

60W, AC-DC converter



## FEATURES

- Universal 85-264VAC or 100-370VDC input voltage
- Operating ambient temperature range: -40°C to +70°C
- High I/O isolation test voltage up to 4000VAC
- Regulated output, low ripple & noise
- Output short circuit, over-current, over-voltage protection
- High efficiency, high reliability
- Plastic case meets UL94V-0 flammability
- Meets EMI CLASS B and surge  $\pm 2\text{KV}/\pm 4\text{KV}$  (level 4) without additional circuits

LHE60-20Bxx series AC-DC converters are highly efficient, environmental-friendly 60W power modules. It features universal AC input and at the same time accepts DC input voltage, low power consumption, high efficiency, high reliability, reinforced isolation. It offers good EMC performance compliant to IEC/EN61000-4 and CISPR32/EN55032 and meets UL/EN/IEC62368 standards. The converters are widely used in industrial, power, instrumentation, communication 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 at 230VAC (%) Typ.	Capacitive Load ( $\mu\text{F}$ ) Max.
UL/EN/IEC	LHE60-20B05	50W	5V/10000mA	82	50000
	LHE60-20B12	60W	12V/5000mA	86	10000
	LHE60-20B15		15V/4000mA		8000
	LHE60-20B24		24V/2500mA		2700
	LHE60-20B48		48V/1250mA		680

Note: \*①Use suffix "A5" for chassis and suffix "A6" for DIN-Rail mounting;  
 ②The product picture is for reference only. For details, please refer to the actual product.

## Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	AC input	85	--	264	VAC
	DC input	100	--	370	VDC
Input Frequency		47	--	63	Hz
Input Current	115VAC	--	--	1.4	A
	230VAC	--	--	0.8	
Inrush Current	115VAC	--	45	--	
	230VAC	--	90	--	
Leakage Current	240VAC/50Hz	0.25mA Max.			
Recommended External Input Fuse		3.15A/250V slow-blow required			
Hot Plug		Unavailable			

## Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		--	$\pm 2$	--	%
Line Regulation	Full load	--	$\pm 0.5$	--	
Load Regulation	0%-100% load	--	$\pm 1$	--	
Ripple & Noise*	20MHz bandwidth (peak-to-peak value)	--	--	150	mV
Stand-by Power Consumption	5/12/15/24V output	--	--	0.5	W
	48V output	--	--	0.65	

Temperature Coefficient		--	±0.02	--	%/°C
Short Circuit Protection		Hiccup, continuous, self-recover			
Over-current Protection		≥110%Io, self-recover			
Over-voltage Protection	5VDC Output	≤9VDC (Output voltage clamp or turn off)			
	12VDC Output	≤16VDC (Output voltage clamp or turn off)			
	15VDC Output	≤24VDC (Output voltage clamp or turn off)			
	24VDC Output	≤35VDC (Output voltage clamp or turn off)			
	48VDC Output	≤60VDC (Output voltage clamp or turn off)			
Minimum Load		0	--	--	%
Hold-up Time	115VAC input	--	8	--	ms
	230VAC input	--	65	--	

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

## General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-PE	2000	--	--	VAC
	Input-Output	4000	--	--	
	Output-PE	500	--	--	
Operating Temperature		-40	--	+70	°C
Storage Temperature		-40	--	+85	
Storage Humidity		--	--	95	%RH
Soldering Temperature	Wave-soldering	260 ± 5°C; time: 5 - 10s			
	Manual-welding	360 ± 10°C; time: 3 - 5s			
Power Derating	-40°C to -30°C	4.0	--	--	%/°C
	+45°C to +70°C (5V output)	3.0	--	--	
	+50°C to +70°C (12V, 15V output)	2.5	--	--	
	+55°C to +70°C (24V, 48V output)	2.5	--	--	
	85VAC - 110VAC	1.0	--	--	%/VAC
	240VAC - 264VAC	0.42	--	--	
Safety Standard		UL/IEC62368-1 safety approved & BS EN62368-1/EN62368-1(Report)			
Safety Class		CLASS I			
MTBF	MIL-HDBK-217F@25°C	> 300,000 h			

