5W, DIY AC/DC converter

FEATURES

- Ultra-wide 85 - 305VAC and 70 - 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
- Controllable life and adjustable cost
- No-load power consumption 0.1W
- Output short circuit, over-current protection
- Designed to meet IEC/EN/UL62368, IEC/EN61558, IEC/EN60335 standards
- IEC/EN/UL62368 safety approval (LS05-13BxxR3 series)
- EN62368 safety approval (LS05-13BxxR3-F series)

LS05-13BxxR3(-F) 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

Certification	Part No.	Output Power	Nominal Output Voltage and Current (Vo/Io)	Efficiency at 230VAC (%) Typ.	Capacitive Load (μF) Max.
CE/UL/CB	LS05-13B03R3	3.3W	3.3V/1000mA	69	2200
	LS05-13B05R3	5W	5V/1000mA	76	1500
	LS05-13B09R3		9V/560mA	77	680
	LS05-13B12R3		12V/420mA	79	470
	LS05-13B15R3		15V/340mA	79	330
	LS05-13B24R3		24V/210mA	81	100
CE	LS05-13B03R3-F*	3.3W	3.3V/1000mA	69	2200
	LS05-13B05R3-F	5W	5V/1000mA	76	1500
	LS05-13B09R3-F		9V/560mA	77	680
	LS05-13B12R3-F		12V/420mA	79	470
	LS05-13B15R3-F		15V/340mA	79	330
	LS05-13B24R3-F		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.
3. *An "-F" suffix designates horizontal package vs. standard vertical mounting.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	AC input	85	--	305	VAC
	DC input	70	--	430	VDC
Input Frequency		47	--	63	Hz
Input Current	115VAC	--	--	0.2	A
	230VAC	--	--	0.1	
Inrush Current	115VAC	--	20	--	
	230VAC	--	40	--	
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	--	--	%

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
		277VAC - 305VAC	0.72	--	--	
Safety Standard			IEC/EN/UL62368, IEC/EN60335, IEC/EN61558			
Safety Certification		LS05-13BxxR3 series	IEC/EN/UL62368			
		LS05-13BxxR3-F series	EN62368			
Safety Class			CLASS II			
MTBF			MIL-HDBK-217F@25°C>1,000,000 h			

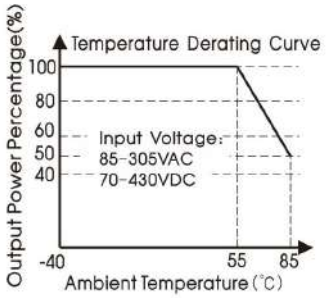
Mechanical Specifications

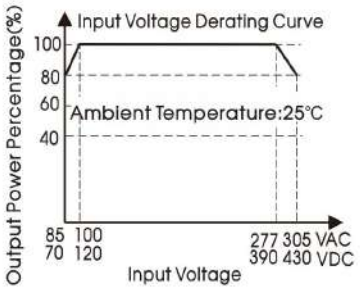
Dimension	LS05-13BxxR3	26.40 x 14.73 x 11.00 mm
	LS05-13BxxR3-F	27.84 x 11.60 x 17.60 mm
Weight	LS05-13BxxR3	5.2g (Typ.)
	LS05-13BxxR3-F	5.6g (Typ.)
Cooling method		Free air convection

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

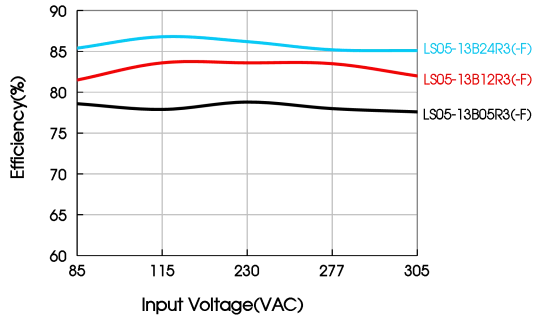
Product Characteristic Curve



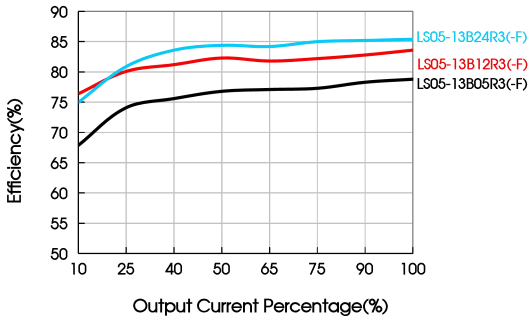


Note:
① With an AC input between 85 -100VAC/277- 305VAC and a DC input between 70 - 120VDC/390 - 430VDC, the output power must be derated as per temperature derating curves;
② This product is suitable for applications using natural air cooling; for applications in closed environment please consult factory or one of our FAE.

