5-25W, AC/DC converter

Report CB RoHS
EN60950-1 IEC60950-1 BS EN 62368-1
EN62368-1

FEATURES

- Wide input voltage range: 85 - 305VAC/100 - 430VDC
- Operating temperature range: -40 to +70℃
- Conversion efficiency up to 87%
- High I/O isolation test voltage up to 3000VAC
- IEC60950, EN60950, EN626368 approval
- Output short circuit, over-current, over-voltage protection
- Mounting: PCB mounting, Chassis mounting, DIN-Rail mounting available

LH(05-25)-13Bxx series series is one of Mornsun's compact size power converters. They feature universal AC input and at the same time accepts DC 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 extremely harsh EMC environment, we recommend using the application circuit show in Design Reference of this datasheet.

Selection Guide

Certification	Part No.	Output Power	Nominal Output Voltage and Current(Vo/Io)	Efficiency (230VAC, %/Typ.)	Max. Capacitive Load(μF)
IEC/EN	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	5.5W	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	11.55W	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	22.5W	9V/2500mA	79	5600
	LH25-13B12	25W	12V/2100mA	83	5400

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IEC/EN	LH25-13B15	24W	15V/1600mA	84	2400
	LH25-13B24	26.4W	24V/1100mA	85	1440
	LH25-13B48	24W	48V/500mA	87	800

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range	AC input		85	--	305	VAC
	DC input		100	--	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	230VAC/50Hz		0.3mA RMS typ.			
Recommended External Input Fuse(Special package series include fuse)	LH05 models		1A/300V, slow-blow			
	LH10/LH15 models		2A/300V, slow-blow			
	LH20/LH25 models		3.15A/300V, slow-blow			
Hot Plug			Unavailable			

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy			--	±2	--	%
Line Regulation	Full load		--	±0.5	--	
Load Regulation	0%-100% load		--	±1	--	
Ripple & Noise*	20MHz bandwidth (peak-peak value)		--	50	100	mV
Temperature Coefficient			--	±0.02	--	%/℃
Short Circuit Protection			Hiccup, Continuous, self-recover			
Over-current Protection			≥110%Io self-recover			
Over-voltage Protection	LH05 models		Over-voltage shutdown			
	LH10/LH15/LH20/LH25 models	3.3/5VDC Output	≤7.5VDC			
		9VDC Output	≤12VDC			
		12 /15VDC Output	≤20VDC			
		24VDC Output	≤30VDC			
		48VDC Output	≤60VDC			
Min. Load			0	--	--	%
Trim	LH20/LH25 models		--	--	±10	
Hold-up Time	115VAC input		--	15	--	ms
	230VAC input		--	80	--	

Note: *The "parallel cable" method is used for ripple and noise test, please refer to AC-DC Converter Application Notes for specific information.

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General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage*	Input-output	Test time: 1min	3000	--	--	VAC
	Input- ⏚		2000	--	--	
Operating Temperature			-40	--	+70	℃
Storage Temperature		LH05/10/15 models	-40	--	+105	
		LH20/25 models	-40	--	+85	
Storage Humidity			--	--	95	%RH
Welding Temperature		Wave-soldering	260±5℃; time: 5-10s			
		Manual-welding	360±10℃; time: 3-5s			
Switching Frequency		LH05 models	--	65	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			IEC60950-1, EN60950-1, EN/BS EN62368-1 safety approved; Design refer to UL60950-1			
Safety Class		LH15-13Bxx	CLASS II			
		Others	CLASS I			
MTBF			MIL-HDBK-217F@25℃ > 300,000 h			

Note:* There is no pin ⏚ on LH15-13Bxx .

