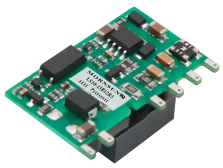
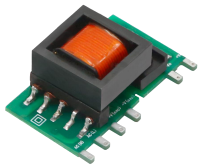
10W, DIY AC/DC converter





FEATURES

- Ultra-wide 85 - 305VAC and 100 - 430VDC input voltage range
- Accepts AC or DC input (dual-use of same terminal)
- Operating ambient temperature range -40℃ to +85℃
- Multi application, flexible layout
- Compact size, high power density, green power
- No-load power consumption as low as 0.1W
- Output short circuit, over-current, over-voltage protection
- Designed to meet IEC/EN61558, IEC/EN60335 standards
- IEC/EN/UL62368 safety approval

LS10-13BxxR3 series is one of Mornsun's highly efficient green power AC-DC Converter series. They feature wide input range accepting either AC or DC voltage, high efficiency, low power consumption and Class II reinforced insulation. All models are particularly suitable for industrial control, electric power, instrumentation and smart home applications which have high requirement for dimension and don't have high requirement on EMC. 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 (μF) Max.
CE/UL/CB	LS10-13B03R3	6.6W	3.3V/2000mA	73	1500
	LS10-13B05R3	10W	5V/2000mA	77	1500
	LS10-13B09R3		9V/1100mA	80	1000
	LS10-13B12R3		12V/830mA	82	680
	LS10-13B15R3		15V/670mA	82	470
	LS10-13B24R3		24V/420mA	83	330

Note: 1. The nominal output voltage refers to the voltage applied to the load terminal after adding external circuits;
2. If the product is used in a severe vibration application, it needs to be glued and fixed.

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	--	--	0.30	A
	230VAC	--	--	0.18	
Inrush Current	115VAC	--	15	--	
	277VAC	--	30	--	
Recommended External Input Fuse		1A, slow-blow, required (The actual use needs to be selected according to the application enviroment)			
Hot Plug		Unavailable			

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	3.3V		--	±3	--	%
	5V/9V/12V/15V/24V		--	±2	--	
Line Regulation	Rated load		--	±1	--	
Load Regulation	0% - 100% load		--	±1.5	--	
Ripple & Noise*	20MHz bandwidth (peak-to-peak value)		--	80	150	mV
Temperature Coefficient			--	±0.02	--	%/°C
Stand-by Power Consumption	230VAC	3.3V/5V	--	0.05	0.10	W
		9V/12V/15V	--	0.09	0.12	
		24V	--	0.13	0.15	
Short Circuit Protection			Hiccup, continuous, self-recovery			

Over-current Protection		⩾110%Io, self-recovery				
Over-voltage Protection	3.3/5VDC output	⩽9VDC (Output voltage clamp or hiccup)				
	9VDC output	⩽15VDC (Output voltage clamp or hiccup)				
	12VDC output	⩽16VDC (Output voltage clamp or hiccup)				
	15VDC output	⩽21VDC (Output voltage clamp or hiccup)				
	24VDC output	⩽32VDC (Output voltage clamp or hiccup)				
Minimum Load		0	--	--	%	
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-output	Electric Strength Test for 1min., leakage current＜5mA	3000	--	--	VAC
Operating Temperature			-40	--	+85	℃
Storage Temperature			-40	--	+105	
Storage Humidity			--	--	95	%RH
Power Derating		+55℃ to +85℃	2.5	--	--	%/℃
		85VAC - 100VAC	1	--	--	%/VAC
		277AVC - 305VAC	0.54	--	--	
Safety Standard			IEC/EN/UL62368, IEC/EN60335, IEC/EN61558			
Safety Certification			IEC/EN/UL62368			
Safety Class			CLASS II			
MTBF			MIL-HDBK-217F@25°C＞1000,000 h			