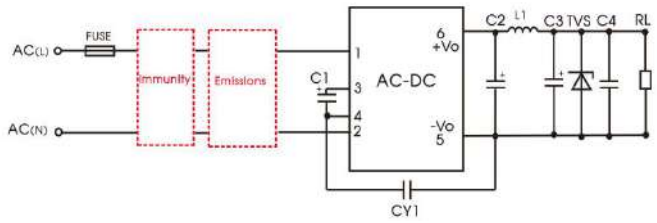
Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load(Vin=230VAC)



Additional Circuits Design Reference



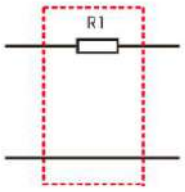
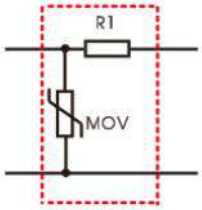
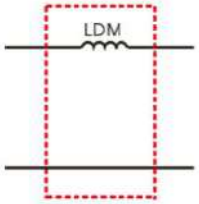
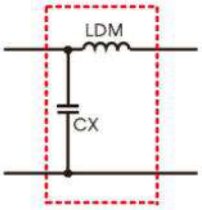
LS series additional circuits design reference

LS05(-F) series additional components selection guide (No EMC devices)							
Part No.	C1(required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
LS05-13B03R3(-F)	10μF/450V (-25℃ to +85℃, 85-305VAC input; -40℃ to +85℃, 165-305VAC input) 22μF/450V (-40℃ to +85℃, 85-305VAC input)	820μF/6.3V (solid-state capacitor)	4.7uH/60mΩ /2.2A	100μF/35V	0.1μF/ 50V	1.0nF/ 400VAC	SMBJ7.0A
LS05-13B05R3(-F)		470μF/16V (solid-state capacitor)					
LS05-13B09R3(-F)		270μF/16V (solid-state capacitor)		47μF/35V			SMBJ12A
LS05-13B12R3(-F)							SMBJ20A
LS05-13B15R3(-F)		220uF/35V					
LS05-13B24R3(-F)							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 >200mA@100KHz.
2. 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.
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.
4. LDM (1.2mH, P/N: 12050373; 4.7mH, P/N: 12050305), L1 (4.7uH, P/N: 12050181) Mornsun quotation is available.

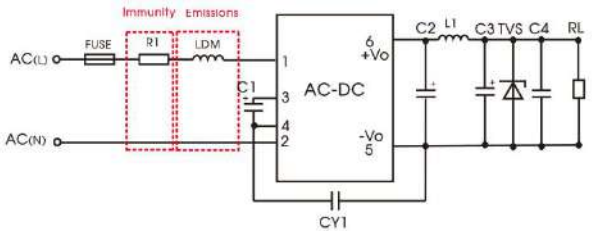
Environmental Application EMC Solution

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	85～305VAC	-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

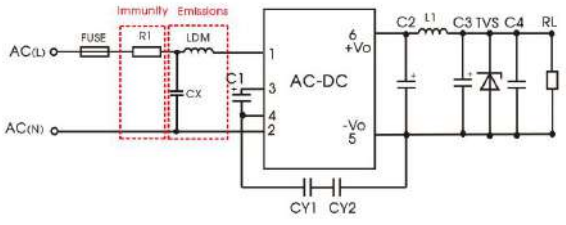


recommended circuit 1

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

FUSE (required)	1A/300V, slow-blow
R1 (wire-wound resistor, required)	12Ω/3W
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——Indoor civil /Universal system recommended circuits for general environment