## Mechanical Specifications

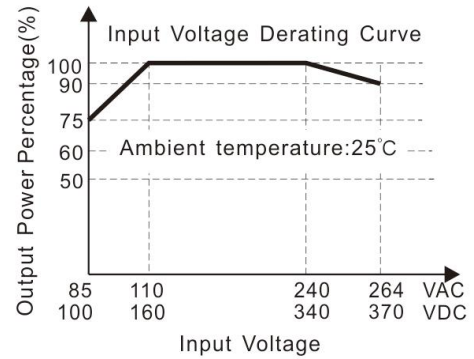
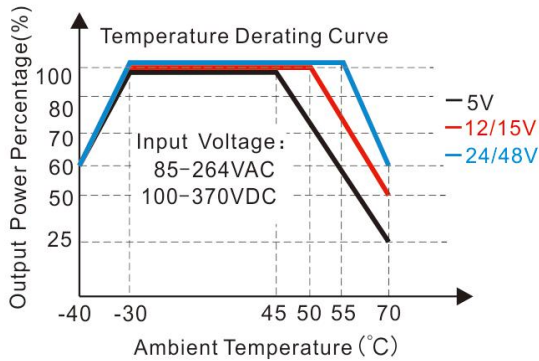
Case Material	Black plastic, flame-retardant and heat-resistant (UL94V-0)	
Dimension	Horizontal package	109.00 x 58.50 x 30.00 mm
	A5 chassis mounting	135.00 x 70.00 x 38.50 mm
	A6 Din-Rail mounting	137.00 x 70.00 x 44.00 mm
Weight	Horizontal package	300g (Typ.)
	A5 chassis mounting	390g (Typ.)
	A6 Din-Rail mounting	460g (Typ.)
Cooling method	Free air convection	

## Electromagnetic Compatibility (EMC)

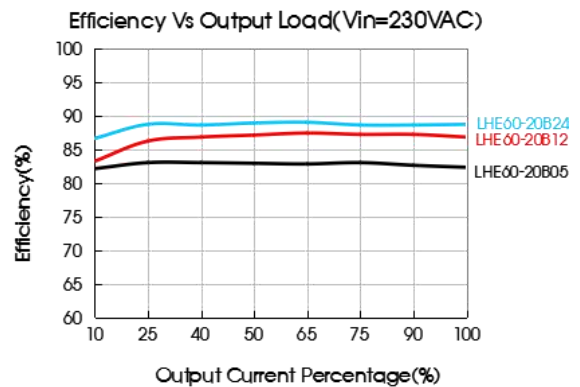
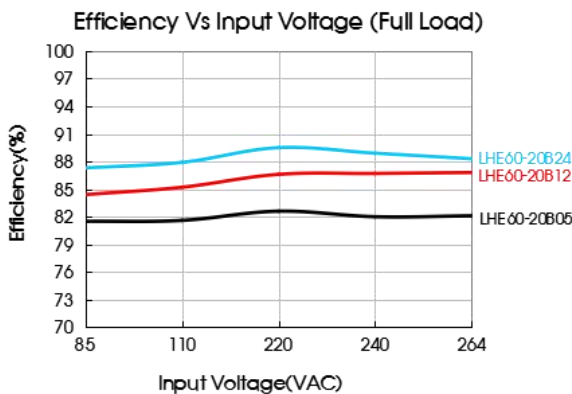
Emissions	CE	CISPR32/EN55032	CLASS B
	RE	CISPR32/EN55032	CLASS B
Immunity	ESD	IEC/EN61000-4-2	Contact ±6KV/Air ±8KV perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m perf. Criteria A

EFT	IEC/EN61000-4-4	±4KV	perf. Criteria B
Surge	IEC/EN61000-4-5	line to line ±2KV/line to PE ±4KV	perf. Criteria B
	IEC/EN61000-4-5	line to line ±4KV/line to PE ±6KV (See Fig. 2 for recommended circuit)	perf. Criteria B
CS	IEC/EN61000-4-6	10Vr.m.s	perf. Criteria A
Voltage dip, short interruption and voltage variation	IEC/EN61000-4-11	0%, 70%	perf. Criteria B

### Product Characteristic Curve



Note: ① With an AC input between 85-110V/240-264VAC and a DC input between 100-160V/340-370VDC, the output power must be derated as per temperature derating curves;  
② This product is suitable for applications using natural air cooling; for applications in closed environment please consult Mornsun FAE.