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 convection

EMC Specifications

EMI	CE	CISPR32/EN55032	CLASS B	
	RE	CISPR32/EN55032	CLASS B	
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	perf. Criteria B
		IEC/EN61000-4-4	±4KV (See Fig. 2 for recommended circuit)	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±1KV/line to ground ±2KV	perf. Criteria B
		IEC/EN61000-4-5	line to line ±2KV/ line to ground ±4KV (See Fig. 2 for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	10Vr.m.s	perf. Criteria A
	PFM	IEC/EN61000-4-8	10A/m	perf. Criteria A
	Voltage dip, short interruption and voltage variation	IEC/EN61000-4-11	0%,70%	perf. Criteria B

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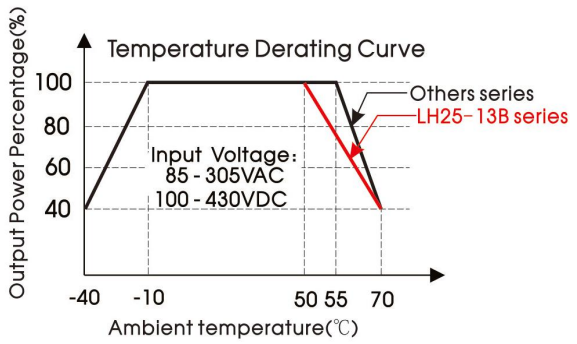
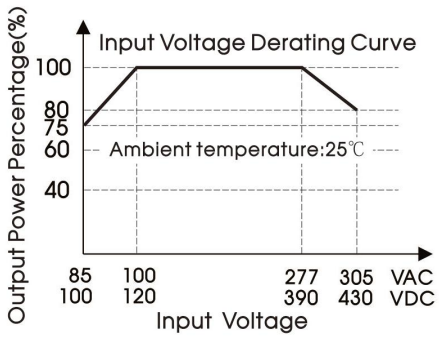
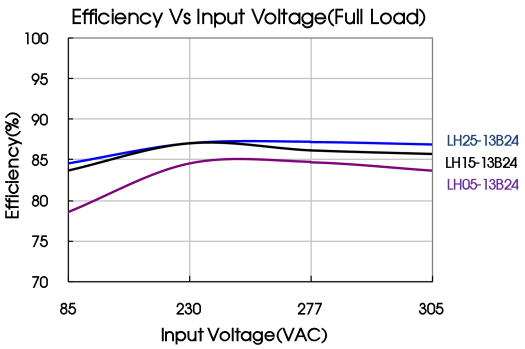
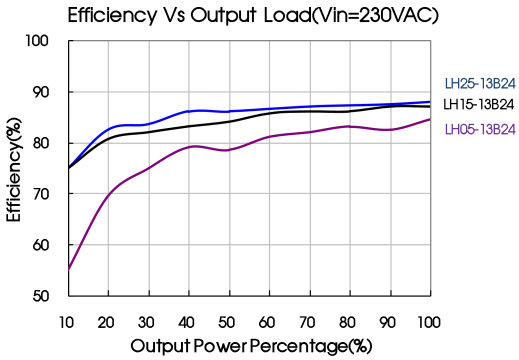
Product Characteristic Curve





Note:
①With an AC input voltage between 85-100VAC/277-305VAC and a DC input between 100-120VDC/390-430VDC the output power must be derated as per the temperature derating curves;
②This product is suitable for applications using natural air cooling; for applications in closed environment please consult Mornsun FAE.





Design Reference

1. Typical application circuit

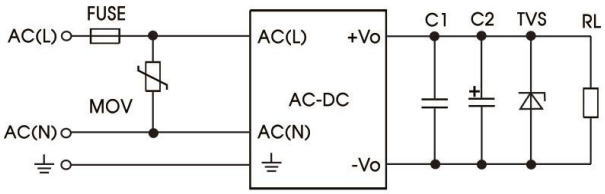


Fig. 1

Model	C1 (uF)	C2 (uF)	FUSE	MOV	TVS
LH05-13B03	1	330	1A/300V slow fusing, necessary	S14K350	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	2A/300V slow fusing, necessary		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)	FUSE	MOV	TVS
LH15-13B15	1	220	2A/300V slow fusing, necessary	S14K350	SMBJ20A
LH15-13B24	1	68			SMBJ30A
LH15-13B48	1	33			SMBJ64A
LH20-13B03	1	330	3.15A/300V slow fusing, necessary		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. Capacitor voltage reduced to at least 80%. C1 is ceramic capacitor, which is used to filter high-frequency noise. TVS is a recommended component to protect post-circuits if converter fails.

