## **MORNSUN**<sup>®</sup>

### 15W, DIY AC/DC converter



## FEATURES

- Ultra-wide 176 528VAC and 248 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 3600VAC
- Multi application, flexible layout
- Output short circuit, over-current protection

LS15-26BxxR3 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	Selection Guide										
Certification	Part No.	Output Power	Nominal Output Voltage and Current (Vo/Io)	Efficiency at 230VAC (%) Typ.	Capacitive Load (uF) Max.						
	LS15-26B03R3	9.9W	3.3V/3000mA	70	1500						
	LS15-26B05R3	14W	5V/2800mA	75	1500						
EN	LS15-26B09R3		9V/1670mA	79	1000						
EIN	LS15-26B12R3	15\4/	12V/1250mA	80	820						
	LS15-26B15R3	15W	15V/1000mA	81	680						
	LS15-26B24R3		24V/625mA	82	390						

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.

3. The product picture is for reference only. For details, please refer to the actual product.

Input Specifications						
Item	Operating Conditions	Min.	Тур.	Max.	Unit	
Input Voltage Range	AC input	176		528	VAC	
input voltage kange	DC input	248		745	VDC	
Input Certified Voltage Range	AC input	200		400	VAC	
Input Frequency		47		63	Hz	
	230VAC			0.25		
Input Current	380VAC			0.20	1	
	230VAC		30		A	
Inrush Current	480VAC		58		-	
Leakage Current	400VAC/50Hz		0.5mA I	RMS Max.		
Recommended External Input Fuse			2A, slow-blow, required (The actual use needs to be selected according to the application environment)			
Hot Plug			Unavailable			

<b>Output Specifications</b>						
Item	Operating Condition	Operating Conditions			Max.	Unit
	3.3V/5V	3.3V/5V		±3		
Output Voltage Accuracy	9V/12V/15V/24V			±2		
	Rated load	3.3V/5V		±l		%
Line Regulation		9V/12V/15V/24V		±0.5		70
	3.3V/5V			±2		
Load Regulation	9V/12V/15V/24V	9V/12V/15V/24V		±l		
Ripple & Noise*	20MHz bandwidth (peak-to-peak value),			100	180	mV
Temperature Coefficient				±0.2		<b>%/</b> ℃

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## AC/DC Converter LS15-26BxxR3 Series

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Stand-by Power Consumption	230VAC input			0.30	w
	380VAC input		0.50		
Short Circuit Protection		Hic	cup, continu	ious, self-reco	over
Over-current Protection			$\geqslant$ 110% lo,	self-recover	
Minimum Load*		0			%
Hold-up Time	230VAC input		35		
	380VAC input		80	ms	

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

General S	pecifications						
ltem		Operating Conditions	Min.	Тур.	Max.	Unit	
Isolation	Input-output	Electric Strength Test for 1min., leakage current <5mA	3600			VAC	
Insulation Resistance Input - output		At 500VDC	100			MΩ	
Operating Terr	perature		-40		+85	ĉ	
Storage Tempe	erature		-40		+105		
Storage Humidity					95	%RH	
		Wave-soldering		260 ± 5℃; time: 5 - 10s			
Soldering Temp	Derature	Manual-welding		360 ± 10℃; time: 3 - 5s			
		<b>+50</b> ℃ <b>to +85</b> ℃	2.0			9/ 1%	
Power Derating	g	<b>-40</b> ℃ to -25℃	2.67			<b>%/</b> ℃	
		480VAC - 528VAC	0.42			%/VAC	
Safety Standard			Design refe	BS EN/EN62368-1 safety approved; Design refer to UL/IEC62368-1, IEC/EN62477 EN61010-1, EN61558-1		N62477-1,	
Safety Class			CLASS II				
MTBF		MIL-HDBK-217F@25°C	≥1,000,000	h			

Mechanical Specifications				
Dimension	40.04 x 20.00x 15.25 mm			
Weight	10.0g (Тур.)			
Cooling method	Free air convection			

