

5-25W, AC/DC converter



### FEATURES

- Wide input voltage range : 85~264VAC/120~370VDC
- Low temperature operating range of military grade: -40~70°C
- Conversion efficiency up to 87%
- Short circuit , over-current, over- voltage protection
- Meets IEC60950, EN60950, UL60950 standards
- Three years warranty



*LB(05-25)-10BxxLT series — is a compact size power converter offered by Mornsun. It features universal input voltage, taking both DC and AC input voltage, low power consumption, high efficiency, high reliability, safer isolation. It offers good EMC performance, meets IEC/EN61000-4, CISPR22/EN55022, UL60950, EN60950 standards, and is widely used in industrial, office and civil applications. For harsh EMC environment, this series of product must use the referred application circuit.*

### Selection Guide

| Certification      | Part No.     | Output Power | Nominal Output Voltage and Current (Vo/Io) | Efficiency (230VAC, %/Typ.) | Max. Capacitive Load(μF) |
|--------------------|--------------|--------------|--|-----------------------------|--------------------------|
| UL/CE<br>(pending) | LB05-10B03LT | 4W           | 3.3V/1250mA                                | 70                          | 4000                     |
|                    | LB05-10B05LT | 5W           | 5V/1000mA                                  | 75                          | 4000                     |
|                    | LB05-10B09LT |              | 9V/550mA                                   | 77                          | 1800                     |
|                    | LB05-10B12LT |              | 12V/420mA                                  | 79                          | 1800                     |
|                    | LB05-10B15LT |              | 15V/330mA                                  | 80                          | 1500                     |
|                    | LB05-10B24LT |              | 24V/230mA                                  | 82                          | 330                      |
|                    | LB10-10B03LT |              | 6.6W                                       | 3.3V/2000mA                 | 70                       |
|                    | LB10-10B05LT | 10W          | 5V/2000mA                                  | 76                          | 9400                     |
|                    | LB10-10B09LT |              | 9V/1100mA                                  | 78                          | 3600                     |
|                    | LB10-10B12LT |              | 12V/900mA                                  | 80                          | 2400                     |
|                    | LB10-10B15LT |              | 15V/700mA                                  | 81                          | 1200                     |
|                    | LB10-10B24LT |              | 24V/450mA                                  | 82                          | 370                      |
|                    | LB15-10B03LT |              | 9.9W                                       | 3.3V/3000mA                 | 73                       |
|                    | LB15-10B05LT | 14W          | 5V/2800mA                                  | 76                          | 20000                    |
|                    | LB15-10B09LT | 15W          | 9V/1600mA                                  | 78                          | 6000                     |
|                    | LB15-10B12LT |              | 12V/1250mA                                 | 80                          | 3000                     |
|                    | LB15-10B15LT |              | 15V/1000mA                                 | 80                          | 3000                     |
|                    | LB15-10B24LT |              | 24V/625mA                                  | 84                          | 900                      |
|                    | LB15-10B48LT |              | 48V/320mA                                  | 85                          | 370                      |
|                    | LB20-10B03LT |              | 13.5W                                      | 3.3V/4100mA                 | 74                       |
|                    | LB20-10B05LT | 17.5W        | 5V/3500mA                                  | 78                          | 12000                    |
|                    | LB20-10B09LT | 20W          | 9V/2100mA                                  | 80                          | 7200                     |
|                    | LB20-10B12LT |              | 12V/1600mA                                 | 82                          | 5400                     |
|                    | LB20-10B15LT |              | 15V/1300mA                                 | 83                          | 2700                     |
|                    | LB20-10B24LT |              | 24V/850mA                                  | 85                          | 1800                     |
|                    | LB25-10B03LT |              | 13.5W                                      | 3.3V/4100mA                 | 74                       |
|                    | LB25-10B05LT | 20.5W        | 5V/4100mA                                  | 79                          | 12000                    |
|                    | LB25-10B09LT | 25W          | 9V/2500mA                                  | 81                          | 5600                     |
| LB25-10B12LT       | 12V/2100mA   |              | 83   | 5400                        |                          |

