

5W, DIY AC/DC converter



FEATURES

- Ultra-wide 90 - 528VAC and 100 - 745VDC input voltage range
- Accepts AC or DC input (dual-use of same terminal)
- Working available with any two phases
- Operating ambient temperature range: -40°C to +85°C
- High I/O isolation test voltage up to 4000VAC
- Multi application, flexible layout
- Output short circuit, over-current protection

LS05-26BxxR3 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 applications which have high requirement for dimension. 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 (uF) Max.
EN	LS05-26B03R3	5W	3.3V/1000mA	70	2200
	LS05-26B05R3		5V/1000mA	72	1500
	LS05-26B09R3		9V/560mA	72	680
	LS05-26B12R3		12V/420mA	78	470
	LS05-26B15R3		15V/340mA	78	330
	LS05-26B24R3		24V/210mA	78	100

Note: 1. The product picture is for reference only. For details, please refer to the actual product
 2. The nominal output voltage refers to the voltage applied to the load terminal after adding external circuits.
 3. 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	90	--	528	VAC
	DC input	100	--	745	VDC
Input Frequency		47	--	63	Hz
Input Current	115VAC	--	--	0.20	A
	230VAC	--	--	0.10	
	480VAC	--	--	0.07	
Inrush Current	115VAC	--	10	--	
	230VAC	--	17	--	
	480VAC	--	28	--	
Leakage Current	480VAC/50Hz	0.6mA RMS Max.			
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	3.3V	--	±3	±6	%
	5V/9V/12V/15V/24V	--	±2.5	±5	
Line Regulation	Rated load	--	±1.5	--	%
Load Regulation	10% - 100% load	--	±3	--	
Ripple & Noise*	20MHz bandwidth (peak-to-peak value), 10% - 100% load	--	100	180	mV
Temperature Coefficient		--	±0.2	--	%/°C

Stand-by Power Consumption	230VAC input	--	--	0.30	W
	380VAC input	--	--	0.50	
Short Circuit Protection	Hiccup, continuous, self-recovery				
Over-current Protection	≥ 120% I _o , self-recovery				
Minimum Load*		10	--	--	%
Hold-up Time	115VAC input	--	8	--	ms
	230VAC input	--	35	--	
	380VAC input	--	100	--	
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			VAC
Operating Temperature		-40	--	+85	°C
Storage Temperature		-40	--	+105	
Storage Humidity		--	--	95	%RH
Soldering Temperature	Wave-soldering	260 ± 5°C; time: 5 - 10s			
	Manual-welding	360 ± 10°C; time: 3 - 5s			
Power Derating	+55°C to +85°C	2.0	--	--	%/°C
	90VAC - 110VAC	2.0	--	--	%VAC
	480VAC - 528VAC	0.42	--	--	
Safety Standard		BS EN/EN62368-1 (Report) Safety Approval; Design refer to IEC/UL62368-1, IEC/EN60335-1, IEC/EN61558-1			
Safety Class		CLASS II			
MTBF	MIL-HDBK-217F@25°C	≥ 500,000 h			

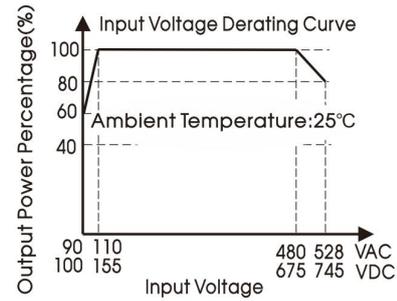
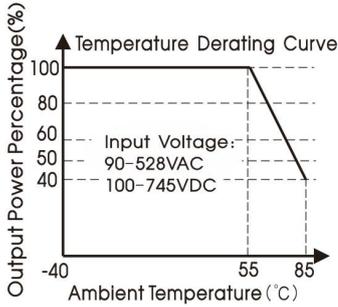
Mechanical Specifications

Dimension	33.50 x 17.20 x 13.00 mm
Weight	6.2g (Typ.)
Cooling method	Free air convection

