

### Typical Features

- ◆ Wide input voltage range 350-2000VDC
- ◆ No load power consumption  $\leq 1.5W$
- ◆ Efficiency up to 83% (Typ.)
- ◆ Operating temperature from  $-30^{\circ}C$  to  $+70^{\circ}C$
- ◆ Switching frequency 65KHz
- ◆ Input reverse polarity protection
- ◆ Short circuit, over current, over voltage protections
- ◆ Isolation voltage 4000VAC
- ◆ Altitude during operation 5000m Max
- ◆ OVC II
- ◆ Pollution degree II
- ◆ Suitable for photovoltaic (PV) power generation and high-voltage inverter applications.



### Application Field

The **BK15-P4S24W series** features compact, high-efficiency DC-DC modular converters with a wide input voltage range, low ripple, low temperature rise, low standby power consumption, high reliability, safe isolation, and excellent EMC performance. This series is widely used in applications such as photovoltaic (PV) power generation, home energy storage, and industrial control. Multiple protection functions ensure the safety of both the power supply and the load under abnormal operating conditions. For applications with strict EMC requirements, please refer to our recommended EMC application circuit.

### Typical Product List

| Certificate | Part No                    | Input Voltage Range |             | Output Specifications |                 |                | Max Capacitive Load @800VDC ( $\mu F$ ) | Ripple & Noise 20MHz (Max) mVp-p | Efficiency @full load, 800VDC (Typ.) % |
|-------------|----------------------------|---------------------|-------------|-----------------------|-----------------|----------------|-----------------------------------------|----------------------------------|----------------------------------------|
|             |                            | Nominal (VDC)       | Range (VDC) | Power P(W)            | Voltage Vo(VDC) | Current Io(mA) |                                         |                                  |                                        |
|             |                            |                     |             |                       |                 |                |                                         |                                  |                                        |
| -           | BK15-P4S12W(-T)(-TS)(-TS1) | 800                 | 350         | 15                    | 12              | 1250           | 1000                                    | 240                              | 80                                     |
| -           | BK15-P4S15W(-T)(-TS)(-TS1) |                     | -           |                       | 15              | 1000           | 680                                     | 240                              | 81                                     |
| -           | BK15-P4S24W(-T)(-TS)(-TS1) |                     | 2000        |                       | 24              | 625            | 470                                     | 240                              | 83                                     |

Note 1: Models marked with an asterisk (\*) are currently under development.

Note 2: Typical output efficiency is measured after 30 minutes of operation at full load (burn-in).

Note 3: The tolerance for typical full-load efficiency (% , Typ.) is  $\pm 2\%$ . Efficiency is calculated as total output power divided by the input power of the module.

Note 4: Ripple & Noise are measured using the parallel cable method. For detailed test configurations, please refer to the "Ripple & Noise Testing Method" section below.

Note 5: All models offer three package variations: suFfix "-T" indicates chassis mounting (terminal block), while "-TS" and "-TS1" indicate DIN-rail mounting (69mm width). All other electrical specifications remain identical.

Note 6: Due to space constraints, this is only a partial product list. For models not listed, please contact our sales department.

### Input Specifications

| Item                        | Test Condition   | Min.                                                                       | Typ. | Max. | Unit |
|-----------------------------|------------------|----------------------------------------------------------------------------|------|------|------|
| Input voltage range         | DC input         | 350                                                                        | 800  | 2000 | VDC  |
| Input current               | Input 350VDC     | -                                                                          | -    | 0.07 | A    |
|                             | Input 800VDC     | -                                                                          | -    | 0.04 |      |
| Surge current               | Input 800VDC     | -                                                                          | -    | 80   | A    |
|                             | Input 1500VDC    | -                                                                          | -    | 110  |      |
| Under voltage protection    | Start protection | 220                                                                        | -    | 340  | VDC  |
|                             | Recovery         | 250                                                                        | -    | 350  |      |
| Standby power consumption   | Input 2000VDC    | -                                                                          | -    | 1.5  | W    |
| Recommended external fuse   | -                | 4A/2000VDC (Required). Fuse voltage rating must exceed max. input voltage. |      |      |      |
| Reverse polarity protection | -                | Supported                                                                  |      |      |      |
| Hot-plug                    | -                | Not Supported                                                              |      |      |      |