### Selection Guide

| Certification      | Part No.     | Output Power | Nominal Output Voltage and Current (Vo/Io) | Efficiency (230VAC, %/Typ.) | Max. Capacitive Load(μF) |
|--------------------|--------------|--------------|--|-----------------------------|--------------------------|
| UL/CE<br>(pending) | LB25-10B15LT | 25W          | 15V/1600mA                                 | 84                          | 2400                     |
|                    | LB25-10B24LT |              | 24V/1100mA                                 | 85                          | 1400                     |
|                    | LB25-10B48LT |              | 48V/500mA                                  | 87                          | 800                      |

### Input Specifications

| Item                            | Operating Conditions  | Min.                       | Typ. | Max. | Unit  |   |
|---------------------------------|-----------------------|----------------------------|------|------|-------|---|
| Input Voltage Range             | AC input              | 85                         | --   | 264  | VAC   |   |
|                                 | DC input              | 120                        | --   | 370  | VDC   |   |
| Input frequency                 |                       | 47                         | --   | 63   | Hz    |   |
| Input current                   | LB05 models           | 115VAC                     | --   | --   | 0.125 | A |
|                                 | LB10 models           |                            | --   | --   | 0.26  |   |
|                                 | LB15 models           |                            | --   | --   | 0.37  |   |
|                                 | LB20/LB25 models      |                            | --   | --   | 0.6   |   |
|                                 | LB05 models           | 230VAC                     | --   | --   | 0.08  |   |
|                                 | LB10 models           |                            | --   | --   | 0.16  |   |
|                                 | LB15 models           |                            | --   | --   | 0.22  |   |
|                                 | LB20/LB25 models      |                            | --   | --   | 0.34  |   |
| Inrush current                  | LB05/LB10/LB15 models | 115VAC                     | --   | 10   | --    |   |
|                                 | LB20/ LB25 models     |                            | --   | 16   | --    |   |
|                                 | LB05/LB10/LB15 models | 230VAC                     | --   | 20   | --    |   |
|                                 | LB20/ LB25 models     |                            | --   | 30   | --    |   |
| Leakage current                 |                       | 0.1mA RMS typ. 230VAC/50Hz |      |      |       |   |
| Recommended External Input Fuse | LB05 models           | 1A/250V, slow fusing       |      |      |       |   |
|                                 | LB10/ LB15 models     | 2A/250V, slow fusing       |      |      |       |   |
|                                 | LB20/ LB25 models     | 3.15A/250V, slow fusing    |      |      |       |   |

### Output Specifications

| Item                          | Operating Conditions              | Min.                      | Typ.  | Max. | Unit |
|-------------------------------|-----------------------------------|---------------------------|-------|------|------|
| Output Voltage Accuracy       | Main circuit                      | --                        | ±2    | --   | %    |
| Line Regulation               | Full load                         | --                        | ±0.5  | --   |      |
| Load Regulation               | 10%-100% load                     | --                        | ±1    | --   |      |
| Output Ripple & Noise*        | 20MHz bandwidth (peak-peak value) | --                        | 50    | 100  | mV   |
| Temperature Drift Coefficient | Main circuit                      | --                        | ±0.02 | --   | %/°C |
| Short Circuit Protection      |                                   | Continuous, self-recovery |       |      |      |
| Over-current Protection       |                                   | ≥110%Io self-recovery     |       |      |      |
| Over-voltage Protection       | 3.3/5VDC                          | ≤7.5VDC                   |       |      |      |
|                               | 9VDC                              | ≤12VDC                    |       |      |      |
|                               | 12/15VDC                          | ≤20VDC                    |       |      |      |
|                               | 24VDC                             | ≤30VDC                    |       |      |      |
|                               | 48VDC                             | ≤60VDC                    |       |      |      |
| Min. Load                     |                                   | 0                         | --    | --   | %    |
| Hold-up Time                  | 115VAC input                      | --                        | 15    | --   | ms   |
|                               | 230VAC input                      | --                        | 80    | --   |      |

Note: \*Parallel line test method is adopted to test the ripple and noise, please see *AC-DC Converter Application Notes* for specific operation methods.

