

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°C to +85°C
- High I/O isolation test voltage up to 3600VAC
- Multi application, flexible layout
- Compact size, high power density, green power
- No-load power consumption 0.1W
- Output short circuit, over-current protection
- Flexible design of peripheral circuit reduces layout problems
- Production process in accordance with IATF16949 system control, applied to automobile industry
- Design refer to IEC/EN/UL62368 standards

CLS05-15B12R3 is one of Mornsun's highly efficient green power AC-DC Converters. It features wide input range accepting either AC or DC voltage, high reliability, low power consumption and reinforced isolation. Production process in accordance with IATF16949 system control, it is particularly suitable for industrial control, electric power, instrumentation, smart home and automobile 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.
CLS05-15B12R3	5W	12V/420mA	79	470

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	--	15	--	
	230VAC	--	30	--	
Recommended External Input Fuse		1A, slow-blow, required (The actual use needs to be selected according to the application environment)			
Hot Plug		Unavailable			

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	10% - 100% load	--	±5	--	%
Linear 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		$\geq 110\%$ 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
Soldering Temperature		Wave-soldering, Max. 10 seconds	255	260	265	℃
		Manual-welding, Max. 5 seconds	350	360	370	
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			

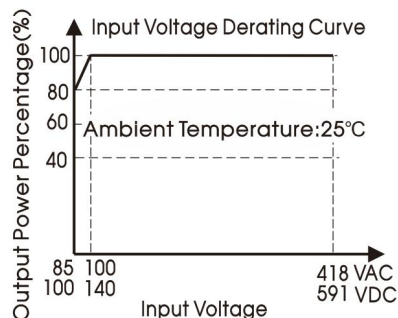
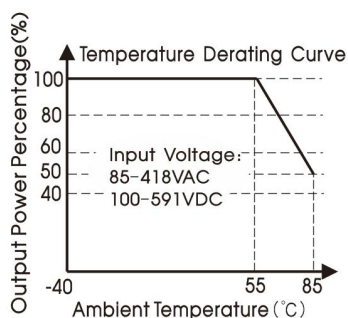
Mechanical Specifications

Dimension	30.28 x 17.96 x 11.00 mm
Weight	5.4g (Typ.)
Cooling method	Free air convection

Electromagnetic Compatibility (EMC)

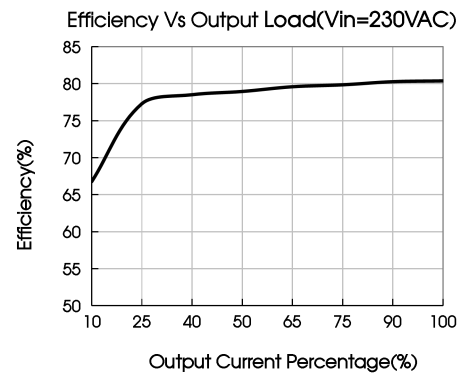
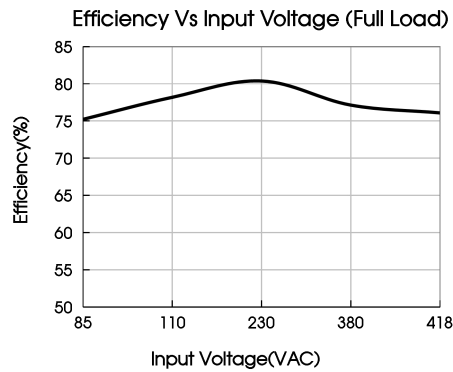
Emissions	CE	CISPR32/EN55032	CLASS A (Application circuit 1, 4)	
		CISPR32/EN55032	CLASS B (Application circuit 2, 3)	
	RE	CISPR32/EN55032	CLASS A (Application circuit 1, 4)	
		CISPR32/EN55032	CLASS B (Application circuit 2, 3)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±6KV	perf. Criteria B
	RS	IEC/EN61000-4-3	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

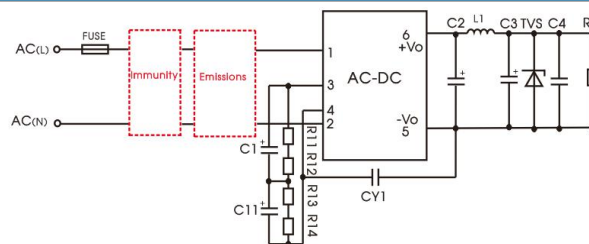


Note: ① With an AC input between 85 - 100VAC and a DC input between 100 - 140VDC, the output power must be derated as per temperature derating curves;

② This product is suitable for applications using natural air cooling; for applications in closed environment please consult Mornsun FAE.



