

5W, DIY AC/DC converter



CE Report  
EN62368-1

RoHS



## 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°C to +85°C
- High I/O isolation test voltage up to 4000VAC
- Multi application, compact size, flexible layout
- No-load power consumption 0.1W
- Output short circuit, over-current protection
- Plastic case meets UL94V-0 flammability
- Pollution degree 3 (meet IEC62368-1)

LS05-23BxxDR3 series is one of Mornsun's miniaturized potting highly efficient green power AC-DC Converters. They feature wide input range accepting either AC or DC voltage, high reliability, low power consumption, reinforced isolation and strong applicability. 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 (uF) Max. |
|---------------|---------------|--------------|--------------------------------------------|-------------------------------|---------------------------|
| EN            | LS05-23B03DR3 | 3.3W         | 3.3V/1000mA                                | 68                            | 2200                      |
|               | LS05-23B05DR3 | 5W           | 5V/1000mA                                  | 71                            | 1500                      |
|               | LS05-23B09DR3 |              | 9V/560mA                                   | 74                            | 680                       |
|               | LS05-23B12DR3 |              | 12V/420mA                                  | 75                            | 470                       |
|               | LS05-23B15DR3 |              | 15V/340mA                                  | 77                            | 330                       |
|               | LS05-23B24DR3 |              | 24V/210mA                                  | 77                            | 100                       |

Note: The nominal output voltage refers to the voltage applied to the load terminal after adding external circuits.

## 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<br>(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    | --   | %    |
| Line Regulation            | Rated load                                               | --   | ±1.5  | --   |      |
| Load Regulation            | 10% - 100% load                                          | --   | ±3    | --   |      |
| Ripple & Noise*            | 20MHz bandwidth (peak-to-peak value),<br>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  |              | $\geq 110\%I_o$ , 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 $< 5\text{mA}$                                   | 4000                                        | --   | --   | VAC                   |
| Insulation Resistance | Input-output                                     | At 500VDC                                                                                          | 100                                         | --   | --   | M $\Omega$            |
| Operating Temperature |                                                  |                                                                                                    | -40                                         | --   | +85  | $^{\circ}\text{C}$    |
| Storage Temperature   |                                                  |                                                                                                    | -40                                         | --   | +105 |                       |
| Storage Humidity      |                                                  |                                                                                                    | --                                          | --   | 95   | %RH                   |
| Soldering Temperature | Wave-soldering                                   |                                                                                                    | $260 \pm 5^{\circ}\text{C}$ ; time: 5 - 10s |      |      |                       |
|                       | Manual-welding                                   |                                                                                                    | $360 \pm 10^{\circ}\text{C}$ ; time: 3 - 5s |      |      |                       |
| Power Derating        | +55 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$ |                                                                                                    | 1.67                                        | --   | --   | %/ $^{\circ}\text{C}$ |
|                       | 85VAC - 100VAC                                   |                                                                                                    | 1.33                                        | --   | --   |                       |
|                       | 277VAC - 305VAC                                  |                                                                                                    | 0.72                                        | --   | --   | %/VAC                 |
| Safety Standard       |                                                  | EN62368-1(Report) safety approved ;<br>Design refer to IEC/UL62368-1, IEC/EN60335-1, IEC/EN61558-1 |                                             |      |      |                       |
| Safety Class          |                                                  | CLASS II                                                                                           |                                             |      |      |                       |
| MTBF                  |                                                  | MIL-HDBK-217F@25 $^{\circ}\text{C}$ > 1,000,000 h                                                  |                                             |      |      |                       |