### Output Specifications

| Item                          |                 | Test Condition                      | Min.                      | Typ.  | Max. | Unit   |
|-------------------------------|-----------------|-------------------------------------|---------------------------|-------|------|--------|
| Output voltage accuracy       |                 | Input full voltage range, any Load  | -                         | ±2.0  | ±3.0 | %      |
| Line regulation               |                 | Rated load                          | -                         | ±1.0  | ±1.5 |        |
| Load regulation               |                 | Nominal input voltage, 0%~100% load | -                         | ±2.0  | ±2.5 |        |
| Minimum load                  |                 | Single output                       | 0                         | -     | -    |        |
| Temperature drift coefficient |                 | -                                   | -                         | ±0.02 | -    | %/℃    |
| Turn-on delay time            |                 | Nominal Input Voltage (Full Load)   | -                         | -     | 2000 | mS     |
| Power off hold-up time        |                 | 350VDC Input (full load)            | 5                         | -     | -    |        |
|                               |                 | 800VDC Input (full load)            | 20                        | -     | -    |        |
| Dynamic response              | Overshoot range | 25%-50%-25%                         | -5.0                      | -     | +5.0 | %      |
|                               | Recovery time   | 50%-75%-50%                         | -                         | -     | 5.0  | mS     |
| Output start-up overshoot     |                 | Full input voltage range            | ≤10                       |       |      | %Vo    |
| Short circuit protection      |                 |                                     | Continuous, self-recovery |       |      | Hiccup |
| Over current protection       |                 | Full input voltage range            | ≥120%Io, self-recovery    |       |      | Hiccup |
| Over voltage protection       |                 | Output 12VDC                        | ≤16                       |       |      | VDC    |
|                               |                 | Output 15VDC                        | ≤25                       |       |      |        |
|                               |                 | Output 24VDC                        | ≤35                       |       |      |        |
| Ripple & Noise                |                 | 5%-100% load, 20MHz bandwidth       | -                         | -     | 240  | mVp-p  |

Note 1: Ripple & Noise are measured using the parallel cable method. For detailed test methods and configurations, please refer to the "Ripple & Noise Testing Method" section below.

