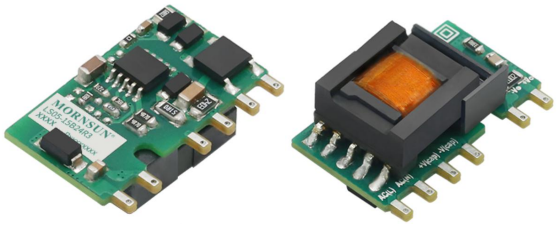
5W, DIY AC/DC converter



RoHS

FEATURES

- Ultra-wide 85 - 418VAC and 100 - 591VDC input voltage range
- Accepts AC or DC input (dual-use of same terminal)
- Operating ambient temperature range: -40℃ to +85℃
- High I/O isolation test voltage up to 3600VAC
- Multi application, flexible layout
- Compact size, high power density, green power
- Controllable life and adjustable cost
- No-load power consumption 0.1W
- Output short circuit, over-current protection

LS05-15BxxR3 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 reliability, low power consumption and reinforced isolation. 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

Part No.	Output Power	Nominal Output Voltage and Current (Vo/Io)	Efficiency at 230VAC (%) Typ.	Capacitive Load (uF) Max.
LS05-15B09R3	5W	9V/560mA	77	680
LS05-15B12R3		12V/420mA	79	470
LS05-15B15R3		15V/340mA	79	330
LS05-15B24R3		24V/210mA	81	100

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	--	418	VAC
	DC input	100	--	591	VDC
Input Certified Voltage Range	AC input	100	--	277	VAC
	DC input	140	--	390	VDC
Input Frequency		47	--	63	Hz
Input Current	115VAC	--	--	0.2	A
	230VAC	--	--	0.1	
Inrush Current	115VAC	--	10	--	
	230VAC	--	20	--	
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	10% - 100% load	--	±5	--	%
Line Regulation	Rated load	--	±1.5	--	
Load Regulation	10% - 100% load	--	±3	--	
Ripple & Noise*	20MHz bandwidth (peak-to-peak value), 10% - 100% load	--	80	150	mV
Temperature Coefficient		--	±0.15	--	%/°C
Stand-by Power Consumption	230VAC	--	0.10	0.15	W

Short Circuit Protection		Hiccup, continuous, self-recovery			
Over-current Protection		≥110%Io, self-recovery			
Minimum Load		10	--	--	%
Hold-up Time	115VAC input	--	8	--	ms
	230VAC input	--	40	--	

Note: 1. * The "parallel cable" method is used for ripple and noise test, please refer to AC-DC Converter Application Notes for specific information;
2. The product is able to work with 0%-10% load and with stable output.

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output	Electric Strength Test for 1min., leakage current<5mA	3600	--	--	VAC
			5000	--	--	VDC
Operating Temperature			-40	--	+85	℃
Storage Temperature			-40	--	+105	
Storage Humidity			--	--	95	%RH
Power Derating		+55℃ to +85℃	1.67	--	--	%/℃
		85VAC - 100VAC	1.33	--	--	%/VAC
Safety Standard			Design refer to IEC/EN/UL62368-1			
Safety Class			CLASS II			
MTBF			MIL-HDBK-217F@25℃>1,000,000 h			

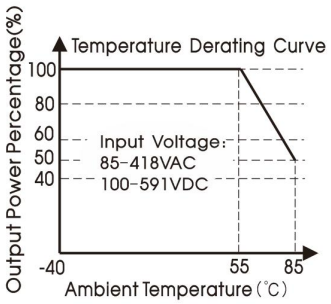
Mechanical Specifications

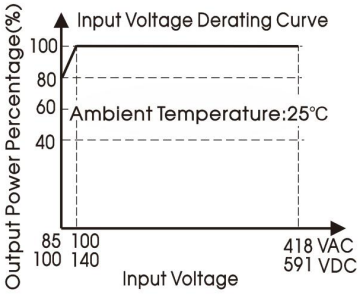
Dimension	27.20 x 14.73 x 11.00 mm
Weight	5.2g (Typ.)
Cooling method	Free air convection

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

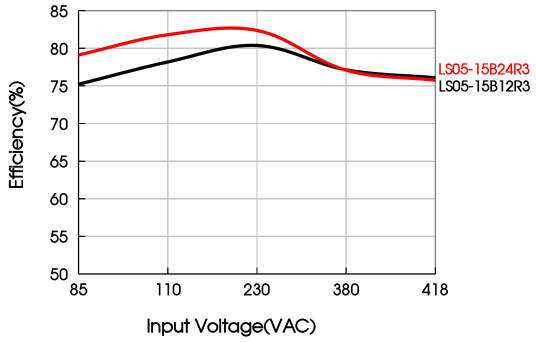
Product Characteristic Curve



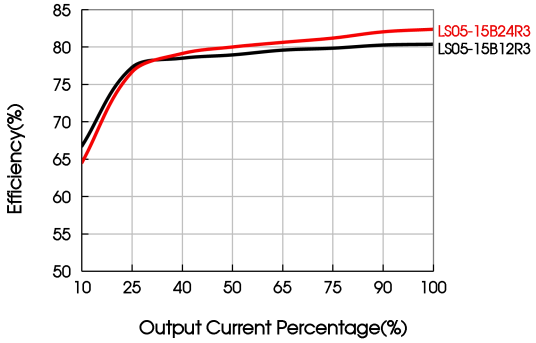


Note: ① With an AC input between 85 -100VAC and a DC input between 100 - 140VDC, the output power must be derated as per temperature derating curves;
② This product is suitable for applications using natural air cooling; for applications in closed environment please consult factory or one of our FAE.