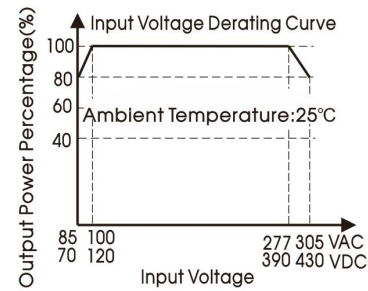
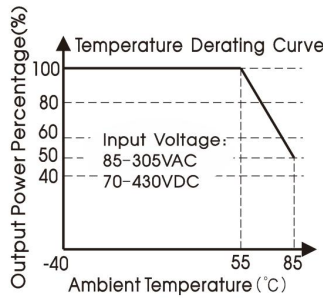
## Mechanical Specifications

|                |                                                             |
|----------------|-------------------------------------------------------------|
| Case Material  | Black plastic, flame-retardant and heat-resistant (UL94V-0) |
| Dimension      | 27.60 x 18.50 x 7.80 mm                                     |
| Weight         | 7.5g (Typ.)                                                 |
| Cooling method | Free air convection                                         |

## Electromagnetic Compatibility (EMC)

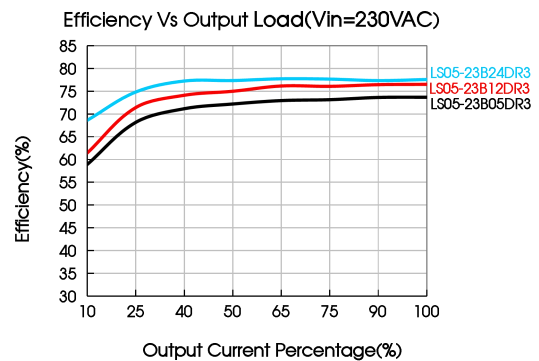
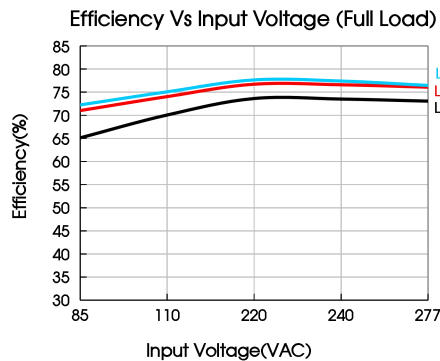
|           |                                                       |                  |                                                                                    |                  |
|-----------|-------------------------------------------------------|------------------|------------------------------------------------------------------------------------|------------------|
| Emissions | CE                                                    | CISPR32/EN55032  | CLASS A (Application circuit 1, 4)                                                 |                  |
|           |                                                       | CISPR32/EN55032  | CLASS B (Application circuit 2, 3, 5)                                              |                  |
| Immunity  | RE                                                    | CISPR32/EN55032  | CLASS A (Application circuit 1, 4)                                                 |                  |
|           |                                                       | CISPR32/EN55032  | CLASS B (Application circuit 2, 3, 5)                                              |                  |
|           | ESD                                                   | IEC/EN61000-4-2  | Contact $\pm 6\text{KV}$ / Air $\pm 8\text{KV}$                                    | perf. Criteria B |
|           | RS                                                    | IEC/EN61000-4-3  | 10V/m                                                                              | perf. Criteria A |
|           | EFT                                                   | IEC/EN61000-4-4  | $\pm 2\text{KV}$ (Application circuit 1, 2)                                        | perf. Criteria B |
|           |                                                       | IEC/EN61000-4-4  | $\pm 4\text{KV}$ (Application circuit 3, 4, 5)                                     | perf. Criteria B |
|           | Surge                                                 | IEC/EN61000-4-5  | line to line $\pm 1\text{KV}$ (Application circuit 1, 2)                           | perf. Criteria B |
|           |                                                       | IEC/EN61000-4-5  | line to line $\pm 2\text{KV}$ (Application circuit 3, 4)                           | perf. Criteria B |
|           |                                                       | IEC/EN61000-4-5  | line to line $\pm 2\text{KV}$ /line to PE $\pm 4\text{KV}$ (Application circuit 5) | 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 A |
|           |                                                       |                  |                                                                                    |                  |