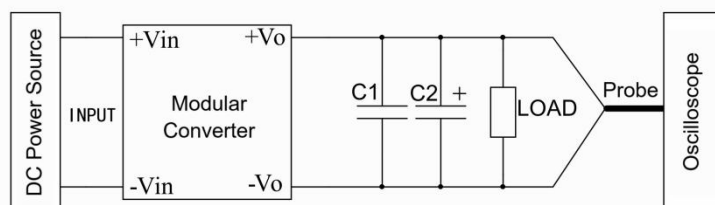
## General Specifications

| Item                  | Test Condition                          |                                 | Min.                                | Typ. | Max.                   | Unit    |
|-----------------------|-----------------------------------------|---------------------------------|-------------------------------------|------|------------------------|---------|
| Switching frequency   | Full Load Output                        |                                 | -                                   | 65   | -                      | KHz     |
| Operating temperature | Refer to the Temperature Derating Graph |                                 | -30                                 | -    | +70                    | °C      |
| Storage temperature   | -                                       |                                 | -30                                 | -    | +105                   | °C      |
| Case temperature rise | Ta=30°C @ Output 100% load              |                                 | -                                   | 55°  | -                      | °K      |
| Soldering temperature | Wave-soldering                          |                                 | 260±4°C, time 5-10S                 |      |                        |         |
|                       | Manual-soldering                        |                                 | 360±8°C, time 4-7S                  |      |                        |         |
| Storage humidity      | -                                       |                                 | -                                   | -    | 95                     | %RH     |
| Isolation voltage     | I/P-O/P                                 | Test 1min, leakage current ≤5mA | 4000                                | -    | -                      | VAC     |
| Insulation resistance | I/P-O/P                                 | @500VDC                         | 100                                 | -    | -                      | MΩ      |
| MTBF                  | MIL-HDBK-217F @ 25°C                    |                                 | 300                                 | -    | -                      | K Hours |
| Case material         | -                                       |                                 | Plastic                             |      |                        |         |
| Vibration             | -                                       |                                 | 10-55Hz, 10G, 30 Min, along X, Y, Z |      |                        |         |
| Safety class          | -                                       |                                 | CLASS II                            |      |                        |         |
| Weights & Dimensions  | Part No.                                | Weight (Typ.)                   | Dimensions L x W x H                |      |                        |         |
|                       | BK15-P4S24W                             | 230g                            | 89.00x63.50x25.00 mm                |      | 3.504x2.500x0.984 inch |         |
|                       | BK15-P4S24W-T                           | 310g                            | 134.00x69.00x33.30 mm               |      | 5.276x2.717x1.311 inch |         |
|                       | BK15-P4S24W-TS                          | 380g                            | 134.00x69.00x38.90 mm               |      | 5.276x2.717x1.531 inch |         |
|                       | BK15-P4S24W-TS1                         | 380g                            | 135.00x69.00x38.90 mm               |      | 5.315x2.717x1.531 inch |         |

## EMC Performance

| Items |     |       | Test Standards  | Performance/Class                                                                                             |
|-------|-----|-------|-----------------|---------------------------------------------------------------------------------------------------------------|
| EMC   | EMI | CE    | CISPR32/EN55032 | Class A @100% load (with the recommended EMC circuit 2)                                                       |
|       |     | RE    | CISPR32/EN55032 | Class A @100% load (with the recommended EMC circuit 2)                                                       |
|       | EMS | ESD   | IEC/EN61000-4-2 | Contact ±6KV, Air ±8KV Perf. Criteria B                                                                       |
|       |     | RS    | IEC/EN61000-4-3 | 10V/m Perf. Criteria B                                                                                        |
|       |     | Surge | IEC/EN61000-4-5 | Line to line ±1KV Perf. Criteria B<br>Line to line ±2KV Perf. Criteria B (with the recommended EMC circuit 2) |
|       |     | EFT   | IEC/EN61000-4-4 | ±2KV Perf. Criteria B<br>±4KV Perf. Criteria B (with the recommended EMC circuit 2)                           |
|       |     | CS    | IEC/EN61000-4-6 | 10Vr.m.s Perf. Criteria A                                                                                     |

## Ripple &amp; Noise Test Instruction (Parallel-line Method, 20MHz bandwidth)



## 1. Ripple &amp; Noise Test Configuration:

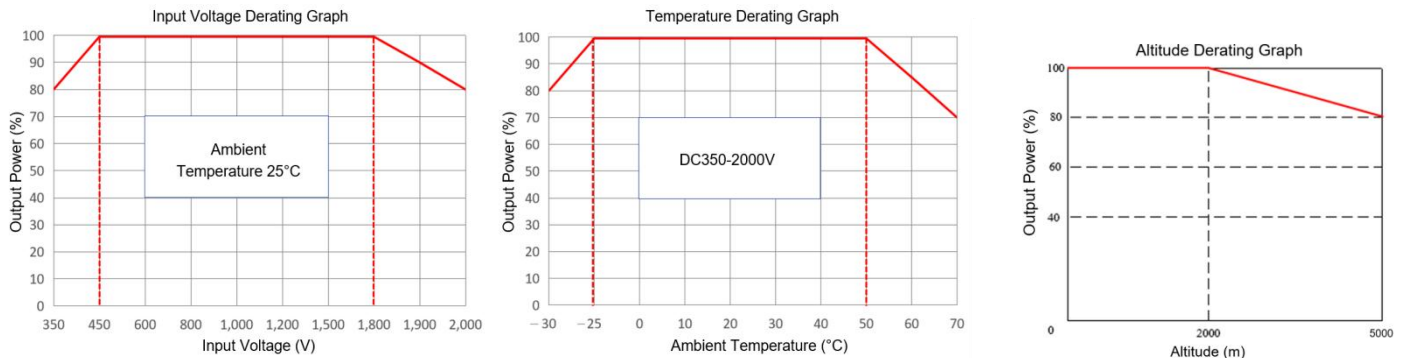
Ripple and noise are measured using the parallel cable method. Set the oscilloscope to 20MHz bandwidth and Sample mode. Use a