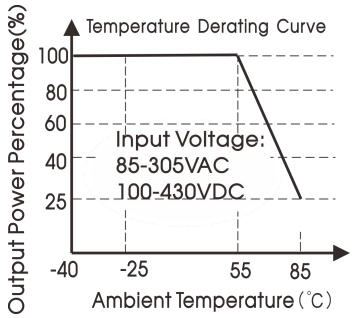
Mechanical Specifications

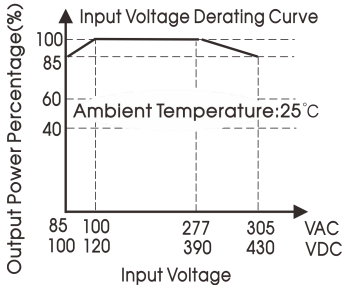
Dimension	32.00 x 17.20 x 15.05 mm
Weight	8.2g (Typ.)
Cooling method	Free air convection

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS A (Application circuit 1, 4)	
		CISPR32/EN55032	CLASS B (Application circuit 2, 3)	
	RE	CISPR32/EN55032	CLASS A (Application circuit 1, 4)	
		CISPR32/EN55032	CLASS B (Application circuit 2, 3)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±6KV	Perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2KV (Application circuit 1, 2)	perf. Criteria B
		IEC/EN61000-4-4	±4KV (Application circuit 3, 4)	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±1KV (Application circuit 1, 2)	perf. Criteria B
		IEC/EN61000-4-5	line to line±2KV (Application circuit 3, 4)	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

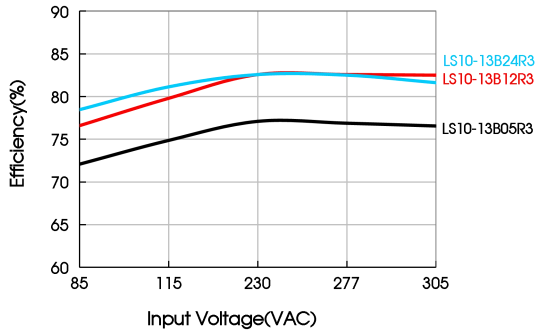
Product Characteristic Curve



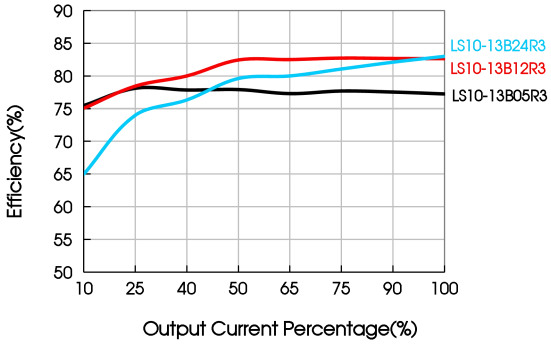


Note:
① With an AC input between 85 -100VAC/277- 305VAC and a DC input between 100 - 120VDC/390 - 430VDC, the output power must be derated as per temperature derating curves;
② This product is suitable for applications using natural air cooling; for applications in closed environment please consult factory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

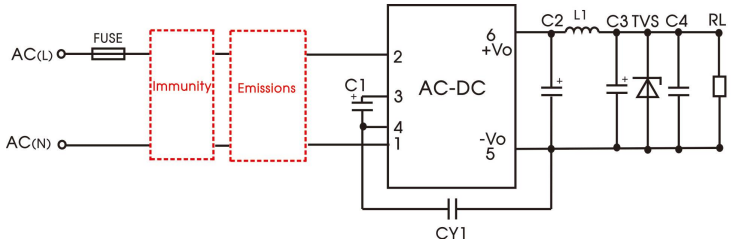
Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load(VIn=230VAC)



Additional Circuits Design Reference



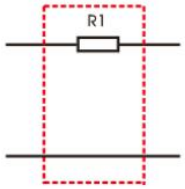
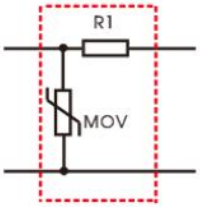
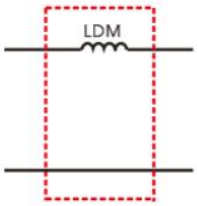
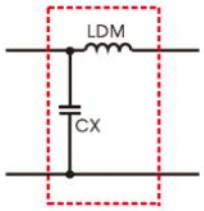
LS series additional circuits design reference