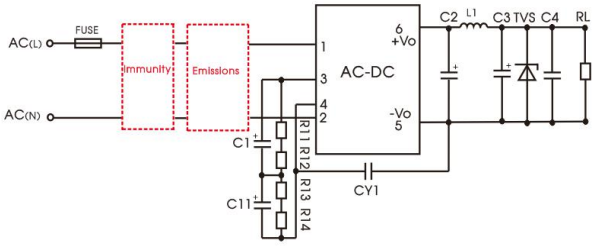
Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load(Vin=230VAC)



Additional Circuits Design Reference



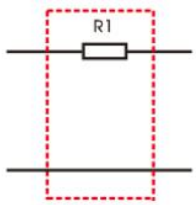
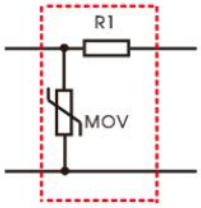
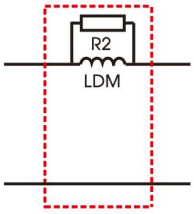
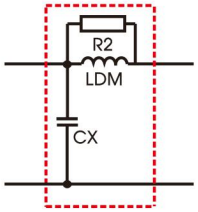
LS series additional circuits design reference

LS05 series additional components selection guide (No EMC devices)							
Part No.	C1/C11(required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
LS05-15B09R3	22uF/400V	270uF/16V (solid-state capacitor)	4.7uH/Max: 80mΩ/2.2A	47uF/35V	0.1uF/ 50V	1.0nF/ 400VAC	SMBJ12A
LS05-15B12R3							SMBJ20A
LS05-15B15R3		220uF/35V					
LS05-15B24R3							SMBJ30A

Note:
1. C1/C11 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>200mA@100KHz. It is recommended to use electrolytic capacitor C1/C11 with ESR≤20Ω at low temperature.
2. R11, R12, R13, R14 are the voltage equalizing resistors of C1, C11 electrolytic capacitors (must be connected), and the resistance is recommended to be greater than 1MΩ, and SMD anodes can be used;
3. We recommend using an electrolytic capacitor with high frequency and low ESR (ESR of C3 at low temperature of -40℃≤1.1Ω) 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.
4. 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.
5. L1 (4.7uH, P/N: 12050181) Mornsun quotation is available.

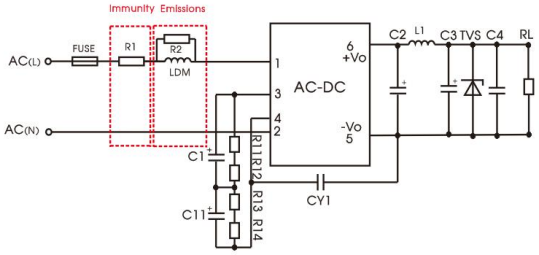
Environmental Application EMC Solution

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	85~418VAC	-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

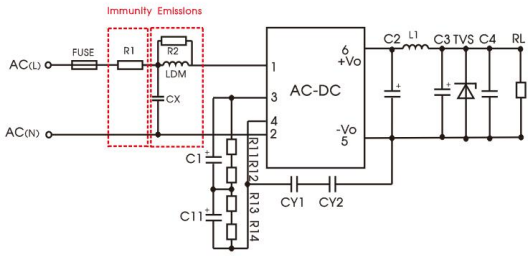


Recommended circuit 1

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

Component	Recommended value
FUSE	1A/400V, slow-blow, required
R1	12Ω/3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (chip resistor)
LDM	4.7mH/Max: 15Ω/Min: 0.2A
Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.	

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

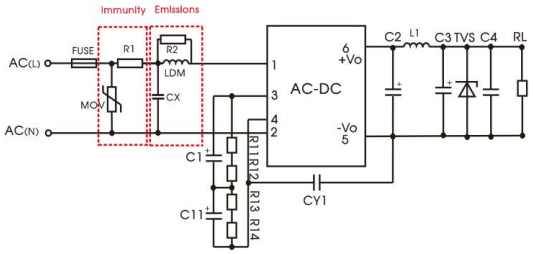


Recommended circuit 2

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

Component	Recommended value
R1	12Ω/3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (chip resistor)
LDM	4.7mH/Max: 15Ω/Min: 0.2A
CX	0.1uF/480VAC
FUSE	1A/400V, slow-blow, required
Note 1: In the home appliance application environment, the two Y capacitors of the primary and secondary need to be externally connected (CY1/CY2, value at 2.2nF/250VAC), which can meet the EN60335 certification. 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. Note 3: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.	