100MHz bandwidth probe with the probe cap and ground clip removed. Connect a 0.1μF ceramic capacitor (C1) and a 10μF high-frequency, low-ESR electrolytic capacitor (C2) in parallel at the probe tip.

## 2. Test Setup Diagram Description:

Connect the input of the module to the power supply, and connect the output to the electronic load via a test jig. Use dedicated sampling wires to measure directly at the output terminals. Ensure that insulated power cables with an appropriate wire gauge are selected based on the actual output current.

## Product Characteristics Graphs



Note 1: For input voltages of 350-450VDC and 1800-2000VDC, the output power must be derated according to the input voltage derating curve.

Note 2: This product is designed for natural convection cooling. Please contact us for applications in enclosed environments.

## Typical Circuit for Application

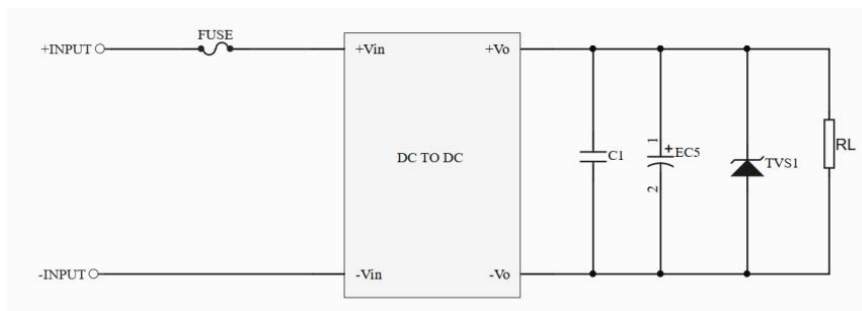


Figure - Circuit 1

| Part No.                   | FUSE                                      | C1      | EC5       | TVS1    |
|----------------------------|-------------------------------------------|---------|-----------|---------|
| BK15-P4S12W(-T)(-TS)(-TS1) | 4A,2000VDC, time-delay fuse<br>(required) | 1μF/50V | 120μF/16V | SMBJ20A |
| BK15-P4S15W(-T)(-TS)(-TS1) |                                           |         | 120μF/25V | SMBJ20A |
| BK15-P4S24W(-T)(-TS)(-TS1) |                                           |         | 68μF/35V  | SMBJ30A |