### General Specifications

| Item                           | Operating Conditions                |                 | Min.                | Typ. | Max. | Unit   |
|--------------------------------|-------------------------------------|-----------------|---------------------|------|------|--------|
| Isolation Voltage              | Input-output                        | Test time: 1min | 3000                | --   | --   | VAC    |
| Operating Temperature          |                                     |                 | -40                 | --   | +70  | °C     |
| Storage Temperature            |                                     |                 | -40                 | --   | +105 |        |
| Storage Humidity               |                                     |                 | --                  | --   | 95   | %RH    |
| Welding Temperature            | Wave-soldering                      |                 | 260±5°C; time:5~10s |      |      |        |
|                                | Manual-welding                      |                 | 360±10°C; time:3~5s |      |      |        |
| Switching Frequency            | LB05 models                         |                 | --                  | 66   | 132  | kHz    |
|                                | LB10 models                         |                 | --                  | 100  | --   |        |
|                                | LB15/LB20/LB25 models               |                 | --                  | 65   | --   |        |
| Power Derating                 | -40°C to -10°C                      |                 | 2                   | --   | --   | % / °C |
|                                | 50°C to +70°C (LB25-10BxxLT series) |                 | 3                   | --   | --   |        |
|                                | 55°C to +70°C (Others)              |                 | 4                   | --   | --   |        |
| Safety Standard                | IEC60950/EN60950/UL60950            |                 |                     |      |      |        |
| Safety-regulated Certification | EN60950/UL60950(pending)            |                 |                     |      |      |        |
| Safety Class                   | LB15-10BxxLT                        |                 | CLASS II            |      |      |        |
|                                | Others                              |                 | CLASS I             |      |      |        |
| Hot Plug                       | Unavailable                         |                 |                     |      |      |        |
| MTBF                           | MIL-HDBK-217F@25°C > 300,000 h      |                 |                     |      |      |        |

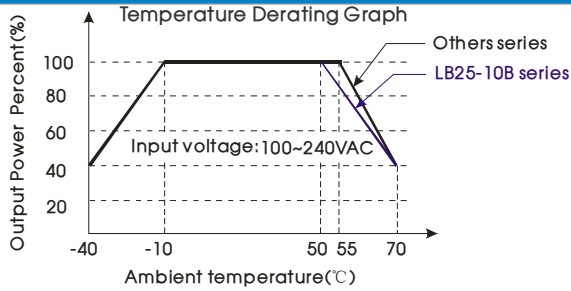
### Physical Specifications

|                    |  |
|--------------------|--|
| Casing Material    | Black flame-retardant and heat-resistant plastic (UL94-V0) |
| Package Dimensions | Refer to the Dimensions                                    |
| Weight             | Refer to the Dimensions                                    |
| Cooling method     | Free air convection  |