LS10 series additional components selection guide (No EMC devices)							
Part No.	C1(required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1(required)	TVS
LS10-13B03R3	22μF/450V	820μF/16V (solid-state capacitor)	2μH/15mΩ Max/6.5A	150μF/35V	0.1μF/50V	1.0nF/400VAC	SMBJ7.0A
LS10-13B05R3							
LS10-13B09R3		270μF/16V (solid-state capacitor)					SMBJ12A
LS10-13B12R3							SMBJ20A
LS10-13B15R3		470uF/35V		220uF/35V			
LS10-13B24R3							SMBJ30A

Note:
1. C1 is used as filter capacitor with AC input (must be connected externally) and as EMC filter capacitor with DC input (must be connected), and it is recommended to use the capacitor with ripple current ＞300mA@100KHz.
2. We recommend using an electrolytic capacitor with high frequency and low ESR rating for C3 (refer to manufacture's datasheet), electrolytic capacitor can be used for C2 when applied in normal and high temperature environments. Combined with C2, L1, they form a pi-type filter circuit. Choose a capacitor voltage rating with at least 20% margin, in other words not exceeding 80%, C4 is a ceramic capacitor, used for filtering high frequency noise.
3. A suppressor diode (TVS) is recommended to protect the application in case of converter failure and specification should be 1.2 times of the output voltage.

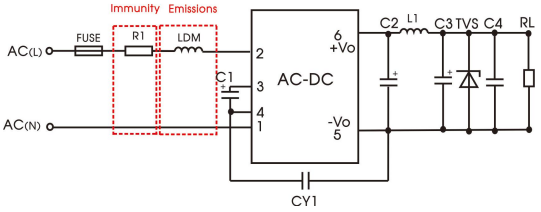
Environmental Application EMC Solution

LS series environmental application EMC solution selection table						
Recommended circuit	Application environmental	Typical industry	Input voltage range	Environment temperature	Emissions	Immunity
1	Basic application	None	85 - 305VAC	-40℃ to +85℃	CLASS A	CLASS III
2	Indoor civil environment	Smart home/Home appliances (2Y)		-25℃ to +55℃	CLASS B	CLASS III
	Indoor general environment	Intelligent building/Intelligent agriculture				
3	Indoor industrial environment	Manufacturing workshop		-25℃ to +55℃	CLASS B	CLASS IV
4	Outdoor general environment	ITS/Video monitoring/Charging point/Communication/Security and protection		-40℃ to +85℃	CLASS A	CLASS IV

Immunity design circuits for reference		Emissions design circuits for reference	
CLASS III	CLASS IV	CLASS A	CLASS B
			

Electromagnetic Compatibility Solution--Recommended Circuit

1. Application circuit 1——Basic application

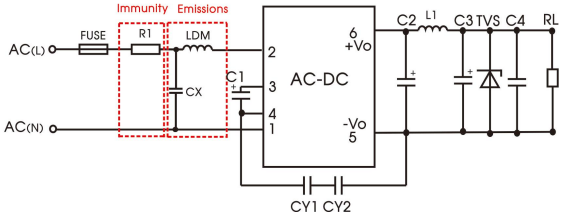


Recommended circuit 1

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Basic application	-40℃ to +85℃	CLASS III	CLASS A

Component	Recommended value
FUSE (required)	1A/300V, slow-blow
R1 (required)	6.8Ω/3W
LDM	2.2mH/Max: 4Ω/Min: 0.24A

2. Application circuit 2——Indoor civil /Universal system recommended circuits for general environment

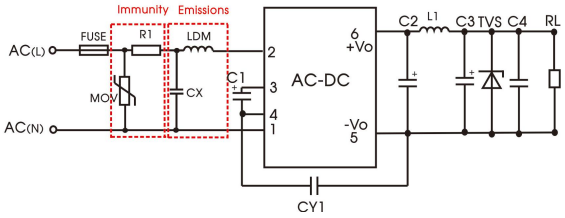


Recommended circuit 2

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Indoor civil /general	-25℃ to +55℃	CLASS III	CLASS B

Component	Recommended value
FUSE (required)	1A/300V, slow-blow
R1 (required)	6.8Ω/3W
CY1(CY2)	1.0nF/400VAC
LDM	2.2mH/Max: 4Ω/Min: 0.24A
CX	0.1μF/310VAC
Note 1: To meet the IEC/EN60335 certification, the two Y capacitors of the primary and secondary need to be externally connected (CY1/CY2, value at 2.2nF/250VAC); Note 2: According to the certification requirements, the X capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8MΩ, and the actual need to be selected according to the certification standard.	