## Recommended EMC Circuit Diagram

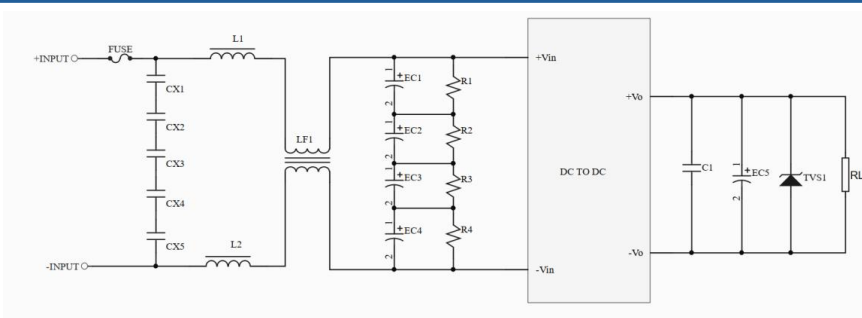
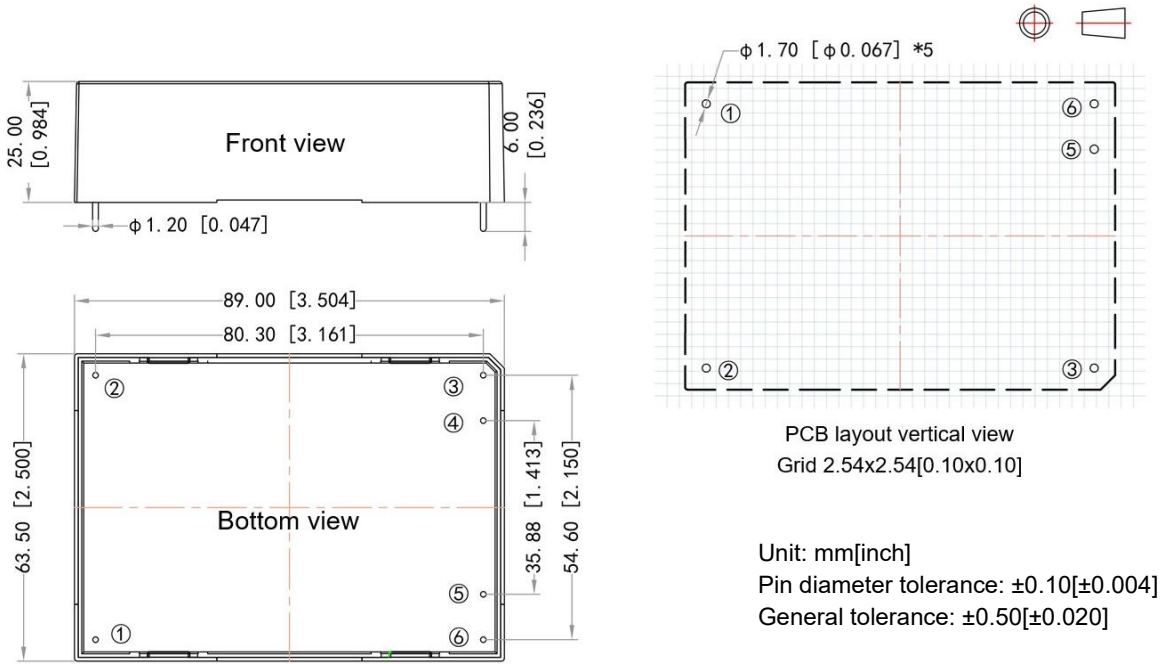


Figure - Circuit 2

| Part No.                   | FUSE                                     | CX1, CX2,<br>CX3, CX4, CX5 | L1, L2   | LF1                        | EC1, EC2,<br>EC3, EC4, EC5 | R1, R2,<br>R3, R4 |
|----------------------------|------------------------------------------|----------------------------|----------|----------------------------|----------------------------|-------------------|
| BK15-P4SXXW(-T)(-TS)(-TS1) | 4A/2000VDC, slow blow<br>fuse (required) | 474K/275VAC                | 190μH/1A | 15mH/1A<br>(with TIW wire) | 10μF/550VDC                | 1.5MΩ<br>/2W      |

Note: In the end product, a UL-compliant Surge Protective Device (SPD) with a maximum VPR/MLV of 4000V must be installed at the input circuit. For other parameters, please refer to Figure 1.