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2. EMC solution-recommended circuit

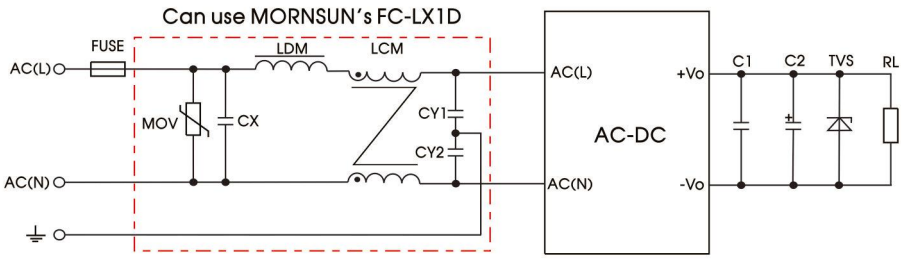
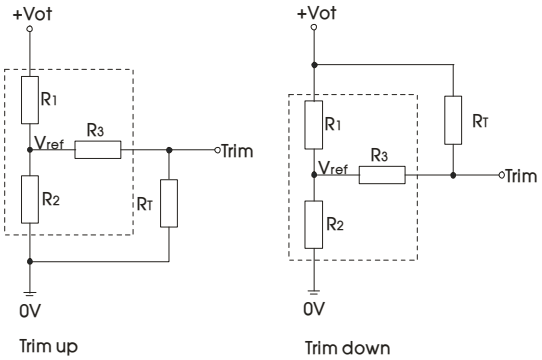


Fig. 2

Element model	Recommended value	Element model	Recommended value	
MOV	S14K350	FC-LX1D	EMC filter	
CY1 , CY2	1000pF/400VAC	FUSE	LH05	2A/300V slow-blow, required
CX	0.1uF/310VAC		LH10/15	2A/300V slow-blow, required
LCM	10mH, P/N: FL2D-Z5-103 (MORNSUN) is recommended		LH20/25	3.15A/300V slow-blow, required
LDM	4.7uH/2A	--	--	

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:

$$\text{up:}\quad R_T=\frac{aR_2}{R_2-a}-R_3 \qquad a=\frac{V_{ref}}{V_{ot}-V_{ref}}\cdot R_1$$

$$\text{down:}\quad R_T=\frac{aR_1}{R_1-a}-R_3 \qquad a=\frac{V_{ot}-V_{ref}}{V_{ref}}\cdot R_2$$

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 about Mornsun EMC Filter products, please visit www.mornsun-power.com to download the Selection Guide of EMC Filter

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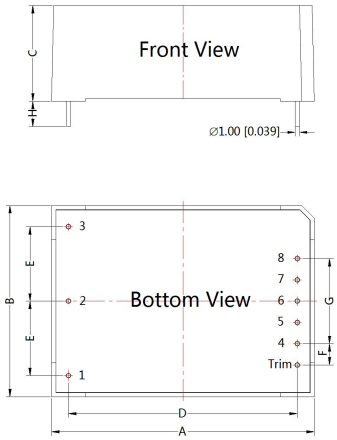
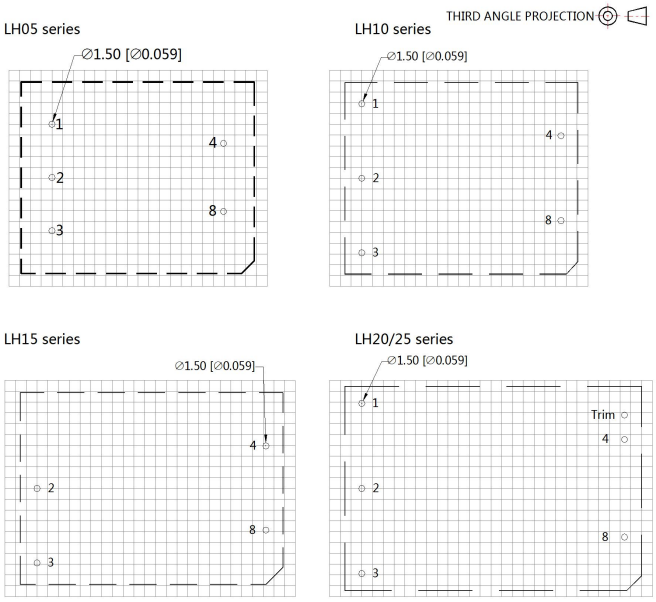
Dimensions and Recommended Layout



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
H	6(Min)				

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.