### Product Characteristic Curve

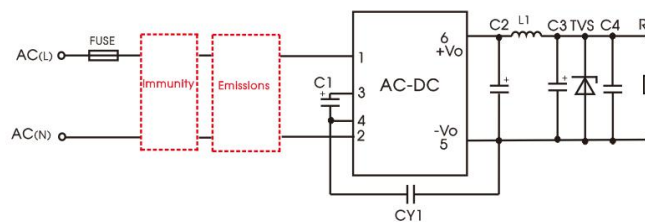


Note: ① With an AC input between 85-100VAC/277-305VAC and a DC input between 70-120VDC/390-430VDC, the output power must be derated as per temperature derating curves;

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



### Additional Circuits Design Reference



LS05 series additional components selection guide (No EMC devices)

| LS05 series additional components selection guide (No EMC devices) |                                                                                                                                          |                                       |                     |                  |               |                   |          |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------|------------------|---------------|-------------------|----------|
| Part No.                                                           | C1(required)                                                                                                                             | C2<br>(required)                      | L1<br>(required)    | C3<br>(required) | C4            | CY1<br>(required) | TVS      |
| LS05-23B03DR3                                                      | 10uF/450V<br>(-25℃ to +85℃,<br>85-305VAC input;<br>-40℃ to +85℃,<br>165-305VAC input)<br>22uF/450V<br>(-40℃ to +85℃,<br>85-305VAC input) | 820uF/6.3V<br>(solid-state capacitor) | 2.2uH/36mΩ<br>/3.3A | 220uF/16V        | 0.1uF/<br>50V | 1.0nF/<br>400VAC  | SMBJ7.0A |
| LS05-23B05DR3                                                      |                                                                                                                                          | 470uF/16V<br>(solid-state capacitor)  |                     | 47uF/35V         |               |                   | SMBJ12A  |
| LS05-23B09DR3                                                      |                                                                                                                                          | 270uF/16V<br>(solid-state capacitor)  | 4.7uH/60mΩ<br>/2.2A |                  |               |                   | SMBJ20A  |
| LS05-23B12DR3                                                      |                                                                                                                                          | 220uF/25V<br>(solid-state capacitor)  |                     |                  |               |                   | SMBJ20A  |
| LS05-23B15DR3                                                      |                                                                                                                                          | 220uF/35V                             |                     |                  |               |                   | SMBJ30A  |
| LS05-23B24DR3                                                      |                                                                                                                                          |                                       |                     |                  |               |                   |          |

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°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.

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.

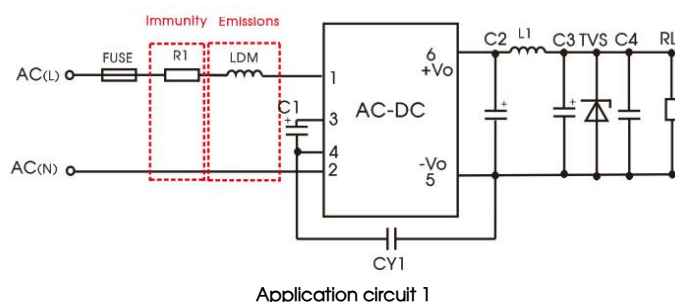
Environmental Application EMC Solution

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   | Level 3  |
| 2                   | Indoor civil environment       | Smart home/Home appliances (2Y)                                           |                     | -25℃ to +55℃            | Class B   | Level 3  |
|                     | Indoor general environment     | Intelligent building/Intelligent agriculture                              |                     | -25℃ to +55℃            | Class B   | Level 4  |
| 3                   | Indoor industrial environment  | Manufacturing workshop                                                    |                     | -40℃ to +85℃            | Class A   | Level 4  |
| 4                   | Outdoor general environment    | ITS/Video monitoring/Charging point/Communication/Security and protection |                     | -40℃ to +85℃            | Class B   | Level 4  |
| 5                   | Outdoor industrial environment | Electricity/Grid                                                          |                     | -40℃ to +85℃            | Class B   | Level 4  |