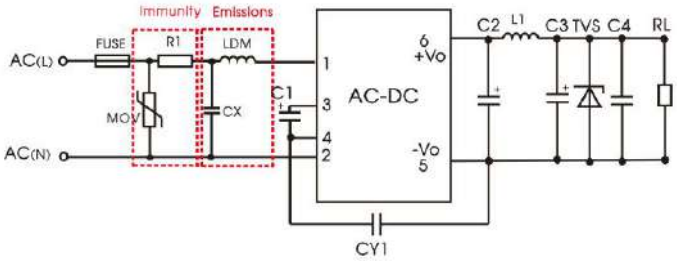


Recommended circuit 2

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

Component	Recommended value
R1 (wire-wound resistor, required)	12Ω/3W
LDM	1.2mH/Max: 4.0Ω/Min: 0.2A
CX	0.1μF/310VAC
FUSE (required)	1A/300V, 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 3.8MΩ, 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

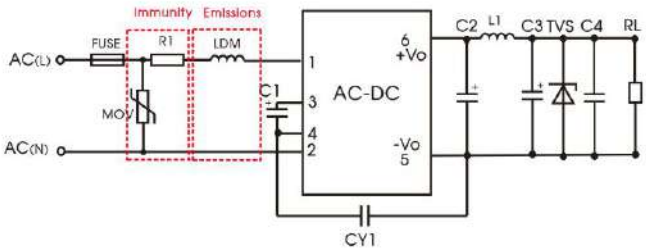


Recommended circuit 3

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

Component	Recommended value
MOV	S14K350
CX	0.1μF/310VAC
LDM	1.2mH/Max: 4.0Ω/Min: 0.2A
R1 (wire-wound resistor, required)	12Ω/3W
FUSE (required)	2A/300V, 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 3.8MΩ, 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

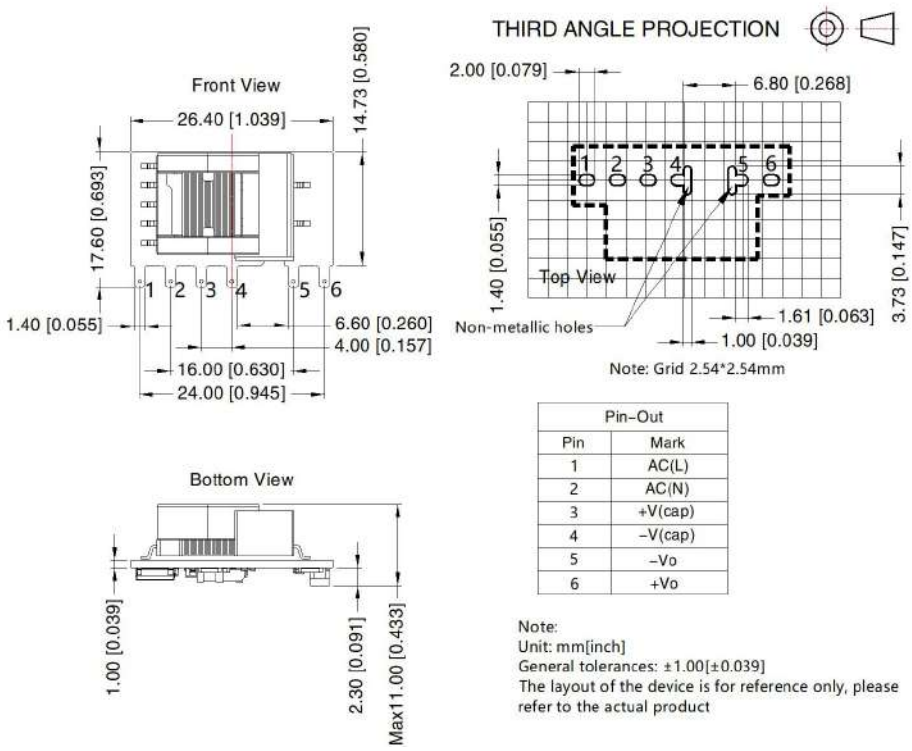
Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Outdoor general environment	-40℃ to +85℃	CLASS Ⅳ	CLASS A

Component	Recommended value
MOV	S14K350
LDM	4.7mH/Max: 15Ω/Min: 0.2A
R1 (wire-wound resistor, required)	12Ω/2W
FUSE (required)	2A/300V, slow-blow
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 LS-R3 DIY AC-DC Converter Application Guide And Design Reference.