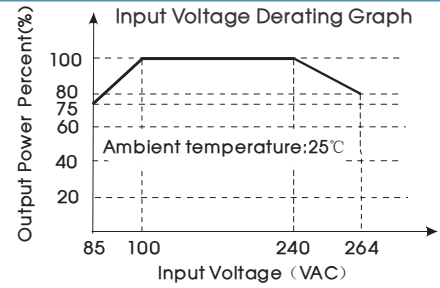
### EMC Specifications

|  |                                |                          |  |                  |
|--|--------------------------------|--------------------------|--|------------------|
| EMI  | Conducted Disturbance          | CISPR22/EN55022, CLASS B |  |                  |
|  | Radiated Emission              | CISPR22/EN55022, CLASS B |  |                  |
| EMS  | Electrostatic Discharge        | IEC/EN61000-4-2          | ±6KV/±8KV                                      | Perf. Criteria B |
|  | Radiation Immunity             | IEC/EN61000-4-3          | 10V/m  | perf. Criteria A |
|  | EFT                            | IEC/EN61000-4-4          | ±2KV   | perf. Criteria B |
|  |                                | IEC/EN61000-4-4          | ±4KV (See Fig. 2 for recommended circuit)      | perf. Criteria B |
|  | Surge Immunity                 | IEC/EN61000-4-5          | ±1KV/±2KV                                      | perf. Criteria B |
|  |                                | IEC/EN61000-4-5          | ±2KV/±4KV (See Fig. 2 for recommended circuit) | perf. Criteria B |
|  | Conducted Disturbance immunity | IEC/EN61000-4-6          | 10 Vr.m.s                                      | perf. Criteria A |
| Immunity for Power frequency magnetic field            | IEC/EN61000-4-8                | 10A/m                    | perf. Criteria A                               |                  |
| Immunities of voltage dip, drop and short interruption | IEC/EN61000-4-11               | 0%-70%                   | perf. Criteria B                               |                  |

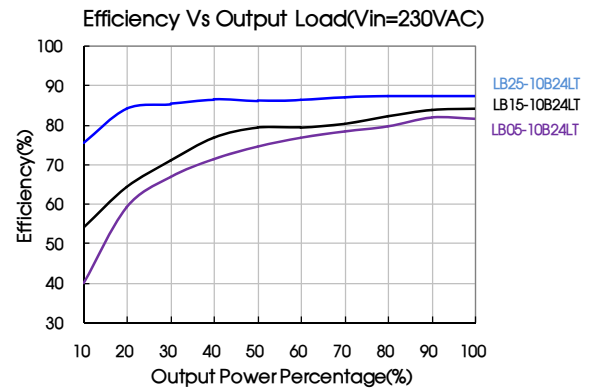
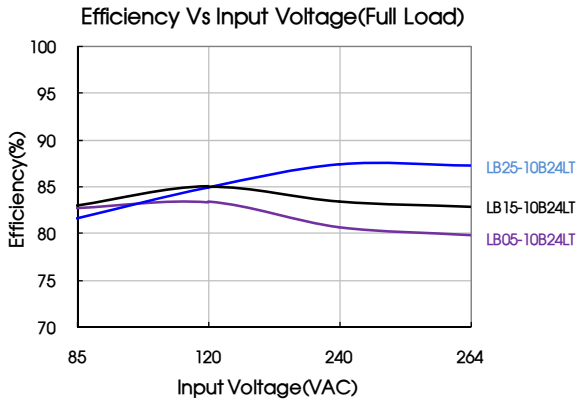
### Product Characteristic Curve



Note: When input 85~100VAC/240~264VAC, it need to be voltage derated on basis of temperature derating.



Note: When input DC, VDC=1.414VAC-20.