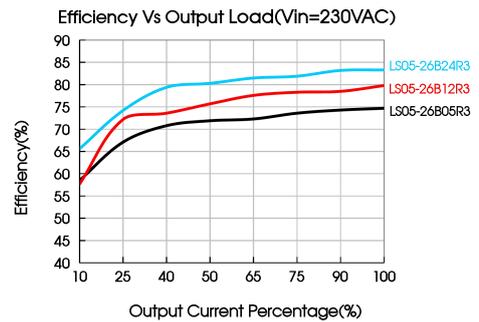
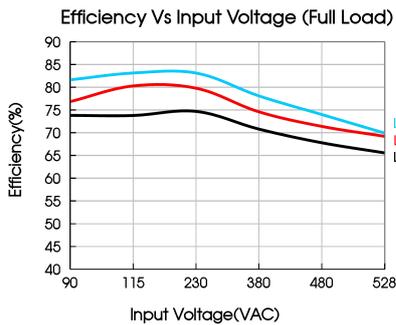
Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS A (Application circuit 1, 4, 5, 6)	
		CISPR32/EN55032	CLASS B (Application circuit 2, 3)	
	RE	CISPR32/EN55032	CLASS A (Application circuit 1, 4, 5, 6)	
		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, 5, 6)	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
		IEC/EN61000-4-5	line to line ±2KV/line to PE ±4KV (Application circuit 5)	perf. Criteria B
		IEC/EN61000-4-5	line to line ±4KV (Application circuit 6)	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	

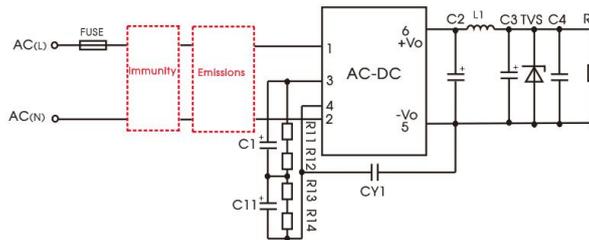
Product Characteristic Curve



Note: ① With an AC input between 90 - 110V/480-528VAC and a DC input between 100 - 155V/675-745VDC, 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



LS series additional circuits design reference

LS05 series additional components selection guide (No EMC devices)

Part No.	C2(required)	L1(required)	C3(required)	C4	CY1(required)	TVS
LS05-26B03R3	470uF/16V(solid-state capacitor)	2.2uH/15mΩ Max/6.5A	150uF/35V	0.1uF/50V	1.0nF/400VAC	SMBJ7.0A
LS05-26B05R3			100uF/35V			SMBJ12A
LS05-26B09R3	270uF/16V(solid-state capacitor)		47uF/35V			SMBJ20A
LS05-26B12R3	220uF/35V					SMBJ30A
LS05-26B15R3	150uF/35V					
LS05-26B24R3						

	C1/C11(required)		R11/R12/R13/R14
	-25°C to +85°C	-40°C to +85°C	1MΩ /1206/(1/4W) (required)
90VAC - 528VAC	33uF/400V	47uF/400V	
165VAC - 528VAC	22uF/400V	33uF/400V	
90VAC - 305VAC	C1: 10uF/450V C11: wire	C1: 22uF/450V C11: wire	--

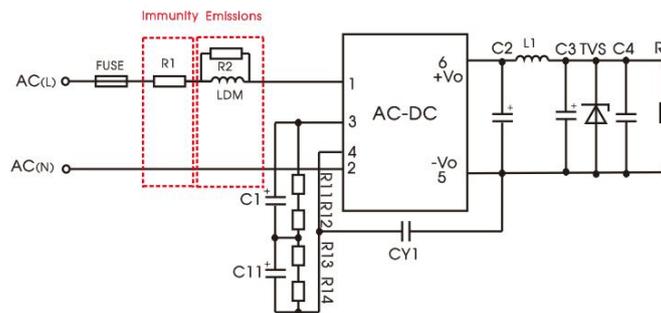
- Note:
- C1/C11 is used as filter capacitor with AC input (must be connected externally) and as EMC filter capacitor with DC input (must be connected), and it is recommended to use the capacitor with ripple current >200mA@100KHz. It is recommended to use electrolytic capacitor C1/C11 with ESR ≤ 20Ω at low temperature.
 - R11, R12, R13, R14 are the voltage equalizing resistors of C1, C11 electrolytic capacitors (must be connected), 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°C ≤ 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.
 - 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.
 - LDM (1.2mH, P/N: 12050314; 2.2mH, P/N: 12050552; 4.7mH, P/N: 12050305), L1 (2.2uH, P/N: 12050504) Mornsun quotation is available.