Electron	nagnetic Compat	ibility (EMC)			
	CE	CISPR32/EN55032	CLASS A (Applicatio	n circuit 1, 4, 5, 6)	
	CE	CISPR32/EN55032	CLASS B (Applicatio		
Emissions	RE	CISPR32/EN55032	CLASS A (Applicatio	n circuit 1, 4, 5, 6)	
	KE	CISPR32/EN55032	CLASS B (Applicatio	n circuit 2, 3)	
	ESD	IEC/EN61000-4-2	Contact ±6KV/Air ±6	BKV	perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A	
		IEC/EN61000-4-4	±2KV (Application c	ircuit 1, 2, 6)	perf. Criteria B
	EFT	IEC/EN61000-4-4	C/EN61000-4-4 ±4KV (Application circuit 3, 4, 5)		
		IEC/EN61000-4-5	line to line ±1KV (Ap	plication circuit 1, 2)	perf. Criteria B
		IEC/EN61000-4-5	line to line ±2KV (Ap	perf. Criteria B	
mmunity	Surge	IEC/EN61000-4-5	line to line ±2KV/line	perf. Criteria B	
		IEC/EN61000-4-5	EN61000-4-5 line to line ±4KV (Application circuit 6)		
	CS	IEC/EN61000-4-6	10Vr.m.s		perf. Criteria A
	Voltage variation*	IEC61000-6-2/IEC6	1000-4-11	70% Un, 25/30 cycle(50/60Hz) 40% Un, 10/12 cycle(50/60Hz) 0% Un, 1 cycle	perf. Criteria B
	voltage interruption*	IEC61000-6-2/IEC6	1000-4-11	0% Un, 250/300 cycle(50/60Hz)	perf. Criteria C

Note: \*Un is the maximum input nominal voltage.



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## AC/DC Converter

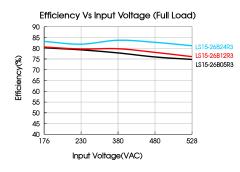
## LS15-26BxxR3 Series

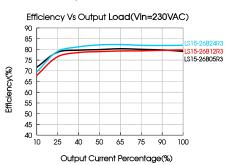
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### Product Characteristic Curve

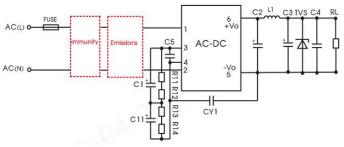


Note: 1) With an AC input between 480-528VAC and a DC input between 678-745VDC, the output power must be derated as per temperature derating curves; 2) This product is suitable for applications using natural air cooling; for applications in closed environment please consult Mornsun FAE.





### Additional Circuits Design Reference



LS series additional circuits design reference

		LS15 series a	dditional	components selectio	n guide (No	EMC devices	)		
Part No.	C1/C11 (required)	R11/R12/R13/R14 (SMD resistor, required)	C5	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
LS15-26B03R3				1500uF/6.3V (solid-state capacitor)		680uF/25V 330uF/25V			SMBJ7.0A
LS15-26B05R3				1000uF/16V (solid-state capacitor)					3141237.07
LS15-26B09R3	47uF/400V	1 <b>M</b> Ω /1206/	4.7nF/	470uF/16V	2.2uH/15m Ω	390uF/16V	0.1uF/	2.2nF/	SMBJ12A
LS15-26B12R3		(1/4W)	1000V	(solid-state capacitor)	Max/6.5A	330uF/25V	50V	400VAC	
LS15-26B15R3				470uF/25V (solid-state capacitor)		100uF/35V	1		SMBJ20A
LS15-26B24R3		470uF/35V	470uF/35V					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  $\leq 100 \,\Omega$  at low temperature.

2. R11, R12, R13, R14 are the voltage equalizing resistors of C1, C11 electrolytic capacitors (must be connected), 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  $-40^{\circ}$ 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, C5 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. LDM (2.2mH, P/N: 12050564), L1 (2.2uH, P/N: 12050504) Mornsun quotation is available.