### Design Reference

#### 1. Typical application circuit

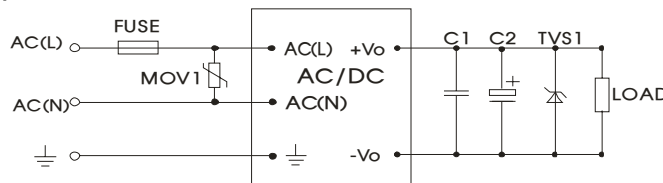


Fig. 1: Typical application circuit

| Model        | C1(uF) | C2(uF) | TVS1     | Model        | C1(uF) | C2(uF) | TVS1     |
|--------------|--------|--------|----------|--------------|--------|--------|----------|
| LB05-10B03LT | 1      | 330    | SMBJ7.0A | LB15-10B15LT | 1      | 220    | SMBJ20A  |
| LB05-10B05LT | 1      | 330    | SMBJ7.0A | LB15-10B24LT | 1      | 68     | SMBJ30A  |
| LB05-10B09LT | 1      | 120    | SMBJ12A  | LB15-10B48LT | 1      | 33     | SMBJ64A  |
| LB05-10B12LT | 1      | 120    | SMBJ20A  | LB20-10B03LT | 1      | 330    | SMBJ7.0A |
| LB05-10B15LT | 1      | 68     | SMBJ20A  | LB20-10B05LT | 1      | 330    | SMBJ7.0A |
| LB05-10B24LT | 1      | 68     | SMBJ30A  | LB20-10B09LT | 1      | 220    | SMBJ12A  |
| LB10-10B03LT | 1      | 470    | SMBJ7.0A | LB20-10B12LT | 1      | 220    | SMBJ20A  |
| LB10-10B05LT | 1      | 330    | SMBJ7.0A | LB20-10B15LT | 1      | 220    | SMBJ20A  |
| LB10-10B09LT | 1      | 120    | SMBJ12A  | LB20-10B24LT | 1      | 220    | SMBJ30A  |
| LB10-10B12LT | 1      | 120    | SMBJ20A  | LB25-10B03LT | 1      | 330    | SMBJ7.0A |
| LB10-10B15LT | 1      | 120    | SMBJ20A  | LB25-10B05LT | 1      | 330    | SMBJ7.0A |
| LB10-10B24LT | 1      | 68     | SMBJ30A  | LB25-10B09LT | 1      | 330    | SMBJ12A  |
| LB15-10B03LT | 1      | 680    | SMBJ7.0A | LB25-10B12LT | 1      | 330    | SMBJ20A  |
| LB15-10B05LT | 1      | 680    | SMBJ7.0A | LB25-10B15LT | 1      | 330    | SMBJ20A  |
| LB15-10B09LT | 1      | 470    | SMBJ12A  | LB25-10B24LT | 1      | 120    | SMBJ30A  |
| LB15-10B12LT | 1      | 220    | SMBJ20A  | LB25-10B48LT | 1      | 68     | SMBJ64A  |

Note:  
Output filtering capacitor C2 is electrolytic capacitor, it is recommended to apply electrolytic capacitor with high frequency and low resistance. For capacitance and current of capacitor please refer to manufacture's datasheet. Capacitance withstand voltage derating should be 80% or above. C1 is ceramic capacitor, advice use 1μF, which is used to filter high-frequency noise. TVS is a recommended component to protect post-circuits if converter fails.

2. EMC solution-recommended circuit

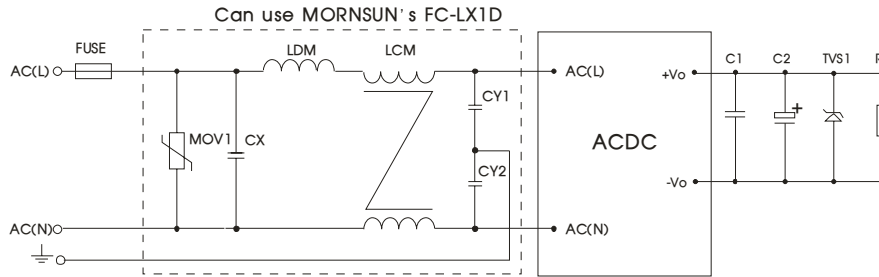


Fig. 2: EMC Recommended circuit with higher requirements

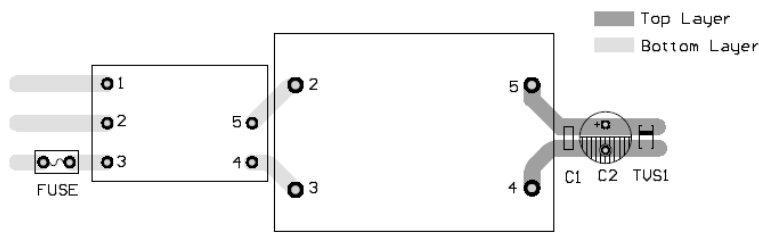
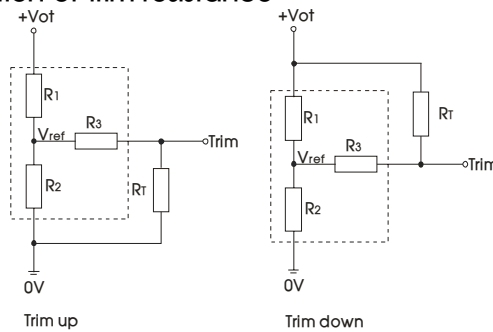