Environmental Application EMC Solution

Recommended circuit	Application environmental	Typical industry	Input voltage range	Environment temperature	Emissions	Immunity
1	Basic application	None	90-528VAC	-40℃ to +85℃	Class A	Level 3
2	Indoor general environment	Intelligent building/Intelligent agriculture		-25℃ to +55℃	Class B	Level 3
3	Indoor industrial environment	Manufacturing workshop		-25℃ to +55℃	Class B	Level 4
4	Outdoor general environment	ITS/Video monitoring/Charging point/Communication/Security and protection		-40℃ to +85℃	Class A	Level 4
5	Outdoor industrial environment	Electricity/Grid		-40℃ to +85℃	Class A	Level 4
6	Strong lightning surge	Electricity dedicated		-40℃ to +85℃	Class A	Level 4

Electromagnetic Compatibility Solution--Recommended Circuit

1. Application circuit 1—Basic application



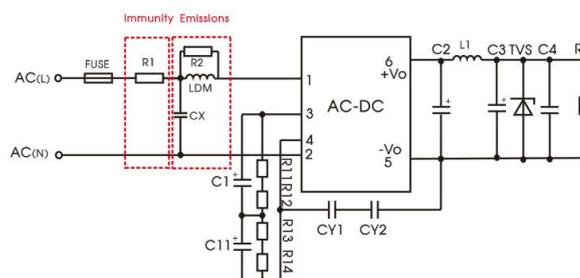
recommended circuit 1

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

FUSE (required)	1A/500V, slow-blow	
R1 (wire-wound resistor, required)	12 Ω /3W	
R2 (SMD resistor)	LS05-26B05/09R3	20K/1206/(1/4W)
	LS05-26B03/12R3	2K/1206/(1/4W)
	LS05-26B15/24R3	15K/1206/(1/4W)
LDM	LS05-26B05R3	1.2mH/Max: 2.5 Ω /Min: 0.2A
	LS05-26B09R3	2.2mH/Max: 15 Ω /Min: 0.2A
	LS05-26B03/12/15/24R3	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.

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



Recommended circuit 2

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

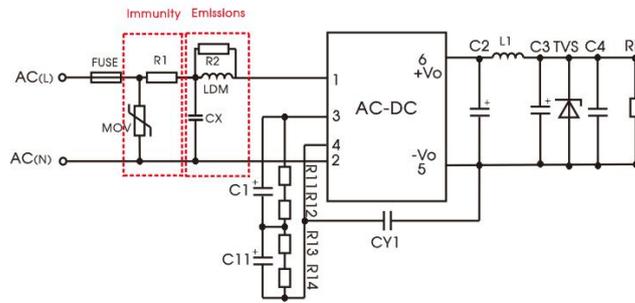
Component	Recommended value
R1 (wire-wound resistor, required)	12 Ω /3W
R2 (SMD resistor)	LS05-26B05/09R3 20K/1206/(1/4W)
	LS05-26B03/12R3 2K/1206/(1/4W)
	LS05-26B15/24R3 15K/1206/(1/4W)
LDM	LS05-26B05R3 1.2mH/Max: 2.5 Ω /Min: 0.2A
	LS05-26B09R3 2.2mH/Max: 15 Ω /Min: 0.2A
	LS05-26B03/12/15/24R3 4.7mH/Max: 15 Ω /Min: 0.2A
CX	0.1uF/480VAC
FUSE (required)	1A/500V, slow-blow

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 3.8M Ω , 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.

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



Recommended circuit 3

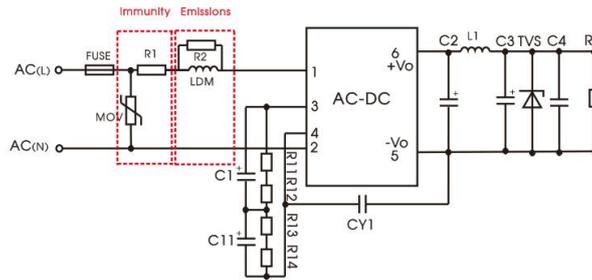
Application environmental	Ambient temperature range	Immunity level	Emissions class
Indoor industrial	-25℃ to +55℃	Level 4	Class B

Component	Recommended value
MOV	S14K550
CX	0.1uF/480VAC
R2 (SMD resistor)	LS05-26B05/09R3 20K/1206/(1/4W)
	LS05-26B03/12R3 2K/1206/(1/4W)
	LS05-26B15/24R3 15K/1206/(1/4W)
LDM	LS05-26B05R3 1.2mH/Max: 2.5 Ω /Min: 0.2A
	LS05-26B09R3 2.2mH/Max: 15 Ω /Min: 0.2A
	LS05-26B03/12/15/24R3 4.7mH/Max: 15 Ω /Min: 0.2A
R1 (wire-wound resistor, required)	12 Ω /3W
FUSE (required)	2A/500V, slow-blow

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.