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

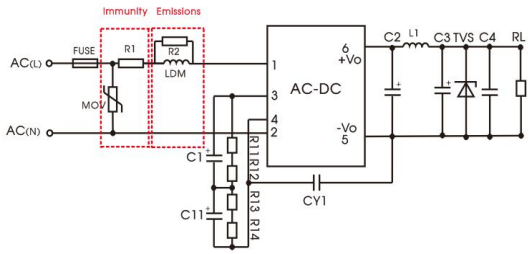


Recommended circuit 3

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

Component	Recommended value
MOV	S14K460
CX	0.1uF/480VAC
LDM	4.7mH/Max: 15Ω/Min: 0.2A
R1	12Ω/3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (chip resistor)
FUSE	2A/400V, slow-blow, required
Note 1: 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. Note 2: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.	

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



Recommended circuit 4

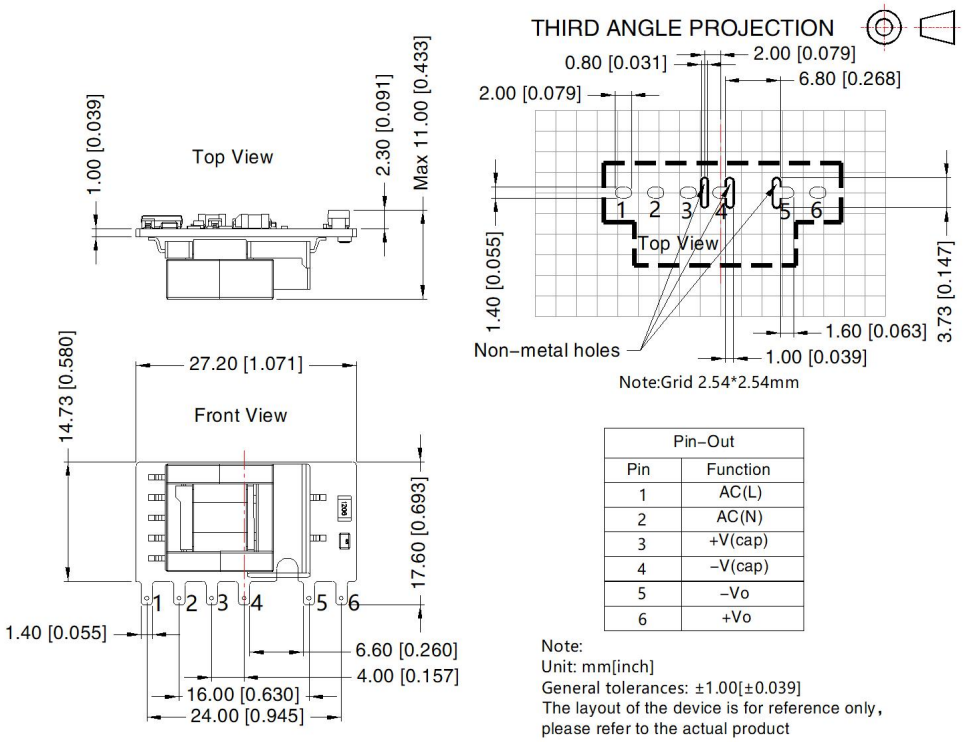
Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Outdoor general environment	-40℃ to +85℃	CLASS Ⅳ	CLASS A

Component	Recommended value
MOV	S14K460
LDM	4.7mH/Max: 15Ω/Min: 0.2A
R1	12Ω/3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (chip resistor)
FUSE	2A/400V, slow-blow, required
Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select chip resistor or carbon film resistor.	

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

Dimensions and Recommended Layout

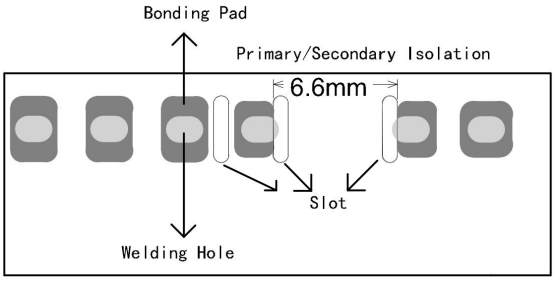
LS05-15BxxR3 series dimensions



Pin-Out	
Pin	Function
1	AC(L)
2	AC(N)
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

LS05-15BxxR3 series recommended pad



Note: There is a slot(non-metallic hole) between pin 4/5, which the side pad were being cut off; There is a slot(non-metallic hole) between pin 3/4; For details, please refer to the recommended dimensions or pad.

Note:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220084;
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, refer to the recommended welding hole design in the external dimension drawing;
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%, 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.

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