Fig.3: Recommended EMC circuit-PCB layout

Suggestions for safety regulation and wiring width: wire width  $\geq 3\text{mm}$ , distance between wires  $\geq 6\text{mm}$ , and distance between wire and ground  $\geq 6\text{mm}$

| Element model | Recommended value                              | Element model | Recommended value  |                                   |
|---------------|--|---------------|--------------------|-----------------------------------|
| MOV1          | S14K350  | FC-LX1D       | 2KV/4KV EMC filter |                                   |
| CY1 , CY2     | 1000pF/400VAC                                  | FUSE          | LB05               | 1A/250V slow fusing, necessary    |
| CX            | 0.1 $\mu$ F/275VAC                             |               | LB10/15            | 2A/250V slow fusing, necessary    |
| LCM           | 10mH, recommended to use MORNSUN's FL2D-Z5-103 |               | LB20/25            | 3.15A/250V slow fusing, necessary |
| LDM           | 5 $\mu$ H                                      | --            | --                 | --                                |

3. Application of Trim and calculation of Trim resistance



Applied circuits of Trim (Part in broken line is the interior of models)

Calculation formula of Trim resistance:

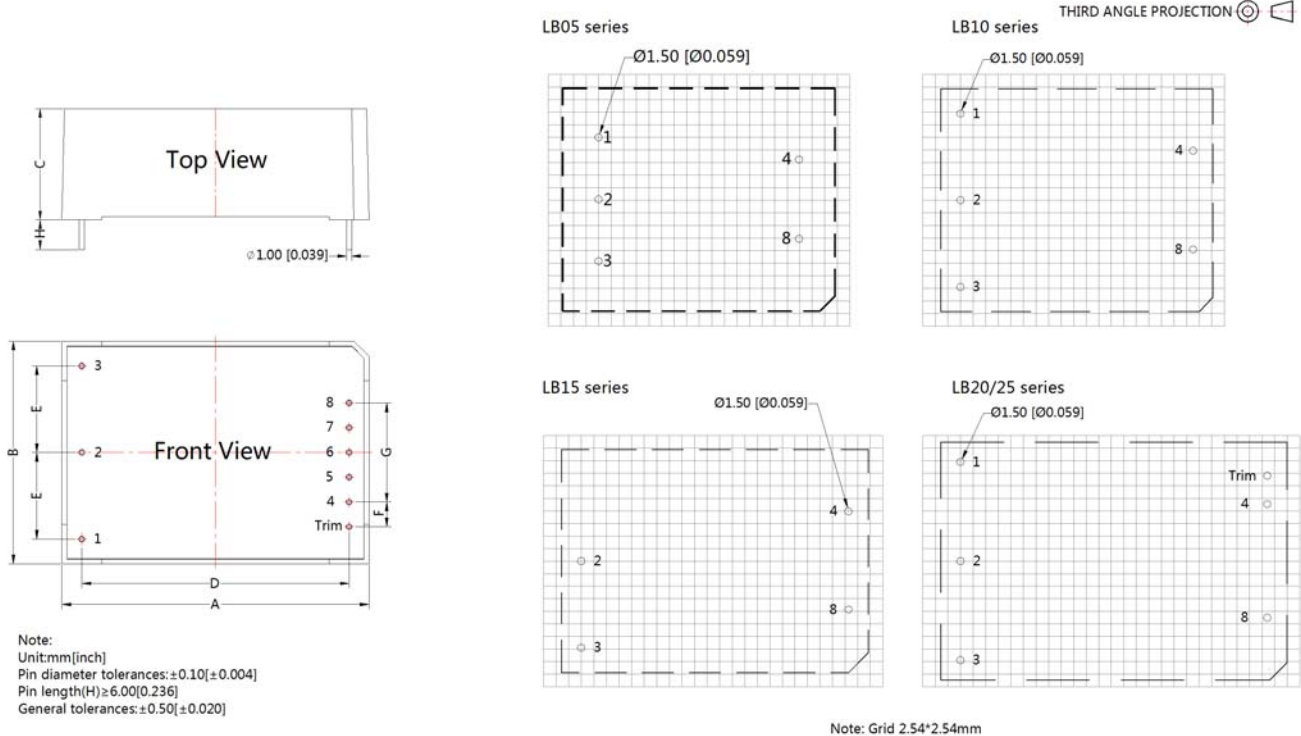
$$\begin{aligned} \text{up: } R_T &= \frac{\alpha R_2}{R_2 - \alpha} - R_3 & \alpha &= \frac{V_{ref}}{V_{ot} - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{\alpha R_1}{R_1 - \alpha} - R_3 & \alpha &= \frac{V_{ot} - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