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



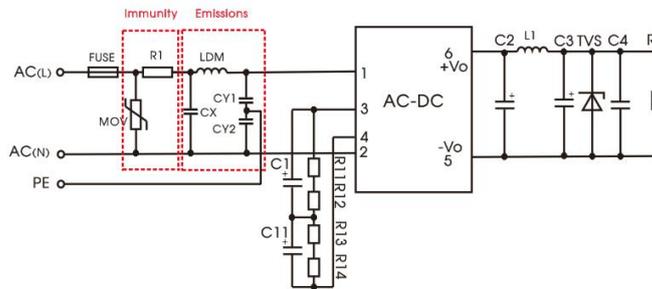
Recommended circuit 4

Application environmental	Ambient temperature range	Immunity level	Emissions class
Outdoor general environment	-40°C to +85°C	Level 4	Class A

Component	Recommended value	
MOV	S14K550	
R2 (SMD resistor)	LS05-26B05/09R3	20K/1206/(1/4W)
	LS05-26B03/12R3	2K/1206/(1/4W)
	LS05-26B15/24R3	15K/1206/(1/4W)
LDM	LS05-26B05R3	1.2mH/Max: 2.5 Ω /Min: 0.2A
	LS05-26B09R3	2.2mH/Max: 15 Ω /Min: 0.2A
	LS05-26B03/12/15/24R3	4.7mH/Max: 15 Ω /Min: 0.2A
R1 (wire-wound resistor, required)	12 Ω /3W	
FUSE (required)	2A/500V, slow-blow	

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.

5. Application circuit 5—Universal system recommended circuits for outdoor industrial environment



Recommended circuit 5

Application environmental	Ambient temperature range	Immunity level	Emissions class
Outdoor industrial environment	-40°C to +85°C	Level 4	Class A

Component	Recommended value	
MOV	S14K550	
LDM	LS05-26B05R3	1.2mH/Max: 2.5 Ω /Min: 0.2A
	LS05-26B09R3	2.2mH/Max: 15 Ω /Min: 0.2A
	LS05-26B03/12/15/24R3	4.7mH/Max: 15 Ω /Min: 0.2A
R1 (wire-wound resistor, required)	12 Ω /3W	
CX	0.1uF/480VAC	
FUSE (required)	2A/500V, slow-blow	
CY1/CY2	1.0nF/400VAC	

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.

6. Application circuit 6—Universal system recommended circuits for strong lightning surge environment

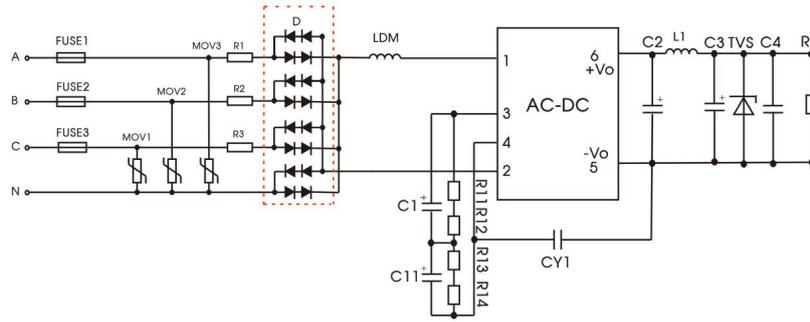


Fig. (1): Recommended circuit for applications which require 4KV differential-mode surge standard (full-wave rectification)

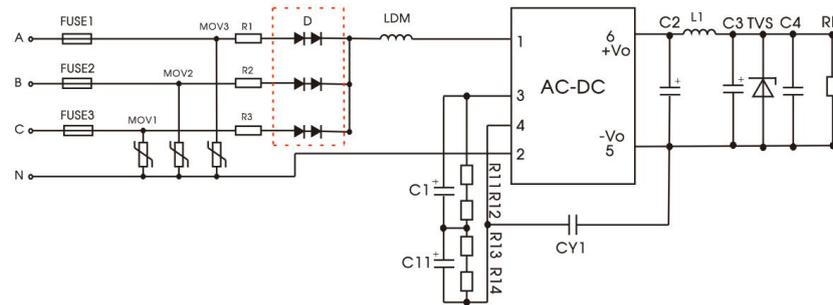


Fig. (2): Recommended circuit for applications which require 4KV differential-mode surge standard (half-wave rectification)

Application environmental	Ambient temperature range	Immunity level	Emissions class
Strong lightning surge environment	-40°C to +85°C	Level 4	Class A