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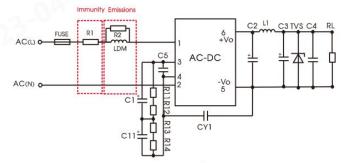
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## **Environmental Application EMC Solution**

	LS series	environmental application E	EMC solution se	election table			
Recommended circuit	Application environmental	Typical industry	Input voltage range	Environment temperature	Emissions	Immunity	
1	Basic application	None		<b>-40</b> ℃ <b>to +85</b> ℃	Class A	Level 3	
2	Indoor general environment	Intelligent building/Intelligent agriculture		<b>-25</b> ℃ to +50℃	Class B	Level 3	
3	Indoor industrial environment	Manufacturing workshop			<b>-25°</b> ℃ to +50°℃	Class B	Level 4
4	Outdoor general environment	ITS/Video monitoring/Charging point/Communication/Security and protection	176 - 528VAC	<b>-40</b> ℃ to +85℃	Class A	Level 4	
5	Outdoor industrial environment	Electricity/Grid		<b>-40</b> ℃ to +85℃	Class A	Level 4	
6	Strong lightning surge	Electricity dedicated		<b>-40℃ to +85</b> ℃	Class A	Level 4	

## Electromagnetic Compatibility Solution--Recommended Circuit

1. Application circuit 1—Basic application

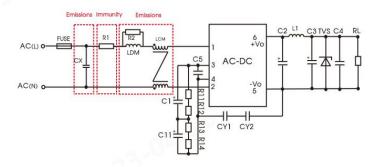


#### Recommended circuit 1

Application environmental	Ambient temperature range	Immunity level	Emissions class		
Basic application	<b>-40</b> ℃ <b>to +85</b> ℃	Level 3	Class A		
Component		Recommended	l value		
FUSE		2A/500V, slow-blow, required			
RI		$6.8 \Omega$ /3W (wire-wound resistor, required)			
R2		4.7K/1206/(1/4W) (SM	MD resistor)		
LDM		2.2mH/Max: 4.81 Ω/	Min: 0.31A		
LDM	sistor peeds to be a wire-wound resistor (re	2.2mH/Max: 4.81 Ω /	Min: 0.31A		

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



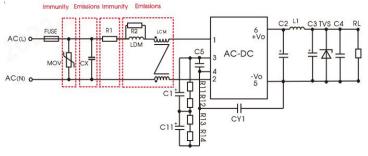
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Application environmental	Ambient temperature rang	e Immunity level	Emissions class			
Indoor civil /general	<b>-25</b> ℃ to +50℃	Level 3	Class B			
Component		Recommende	d value			
R1		6.8 $\Omega$ /3W (wire-wound resistor, required)				
R2		4.7K/1206/(1/4W) (SMD resistor)				
LDM		2.2mH/Max: 4.81 $\Omega$ /Min: 0.31A				
LCM	10r	10mH/1A, P/N: FL2D-10-103B (MORNSUN) is recommended				
CX		0.1uF/480VAC				
FUSE		2A/500V, slow-blow, required				

Note 1: According to the certification requirements, the CX 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 SMD resistor or carbon film resistor.

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

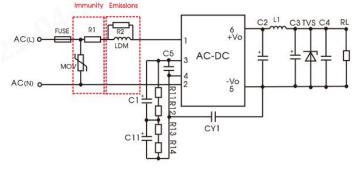


#### Recommended circuit 3

Application environmental	rature range	Immunity level	Emissions class			
Indoor industrial	Indoor industrial -25°C to +50°C Level 4			Class B		
 Component			Recommer	nded value		
MOV		S14K550				
CX		0.1uF/480VAC				
R2		4.7K/1206/(1/4W) (SMD resistor)				
LDM		2.2mH/Max: 4.81 Ω /Min: 0.31A				
LCM			10mH/1A, P/N: FL2D-10-103B (MORNSUN) is recommended			
RI			6.8 $\Omega$ /3W (wire-wound resistor, required)			
FUSE			2A/500V, slow-	blow, required		

Note 1: According to the certification requirements, the CX capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8M $\Omega$ , 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.