Additional Circuits Design Reference



Additional circuits design reference

Additional components selection guide (No EMC devices)

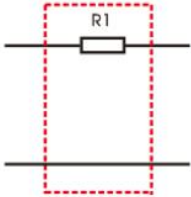
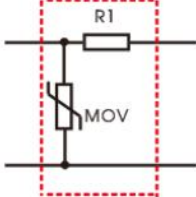
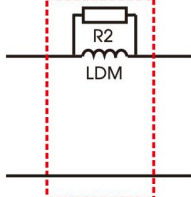
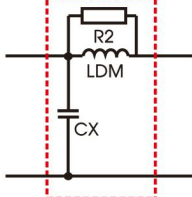
Part No.	C1/C11 (required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
CLS05-15B12R3	22uF/400V	270uF/16V (solid-state capacitor)	4.7uH/Max: 80mΩ/2.2A	47uF/35V	0.1uF/50V	1.0nF/400VAC	SMBJ20A

- Note:
- 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 $>200\text{mA}@100\text{KHz}$. It is recommended to use electrolytic capacitor C1/C11 with $\text{ESR} \leq 20\Omega$ at low temperature.
 - 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 $1\text{M}\Omega$, and SMD anodes can be used;
 - We recommend using an electrolytic capacitor with high frequency and low ESR (ESR of C3 at low temperature of $-40^\circ\text{C} \leq 1.1\Omega$) 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.
 - 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.
 - L1 (4.7uH, P/N: 12050181) Mornsun quotation is available.

Environmental Application EMC Solution

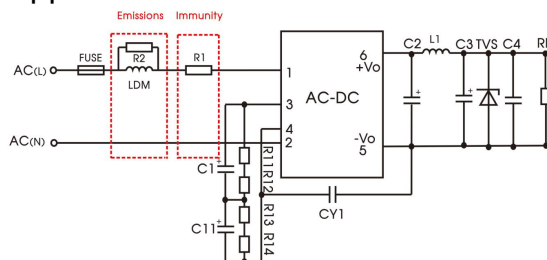
Environmental application EMC solution selection table

Recommended circuit	Application environmental	Typical industry	Input voltage range	Environment temperature	Emissions	Immunity
1	Basic application	None	85 - 418VAC	-40°C to $+85^\circ\text{C}$	Class A	Level 3
2	Indoor civil environment	Smart home/Home appliances (2Y)		-25°C to $+55^\circ\text{C}$	Class B	Level 3
	Indoor general environment	Intelligent building/Intelligent agriculture		-25°C to $+55^\circ\text{C}$	Class B	Level 4
3	Indoor industrial environment	Manufacturing workshop		-25°C to $+55^\circ\text{C}$	Class B	Level 4
4	Outdoor general environment	ITS/Video monitoring/Charging point/Communication/Security and protection		-40°C to $+85^\circ\text{C}$	Class A	Level 4

Immunity design circuits for reference		Emissions design circuits for reference	
Level 3	Level 4	Class A	Class B
			

Electromagnetic Compatibility Solution—Recommended Circuit

1. Application circuit 1—Basic application



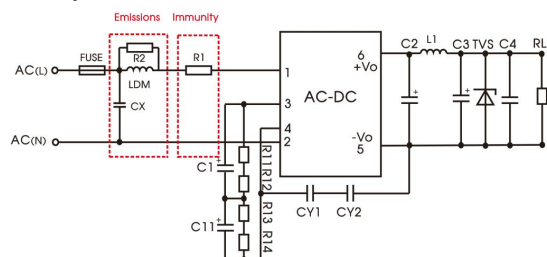
Recommended circuit 1

Application environmental	Ambient temperature range	Immunity Level	Emissions Class
Basic application	-40℃ to +85℃	Level 3	Class A

Component	Recommended value
FUSE	1A/400V, slow-blow, required
R1	12 Ω /3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (SMD resistor)
LDM	4.7mH/Max: 15 Ω /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 SMD resistor or carbon film resistor; Or use NTC (required), the recommended value is 15 Ω .

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



Recommended circuit 2

Application environmental	Ambient temperature range	Immunity Level	Emissions Class
Indoor civil/general	-25℃ to +55℃	Level 3	Class B

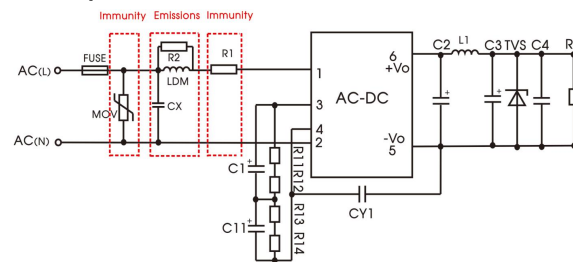
Component	Recommended value
R1	12 Ω /3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (SMD resistor)
LDM	4.7mH/Max: 15 Ω /Min: 0.2A
CX	0.1uF/480VAC
FUSE	1A/400V, slow-blow, required

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 SMD resistor or carbon film resistor; Or use NTC (required), the recommended value is 15 Ω .