LS05-13BxxR3 Dimensions and Recommended Layout

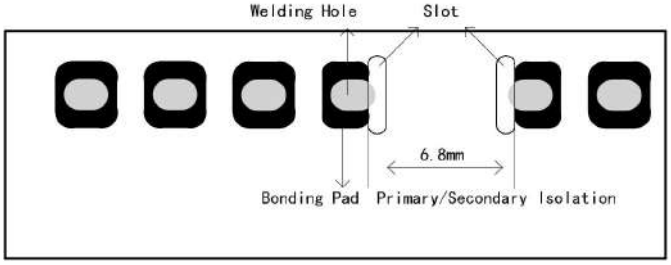
LS05-13BxxR3 series dimensions



Pin-Out	
Pin	Mark
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

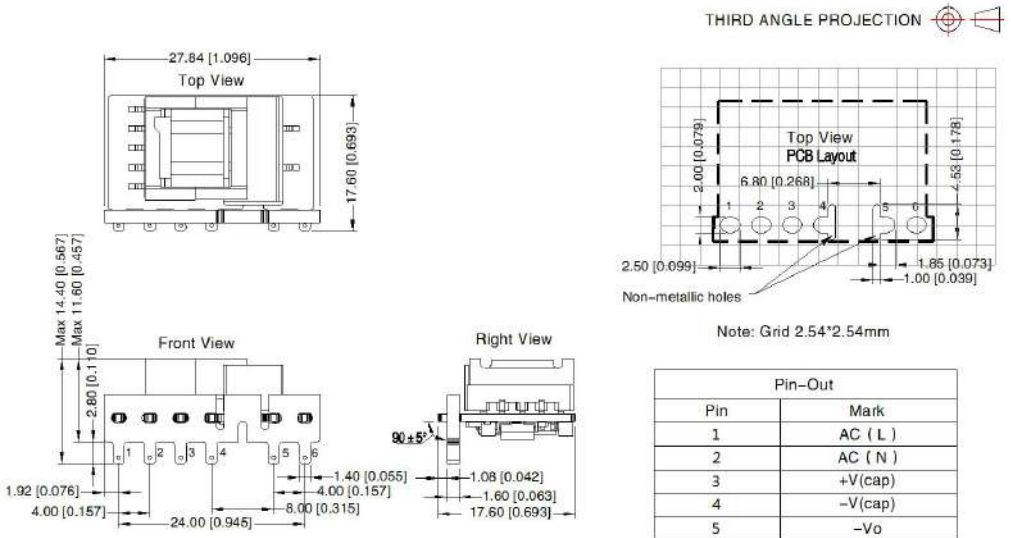
LS05-13BxxR3 series recommended pad



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

LS05-13BxxR3-F Dimensions and Recommended Layout

LS05-13BxxR3-F series dimensions

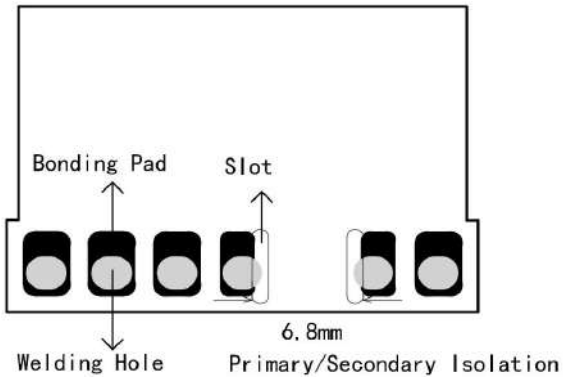


Note: Grid 2.54*2.54mm

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

Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 1.0[± 0.040]
The layout of the device is for reference only, please refer to the actual product

LS05-13BxxR3-F series recommended pad



Note: There is a slot(non-metallic hole) between pin 4/5, which the side pad were being cut off. 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(LS05-13BxxR3); 58220093(LS05-13BxxR3-F);
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.

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. China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com