$R_T$  is Trim resistance;  
 $\alpha$  is a self-defined parameter, with no real meaning.

| Vout | R1(K $\Omega$ ) | R2(K $\Omega$ ) | R3(K $\Omega$ ) | Vref(V) | Vot(V)   |
|------|-----------------|-----------------|-----------------|---------|--|
| 3.3V | 3.3             | 1.98            | 1               | 1.24    | Output voltage after regulation, variation $\leq \pm 10\%$ |
| 5V   | 3.3             | 3.3             | 1               | 2.5     |  |
| 9V   | 7.5             | 2.87            | 1               | 2.5     |  |
| 12V  | 3.83            | 1               | 1               | 2.5     |  |
| 15V  | 7.5             | 1.5             | 1               | 2.5     |  |
| 24V  | 8.66            | 1               | 1               | 2.5     |  |
| 48V  | 68              | 3.73            | 1               | 2.5     |  |

4. For more information please find the application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

## Dimensions and Recommended Layout



| Dimensions (Unit: mm) |       |       |       |       |       |
|-----------------------|-------|-------|-------|-------|-------|
| NO.                   | LB05  | LB10  | LB15  | LB20  | LB25  |
| A                     | 55.00 | 55.00 | 62.00 | 70.00 | 70.00 |
| B                     | 45.00 | 45.00 | 45.00 | 48.00 | 48.00 |
| C                     | 21.00 | 21.00 | 22.50 | 23.50 | 23.50 |
| D                     | 40.50 | 47.00 | 54.00 | 62.00 | 62.00 |
| E                     | 12.50 | 17.50 | 17.50 | 20.00 | 20.00 |
| F                     | --    | --    | --    | 5.75  | 5.75  |
| G                     | 16.00 | 20.00 | 20.00 | 23.00 | 23.00 |

| Models Weight |      |      |      |      |      |
|---------------|------|------|------|------|------|
| Weight (Typ.) | LB05 | LB10 | LB15 | LB20 | LB25 |
|               | 70g  | 80g  | 85g  | 120g | 120g |

| Pin Connection |              |
|----------------|--------------|
| Pin            | LBxx-10BxxLT |
| 1              |              |
| 2              | AC(N)        |
| 3              | AC(L)        |
| 4              | -Vo          |
| 5              | No Pin       |
| 6              | No Pin       |
| 7              | No Pin       |
| 8              | +Vo          |
| Trim           | Trim**       |

There is no pin "1" on LB15-10BxxLT  
Trim\*\*: only for LB20/25-10BxxLT Series.

Note:

1. Packing Information please refer to 'Product Packing Information'. The Packing bag number of Horizontal package : 58220006;
2. Unless otherwise specified, data in this datasheet should be tested under the conditions of  $T_a=25^{\circ}\text{C}$ , humidity<75% when inputting nominal voltage and outputting rated load;
3. All index testing methods in this datasheet are based on our Company's corporate standards;
4. The performance indexes of the product models listed in this manual are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technician for specific information;
5. We can provide product customization service;
6. Specifications of this product are subject to changes without prior notice.

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