### Design Reference

#### 1. Typical application

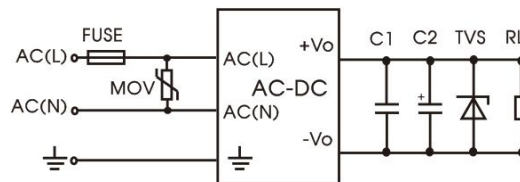


Fig. 1: Typical circuit diagram

Part No.	C1(uF)	C2(uF)	FUSE	MOV	TVS
LHE60-20B05	1	680	3.15A/250V slow-blow, required	S14K300	SMBJ7.0A
LHE60-20B12		330			SMBJ20A
LHE60-20B15		330			SMBJ20A
LHE60-20B24		200			SMBJ30A
LHE60-20B48		100			SMBJ64A

#### Output Filter Components:

We recommend using an electrolytic capacitor with high frequency, and low ESR rating for C2 (refer to manufacture's datasheet). Choose a Capacitor voltage rating with at least 20% margin, in other words not exceeding 80%. C1 is a ceramic capacitor used for filtering high-frequency noise and TVS is a recommended suppressor diode to protect the application in case of a converter failure.

2. EMC compliance recommended circuit

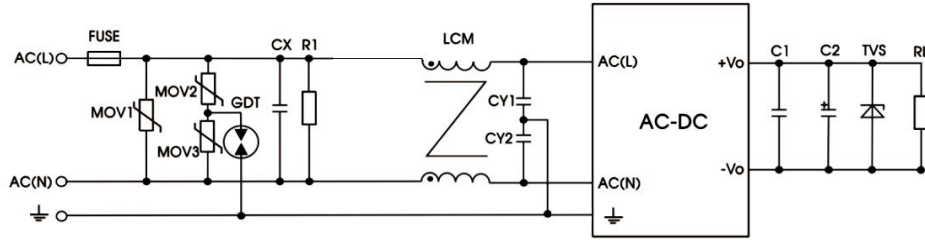
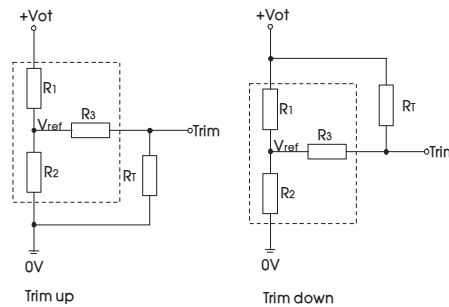


Fig. 2: EMC application circuit with higher requirements

Component	Recommended value
MOV1	S20K300
MOV2	S14K350
MOV3	S14K350
CX	0.15uF/300VAC
CY1	2.2nF/400VAC
CY2	2.2nF /400VAC
R1	1MΩ /2W
LCM	2.2mH, P/N: FL2D-30-222 (MORNSUN) is recommended
GDT	B5G3600
FUSE	6.3A/250V, slow-blow, required

3. Trim Function for Output Voltage Adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Calculating Trim resistor values:

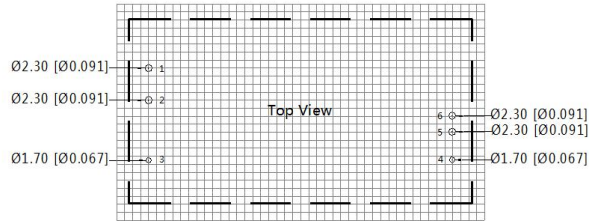
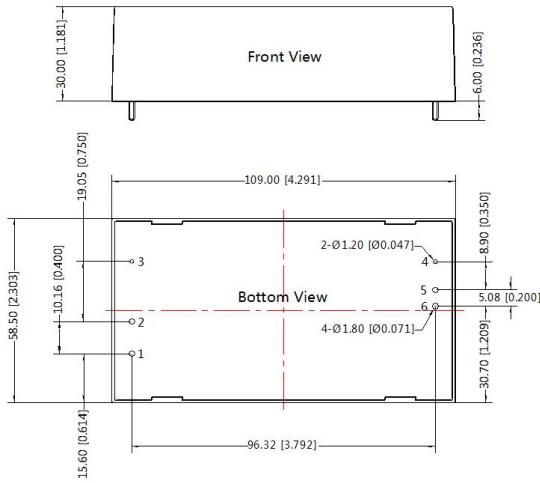
$$\begin{aligned}
 \text{up: } R_T &= \frac{\alpha R_2}{R_2 - \alpha} \cdot R_3 & \alpha &= \frac{V_{ref}}{V_{ot} - V_{ref}} \cdot R_1 & R_T &= \text{Trim Resistor value;} \\
 & & & & \alpha &= \text{self-defined parameter;} \\
 \text{down: } R_T &= \frac{\alpha R_1}{R_1 - \alpha} \cdot R_3 & \alpha &= \frac{V_{ot} - V_{ref}}{V_{ref}} \cdot R_2 & V_{ot} &= \text{desired output voltage}
 \end{aligned}$$

Vout nominal	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)	Vref (V)	Vot (V)
5V	3.3	3.3	1	2.5	Resulting Trimmed Output voltage; range ≤ ±10%
12V	3.83	1	1	2.5	
15V	7.5	1.5	1	2.5	
24V	8.66	1	1	2.5	
48V	33	1.8	1	2.5	

4. For additional information please refer to application notes on [www.mornsun-power.com](http://www.mornsun-power.com).