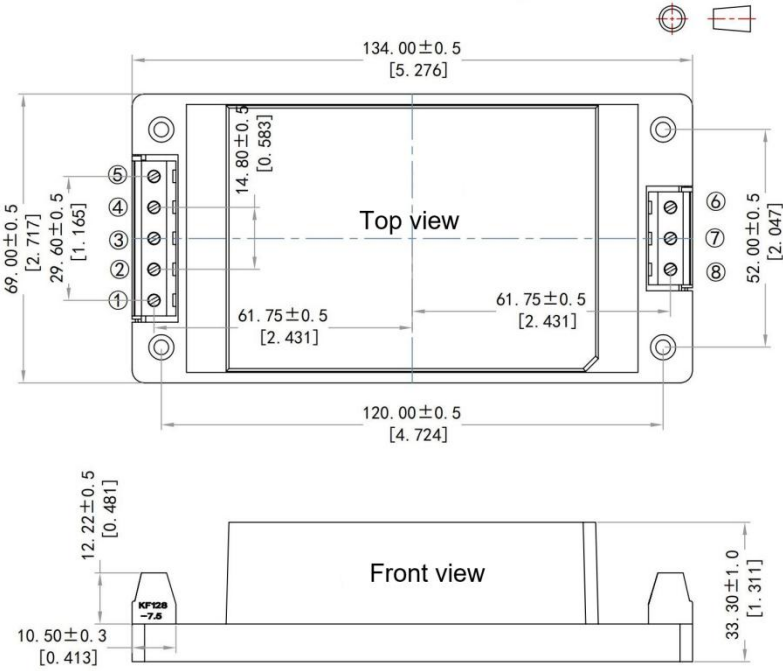
Mechanical Dimensions



Pin-out Function Description

| Pin No.  | 1              | 2              | 3             | 4      | 5               | 6               |
|----------|----------------|----------------|---------------|--------|-----------------|-----------------|
| Function | -Vin           | +Vin           | NC            | NP     | -Vo             | +Vo             |
|          | Input Negative | Input Positive | No Connection | No Pin | Output Negative | Output Positive |

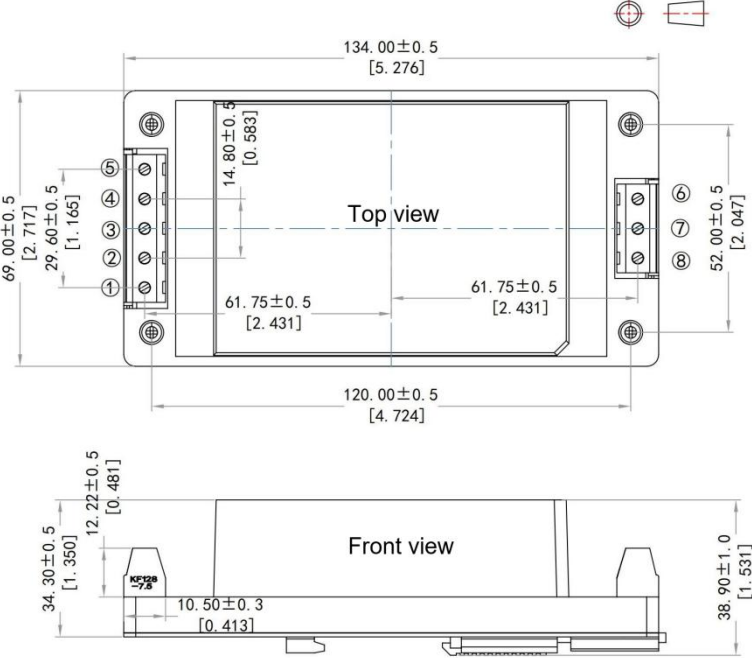
(-T) Mechanical Dimensions



Note:  
Unit: mm[inch]  
Lead wires gauge: 24-12AWG  
Screwing torque: 0.4N.m Max  
General tolerance: ±1.00[±0.039]

| Terminal Function Description |                |               |    |    |                |                 |                 |               |
|-------------------------------|----------------|---------------|----|----|----------------|-----------------|-----------------|---------------|
| Terminal No.                  | 1              | 2             | 3  | 4  | 5              | 6               | 7               | 8             |
| Function                      | +Vin           | NC            | NC | NC | -Vin           | +Vo             | -Vo             | NC            |
|                               | Input Positive | No Connection |    |    | Input Negative | Output Positive | Output Negative | No Connection |