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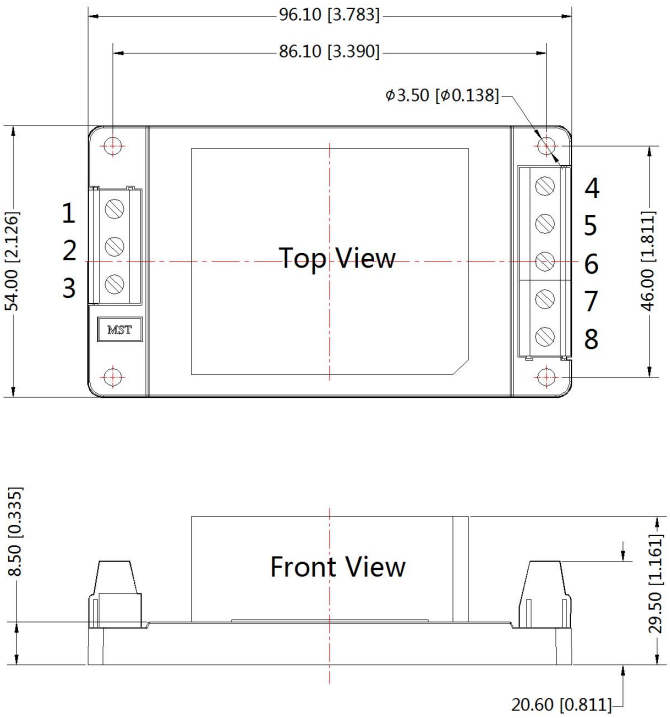
LHXXA2 Dimensions

THIRD ANGLE PROJECTION



Pin-Out	
Pin	LHxx-13BxxA2
1	⏚
2	AC(N)
3	AC(L)
4	-Vo
5	NC
6	NC/Trim**
7	NC
8	+Vo

There is no pin "1" on the LH15-13BxxA2 series.
NC/Trim** : The pin is Trim on the LH20/25-13BxxA2 series and is not connected on other single output products.

*The figure left is related to the LH10-13BxxA2 series. the height of other series is different.

Note:
Unit:mm[inch]
Wire range : 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances:±1.00[±0.039]

Dimensions (Unit: mm)	
Model	Dimensions
LH05XXA2	96.1*54.0*29.5mm
LH10XXA2	96.1*54.0*29.5mm
LH15XXA2	96.1*54.0*31.0mm
LH20XXA2	96.1*54.0*32.0mm
LH25XXA2	96.1*54.0*32.0mm

Models weight					
Weight	LH05	LH10	LH15	LH20	LH25
Typ.	125g	125g	135g	170g	170g

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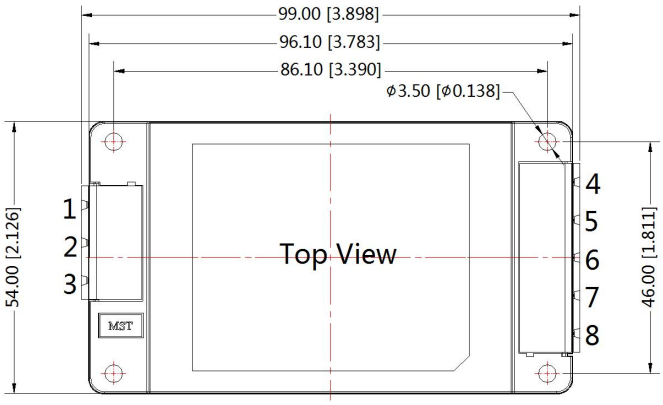
LHXXA3 Dimensions

