6. Specifications of this product are subject to changes without prior notice.

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