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



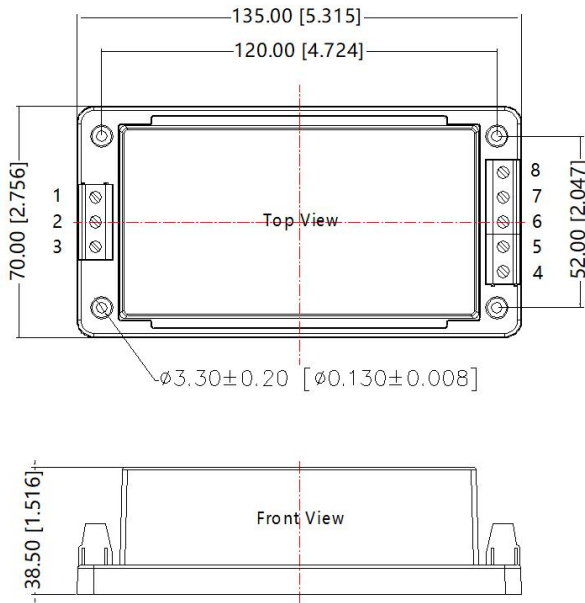
Note : Grid 2.54\*2.54mm

Pin-Out	
Pin	Function
1	AC(N)
2	AC(L)
3	⏏
4	Trim
5	-Vo
6	+Vo

Note:  
Unit: mm[inch]  
Pin1,2,5,6's diameter: 1.80[0.071], pin 3,4's diameter: 1.20[0.047]  
Pin diameter tolerances:  $\pm 0.10[\pm 0.004]$   
Pin tolerances(H):  $\pm 1.50[\pm 0.059]$   
General tolerances:  $\pm 0.50[\pm 0.020]$

A5 Dimensions

THIRD ANGLE PROJECTION

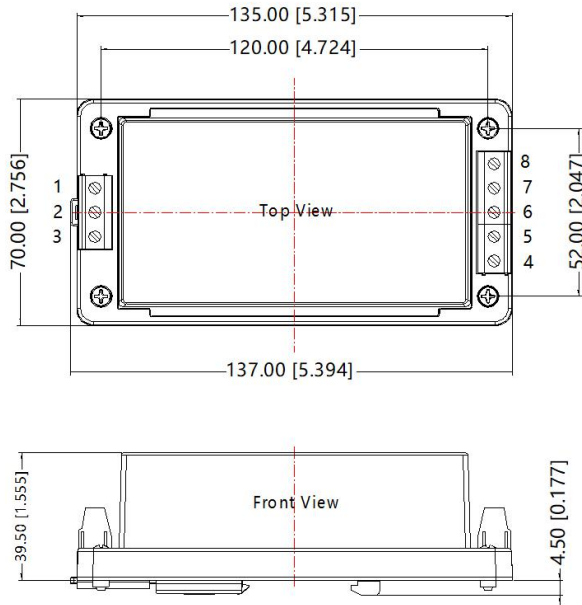


Pin-Out	
Pin	Function
1	AC(N)
2	AC(L)
3	⏏
4	Trim
5	-Vo
6	+Vo
7	NC
8	NC

Note:  
Unit: mm[inch]  
Wire range: 24~12 AWG  
Tightening torque: Max 0.4 N·m  
General tolerances:  $\pm 1.00[\pm 0.040]$

A6 Dimensions

THIRD ANGLE PROJECTION 



Pin-Out	
Pin	Function
1	AC(N)
2	AC(L)
3	⏏
4	Trim
5	-Vo
6	+Vo
7	NC
8	NC

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[±0.040]

- Note:
- For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). Packaging bag number: 58220020 (Horizontal package); 58220031 (A5/A6 package);
  - 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;
  - Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^\circ\text{C}$ , humidity<75% with nominal input voltage and rated output load;
  - All index testing methods in this datasheet are based on our company corporate standards;
  - We can provide product customization service, please contact our technicians directly for specific information;
  - Products are related to laws and regulations: see "Features" and "EMC";
  - If product involves multi-brand materials and there are differences in color etc, please refer to the standards of each manufacturer;
  - 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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