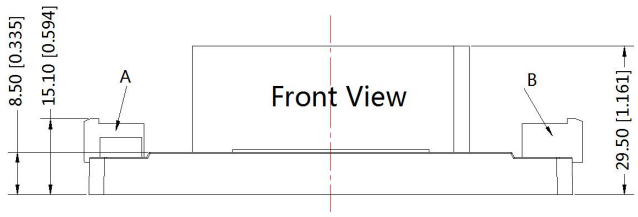
THIRD ANGLE PROJECTION



Pin-Out	
Pin	LHxx-13BxxA3
1	⏚
2	AC(N)
3	AC(L)
4	-Vo
5	NC
6	NC/Trim**
7	NC
8	+Vo

There is no pin "1" on the LH15-13BxxA3 series.
NC/Trim** : The pin is Trim on the LH20/25-13BxxA3 series and is not connected on other single output products.

*The figure left is related to the LH10-13BxxA3 series. the height of other series is different.



Note:
Unit:mm[inch]
General tolerances:±1.00[±0.039]
A:DEGSON P/N:
2EDGRC-7.5-03P-14-100A (H)
B:DEGSON P/N:
2EDGRC-7.5-05P-14-100A (H)

Dimensions (Unit: mm)	
Model	Dimensions
LH05XXA3	99.0*54.0*29.5mm
LH10XXA3	99.0*54.0*29.5mm
LH15XXA3	99.0*54.0*31.0mm
LH20XXA3	99.0*54.0*32.0mm
LH25XXA3	99.0*54.0*32.0mm

Models weight					
Weight	LH05	LH10	LH15	LH20	LH25
Typ.	125g	125g	135g	170g	170g

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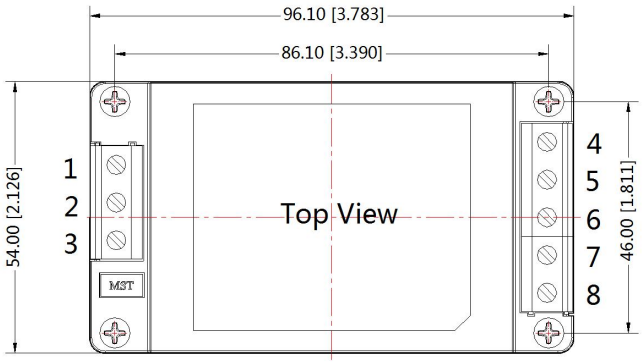
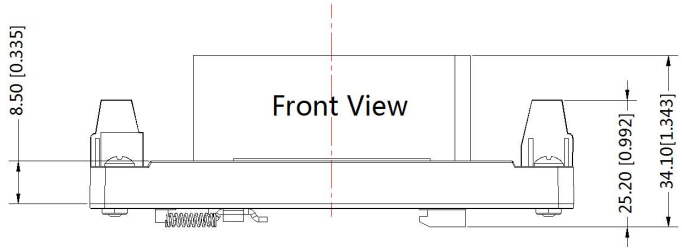
LHXXA4 Dimensions

THIRD ANGLE PROJECTION



Pin-Out	
Pin	LHxx-13BxxA4
1	⏚
2	AC(N)
3	AC(L)
4	-Vo
5	NC
6	NC/Trim**
7	NC
8	+Vo

There is no pin "1" on the LH15-13BxxA4 series.
NC/Trim** : The pin is Trim on the LH20/25-13BxxA4 series and is not connected on other single output products.



*The figure left is related to the LH10-13BxxA4 series. the height of other series is different.

Note:
Unit:mm[inch]
Mounting rail: TS35, rail needs to connect safety ground
Wire range : 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances:±1.00[±0.039]

Dimensions (Unit: mm)	
Model	Dimensions
LH05XXA4	96.1*54.0*34.1mm
LH10XXA4	96.1*54.0*34.1mm
LH15XXA4	96.1*54.0*35.6mm
LH20XXA4	96.1*54.0*36.6mm
LH25XXA4	96.1*54.0*36.6mm

Models weight					
Weight	LH05	LH10	LH15	LH20	LH25
Typ.	165g	165g	175g	210g	210g

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220006; the Packing bag number of A2/A3/A4 package: 58220010;
2. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75% with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on our Company's corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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