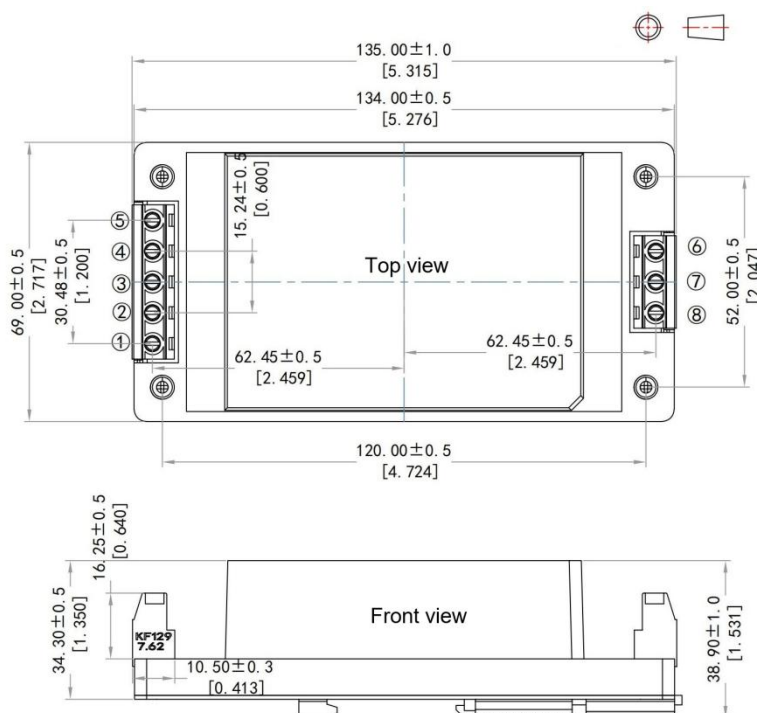
(-TS) Mechanical Dimensions



Note:  
Unit: mm[inch]  
Lead wires gauge: 24-12AWG  
Screwing torque: 0.4N.m Max  
General tolerance: ±1.00[±0.039]

| Terminal Function Description |                |               |    |    |                |                 |                 |               |
|-------------------------------|----------------|---------------|----|----|----------------|-----------------|-----------------|---------------|
| Terminal No.                  | 1              | 2             | 3  | 4  | 5              | 6               | 7               | 8             |
| Function                      | +Vin           | NC            | NC | NC | -Vin           | +Vo             | -Vo             | NC            |
|                               | Input Positive | No Connection |    |    | Input Negative | Output Positive | Output Negative | No Connection |

**(-TS1) Mechanical Dimensions**



**Terminal Function Description**

| Terminal No. | 1     | 2             | 3  | 4  | 5              | 6               | 7               | 8             |
|--------------|-------|---------------|----|----|----------------|-----------------|-----------------|---------------|
| Function     | +Vin  | NC            | NC | NC | -Vin           | +Vo             | -Vo             | NC            |
|              | Input | No Connection |    |    | Input Negative | Output Positive | Output Negative | No Connection |

**Application Notice:**

1. The product must be operated within the specified parameters; otherwise, permanent damage may occur.
2. An external fuse must be connected to the input terminal.
3. If the product operates below the minimum load requirement, we cannot guarantee that all performance specifications in this manual will be met.
4. If the product operates beyond its specified load range, we cannot guarantee that all performance specifications in this manual will be met.
5. Unless otherwise specified, all specifications are measured at  $T_a = 25^\circ \text{C}$ , humidity  $< 75\%$ , nominal input voltage, and rated output load (resistive load).
6. All testing methods for the specifications listed above are based on our corporate standards.
7. The specifications listed above apply to the standard models in this manual. Specifications for non-standard or customized models may vary. For specific details, please contact our technical support team.
8. Aipupower can offer customized power solutions to meet specific requirements.

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