Electromagnetic Compatibility Solution—Recommended Circuit

1. Application circuit 1—Basic application

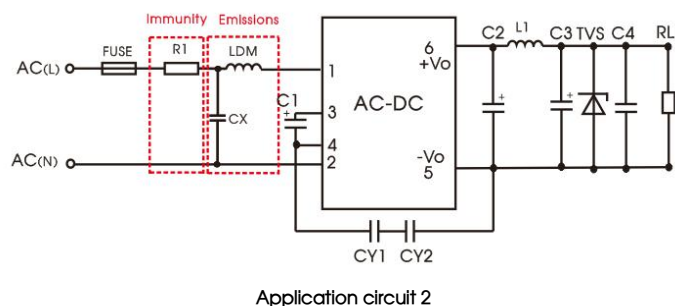


| Application environmental | Ambient temperature range | Immunity level | Emissions class |
|---------------------------|---------------------------|----------------|-----------------|
| Basic application         | -40℃ to +85℃              | Level 3        | Class A         |

|      |                                          |
|------|------------------------------------------|
| FUSE | 1A/300V, slow-blow, required             |
| R1   | 24 Ω /3W (wire-wound resistor, required) |
| 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 resistors or carbon film resistor.

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



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

Note 1: In the home appliance application environment, the two Y capacitors of the primary and secondary need to be externally connected (CV1/CV2, 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 resistors or carbon film resistor.

The diagram illustrates a power supply system. It begins with an AC input consisting of two lines: AC(L) and AC(N). These lines pass through a FUSE and a MOV (Metal Oxide Varistor) for protection. The circuit then enters a red dashed box labeled "Immunity Emissions", which contains a network of components: a resistor R1, an inductor LDM, and a capacitor CX. Following this network, the circuit splits into two paths. One path goes to terminal 1 of an AC-DC converter block, which has terminals 3, 4, and 2. The other path goes to terminal 3 of a DC-DC converter block, which has terminals 5 and 6. The AC-DC converter block is connected to a DC-DC converter block. The DC-DC converter block has a feedback capacitor CY1 connected between terminals 5 and 6. The output of the DC-DC converter is taken from terminals 2 and 3, which are labeled +Vo and -Vo respectively. The output is filtered by a capacitor C2 and an inductor L1. The output is then connected to a TVS (Transient Voltage Suppressor) diode and a capacitor C3. Finally, the output is connected to a load resistor R4 and a capacitor C4.

|                           |                           |                |                 |
|---------------------------|---------------------------|----------------|-----------------|
| Application environmental | Ambient temperature range | Immunity level | Emissions class |
| Indoor Industrial         | -25°C to +55°C            | Level 4        | Class B         |

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.

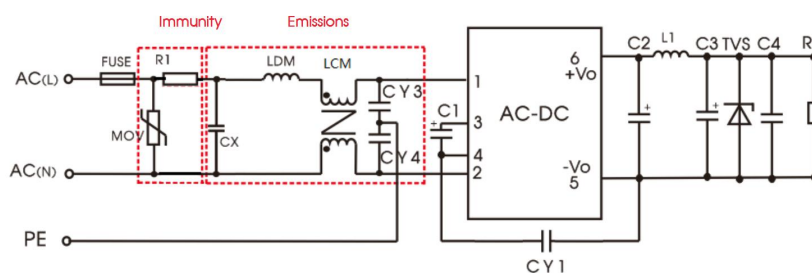
Note 2: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select SMD resistors or carbon film resistor.

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

Note: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select SMD resistors or carbon film resistor.