#### 



Recommended circuit 4

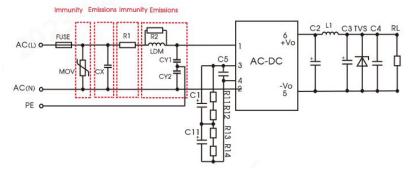


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	Application environmental	Ambient temper	ature range	Immunity level	Emissions class	
	Outdoor general environment	<b>-40</b> ℃ to +	<b>85</b> ℃	Level 4	Class A	
Component			Recommended value			
	MOV	OV \$14K550				
	R2		4.7K/1206/(1/4W) (SMD resistor)			
	LDM 2.2mH/Max: 4.81 $\Omega$ /Min: 0.31A					
	R1 6.8 \Quad /3W (wire-wound resistor, required)					
FUSE		2A/500V, slow-blow, required				
Note: R1 is t	he input plug-in resistor, this resistor n	eeds to be a wire-wo	und resistor (req	uired), please do not sele	ct SMD resistor or carbon	n 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	<b>-40</b> ℃ to +85℃	Level 4	Class A	

Component	Recommended value	
MOV	S14K550	
LDM	2.2mH/Max: 4.81 Ω /Min: 0.31A	
RI	6.8 $\Omega$ /3W (wire-wound resistor, required)	
СХ	0.1uF/480VAC	
FUSE	2A/500V, slow-blow, required	
CY2/CY3	1nF/400VAC	

Note 1: According to the certification requirements, the CX capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8M $\Omega$ , 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.

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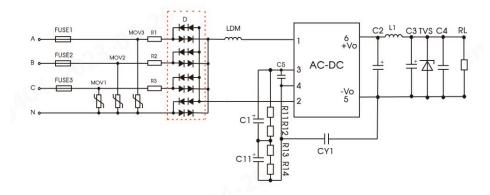


Fig. (1): Recommended circuit for applications which require 4KV differential-mode surge standard (full-wave rectification)

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## AC/DC Converter LS15-26BxxR3 Series

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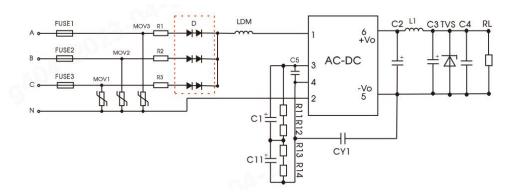


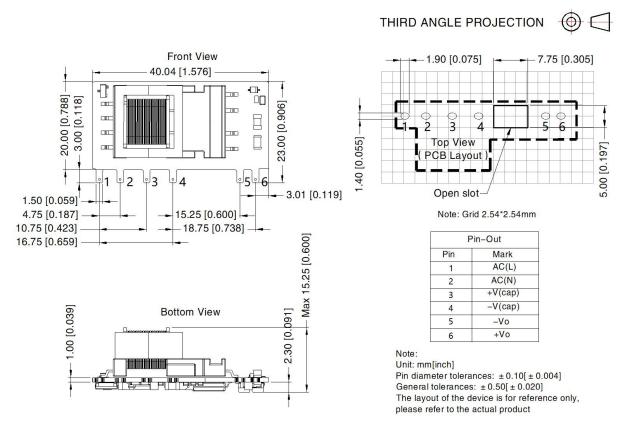
Fig. (2): Recommended circuit for applications which require 4KV differential-mode surge standard (half-wave rectification)

	Application environmental Ambient temp		erature range Immunity level		Emissions class
	Strong lightning surge environment	<b>-40</b> ℃ to	<b>+85</b> ℃	Level 4	Class A
Component			Recommended value		
FUSE1/FUSE2/FUSE3		6.3A/500V, slow-blow, required			
MOV1/MOV2/MOV3		S14K550			
R1/R2/R3 12 \overline{2}/5W (wire-wound res			d resistor, required)		
D		2A/1000V			
LDM		2.2mH/Max: 4.81 Ω /Min: 0.31A			
Note: R1/R2/R3	is the input plug-in resistor, this resist	or needs to be a w	ire-wound resistor (	(required), please do not	select SMD resistor or carbon film res

### 7. For additional information please refer to application notes on <u>www.mornsun-power.com.</u>

## **Dimensions and Recommended Layout**



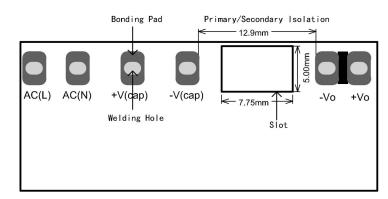


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## LS15-26BxxR3 series recommended pad



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 <u>www.mornsun-power.com</u>. Packaging bag number: 58220252;
- 2. External electrolytic capacitors are required to modules, more details refer to typical applications;
- 3. This part is open frame, at least 8.4 mm 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°C, humidity<75%, nominal input voltage (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. 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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