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



Recommended circuit 3

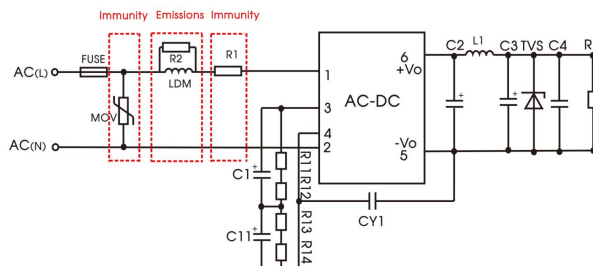
Application environmental	Ambient temperature range	Immunity Level	Emissions Class
Indoor industrial	-25℃ to +55℃	Level 4	Class B

Component	Recommended value
MOV	S14K460
CX	0.1uF/480VAC
LDM	4.7mH/Max: 15 Ω /Min: 0.2A
R1	12 Ω /3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (SMD 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 3.8M Ω , 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 SMD resistor or carbon film resistor; Or use NTC (required), the recommended value is 15 Ω .

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



Recommended circuit 4

Application environmental	Ambient temperature range	Immunity Level	Emissions Class
Outdoor general environment	-40℃ to +85℃	Level 4	Class A

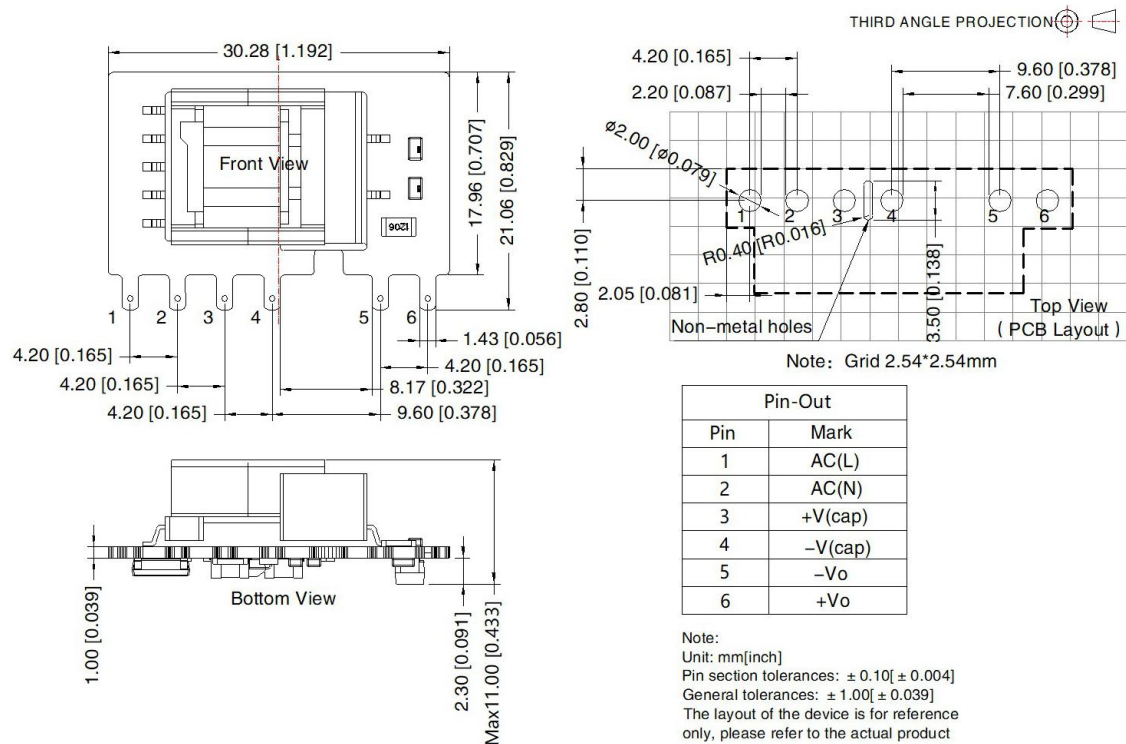
Component	Recommended value
MOV	S14K460
LDM	4.7mH/Max: 15 Ω /Min: 0.2A
R1	12 Ω /3W (wire-wound resistor, required)
R2	10K/1206/(1/4W) (SMD resistor)
FUSE	2A/400V, slow-blow, required

Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select SMD resistor or carbon film resistor; Or use NTC (required), the recommended value is 15 Ω .

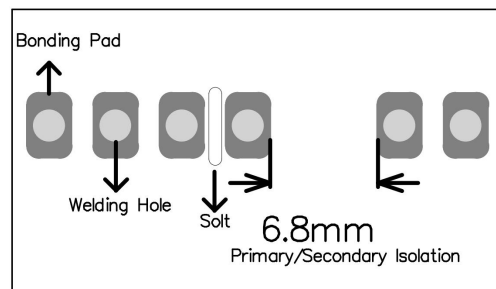
5. For additional information please refer to application notes on www.mornsun-power.com

Dimensions and Recommended Layout

CLS05-15B12R3 dimensions



CLS05-15B12R3 recommended pad



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

Note:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220018;
- External electrolytic capacitors are required to modules, more details refer to typical applications;
- 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;
- Unless otherwise specified, parameters in this datasheet were measured under the conditions of $T_a=25^{\circ}\text{C}$, humidity<75%, nominal input voltage (115V and 230V) 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";
- 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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