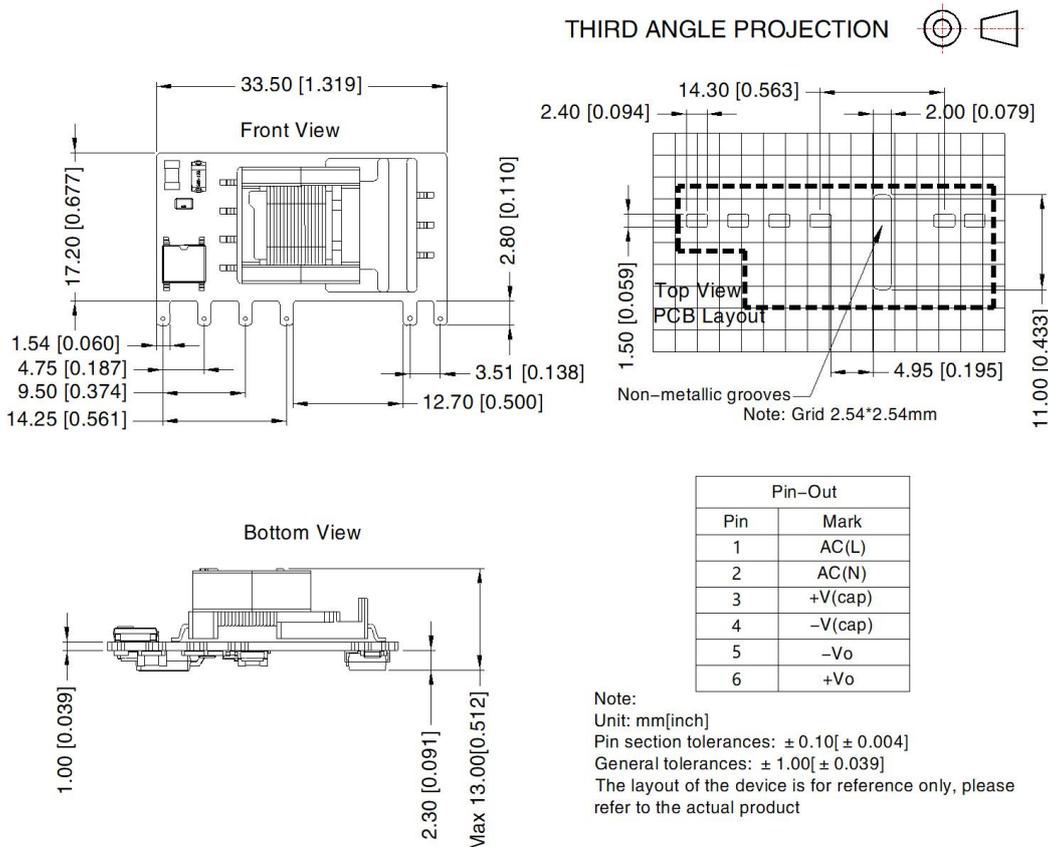
Component	Recommended value	
FUSE1/FUSE2/FUSE3 (required)	3.15A/500V	
MOV1/MOV2/MOV3	S14K550	
R1/R2/R3 (wire-wound resistor, required)	12Ω /5W	
D	2A/1000V	
LDM	LS05-26B05R3	1.2mH/Max: 2.5Ω /Min: 0.2A
	LS05-26B09R3	2.2mH/Max: 15Ω /Min: 0.2A
	LS05-26B03/12/15/24R3	4.7mH/Max: 15Ω /Min: 0.2A

Note: R1/R2/R3 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.

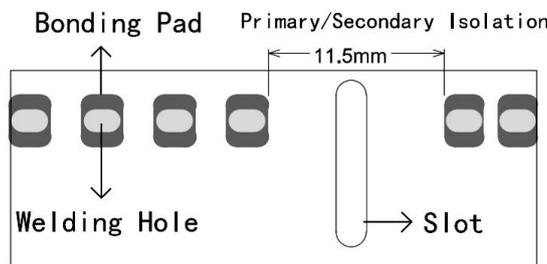
7. For additional information please refer to application notes on www.mornsun-power.com.

Dimensions and Recommended Layout

LS05-26BxxR3 series dimensions



LS05-26BxxR3 series recommended pad



Note: There is a slot(non-metallic hole) between pin 4/5; 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: 58220134;
2. External electrolytic capacitors are required to modules, more details refer to typical applications;
3. This part is open frame, at least 8.4mm 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 $T_a=25^{\circ}\text{C}$, humidity<75%, nominal input voltage (115V, 230V and 380V) 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. If product involves multi-brand materials and there are differences in color etc, please refer to the standards of each manufacturer;
9. 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.

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