3. Application circuit 3——Universal system recommended circuits for indoor industrial environment

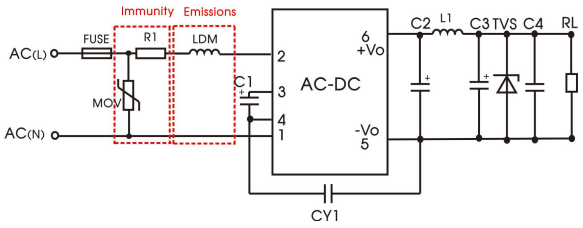


Recommended circuit 3

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Indoor industrial	-25℃ to +55℃	CLASS Ⅳ	CLASS B

Component	Recommended value
FUSE (required)	2A/300V, slow-blow
MOV	S14K350
CY1	1nF/400VAC
CX	0.1μF/310VAC
LDM	2.2mH/Max: 4Ω/Min: 0.24A
R1 (required)	6.8Ω/3W
Note: According to the certification requirements, the X capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8MΩ, and the actual need to be selected according to the certification standard.	

4. Application circuit 4——Universal system recommended circuits for outdoor general/harsh environment



Recommended circuit 4

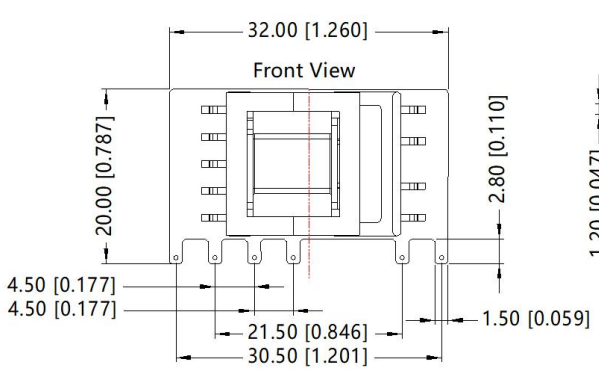
Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Outdoor general environment	-40℃ to +85℃	CLASS Ⅳ	CLASS A

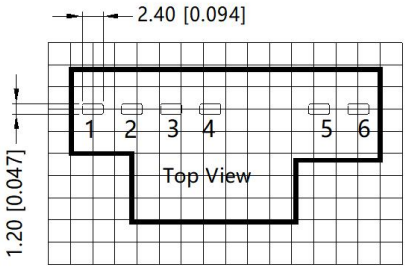
Component	Recommended value
FUSE (required)	2A/300V, slow-blow
MOV	S14K350
LDM	2.2mH/Max: 4Ω/Min: 0.24A
R1 (required)	6.8Ω/3W

5. For additional information please refer to application notes on www.mornsun-power.com.

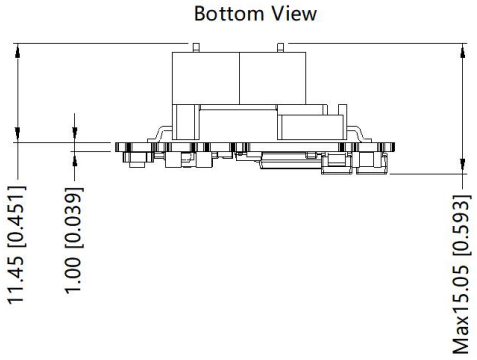
LS10-13BxxR3 Dimensions and Recommended Layout

THIRD ANGLE PROJECTION





Note:Grid 2.54*2.54mm



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

Note:
Unit: mm[inch]
General tolerances: ±1.00[±0.039]
The layout of the device is for reference only , please refer to the actual product

Note:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220134;
2. External electrolytic capacitors are required to modules, more details refer to typical applications;
3. This part is open frame, at least 6.4mm creepage distance between the primary and secondary external components of the module is needed to meet the safety requirement;
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%, recommended circuit, nominal input voltage (115V and 230V) and rated output load;
5. All index testing methods in this datasheet are based on our company 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.

Mornsun Guangzhou Science & Technology Co., Ltd.
Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. Chin
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com