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



Application circuit 5

| Application environmental      | Ambient temperature range | Immunity level | Emissions class |
|--------------------------------|---------------------------|----------------|-----------------|
| Outdoor industrial environment | -40℃ to +85℃              | Level 4        | Class B         |

| Component | Recommended value                        |
|-----------|------------------------------------------|
| C1        | 22uF/450V                                |
| MOV       | S14K350                                  |
| CX        | 0.1uF/310VAC                             |
| LDM       | 330uH/960mΩ Max/0.31A                    |
| LCM       | 3.1mH                                    |
| R1        | 47 Ω /5W (wire-wound resistor, required) |
| CY3/CY4   | 1nF/400VAC                               |
| FUSE      | 2A/300V, slow-blow, required             |

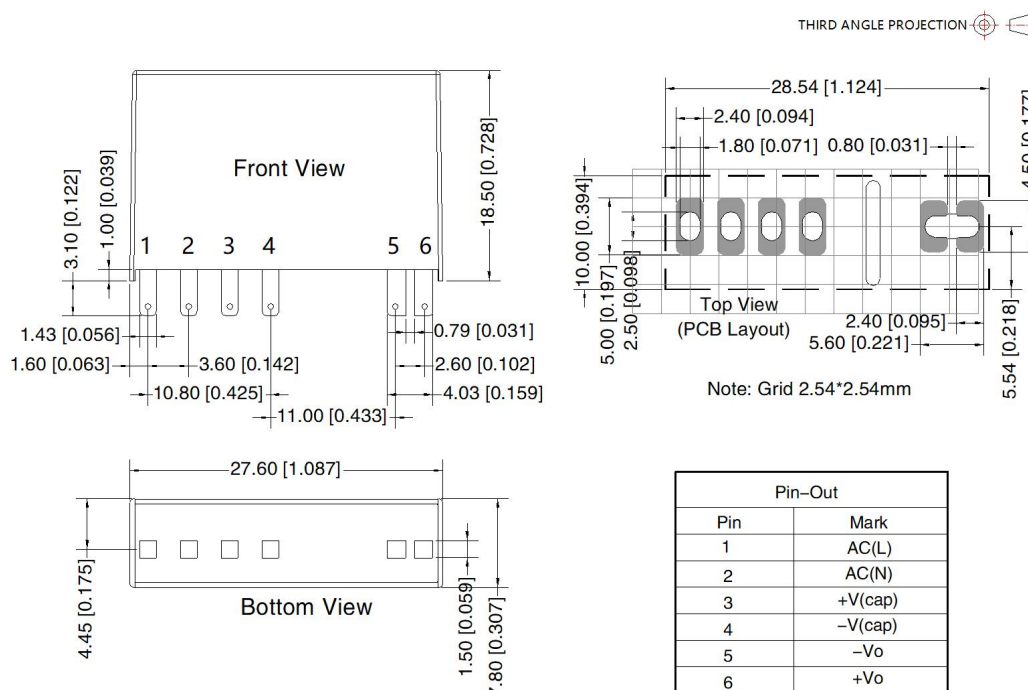
Note 1: According to the certification requirements, the X capacitor needs to be connected in parallel with the bleeder resistance, the recommended resistance value is less than 3.8MΩ, and the actual need to be selected according to the certification standard.

Note 2: R1 is the input plug-in resistor, this resistor needs to be a wire-wound resistor (required), please do not select SMD resistors or carbon film resistor.

### 6. For additional information please refer to application notes on [www.mornsun-power.com](http://www.mornsun-power.com).

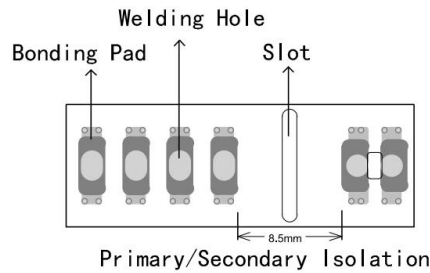
## Dimensions and Recommended Layout

### LS05-23BxxDR3 series dimensions



Note:  
Unit: mm[inch]  
Pin section tolerances:  $\pm 0.15[\pm 0.006]$   
General tolerances:  $\pm 0.50[\pm 0.020]$

LS05-23BxxDR3 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](http://www.mornsun-power.com). Packaging bag number: 58220074;
2. External electrolytic capacitors are required to modules, more details refer to typical applications;
3. This series is a potting product, 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  $T_a=25^{\circ}\text{C}$ , 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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