## Descriptions

3W isolated, DC/DC Converter







RoHS

c UL us Report UL62368-1

CE Report EN62368-1

UKCA Report BS EN62368-1

## Features

- Compact SIP package
- Wide input voltage range (2:1)
- Operating temperature range: -40℃ to +85℃
- I/O Isolation test voltage 3k VDC
- High power density
- Short circuit protection (self-recovery)
- Remote On/Off

## Applications

- Industrial control
- Power
- Home appliances
- Instrumentation
- Communication
- Civil applications

## Selection Guide

| Certification | Part No. | Input Voltage (VDC) | | Output | | Ripple&noise (mVp-p) Typ./Max. | Full Load Efficiency (%) Min./Typ. | Capacitive Load② (μF)Max. |
|---|---|---|---|---|---|---|---|---|
| | | Nominal (Range) | Max.① | Voltage (VDC) | Current(mA) Max./Min. | | | |
| EN/BS EN | DES3-E0505 | 5 (4.5-9) | 11 | ±5 | ±250/±13 | 40/75 | 72/74 | 1000 |
| | DES3-E0512 | | | ±12 | ±104/±5 | | 75/77 | 470 |
| | DES3-E0515 | | | ±15 | ±83/±4 | | 75/77 | 330 |
| | DES3-F0505 | | | 5 | 500/25 | | 71/73 | 2200 |
| | DES3-F0509 | | | 9 | 278/14 | | 72/74 | 1000 |
| | DES3-F0512 | | | 12 | 208/10 | | 75/77 | 680 |
| | DES3-F0515 | | | 15 | 167/8 | | 72/74 | 470 |
| | DES3-E1205 | 12 (9-18) | 20 | ±5 | ±300/±15 | | 76/78 | 1000 |
| | DES3-E1212 | | | ±12 | ±125/±6 | | 77/79 | 470 |
| | DES3-E1215 | | | ±15 | ±100/±5 | | 78/80 | 330 |
| | DES3-F1203 | | | 3.3 | 758/38 | | 73/75 | 2700 |
| | DES3-F1205 | | | 5 | 600/30 | | 74/76 | 2200 |
| | DES3-F1209 | | | 9 | 333/17 | 70/100 | 77/79 | 1000 |
| | DES3-F1212 | | | 12 | 250/13 | 100/150 | 80/82 | 680 |
| | DES3-F1215 | | | 15 | 200/10 | | 81/83 | 470 |
| | DES3-F1224 | | | 24 | 125/6 | | 79/81 | 330 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DES3-E2405 | 24 (18-36) | 40 | ±5 | ±300/±15 | 40/75 | 77/79 | 1000 |
| | DES3-E2409 | | | ±9 | ±167/±8 | | 79/81 | 680 |
| | DES3-E2412 | | | ±12 | ±125/±6 | | 81/83 | 470 |
| | DES3-E2415 | | | ±15 | ±100/±5 | | 81/83 | 330 |
| UL/EN/BS EN | DES3-F2403 | | | 3.3 | 758/38 | | 72/74 | 2700 |
| | DES3-F2405 | | | 5 | 600/30 | | 79/81 | 2200 |
| EN/BS EN | DES3-F2409 | | | 9 | 333/17 | | 81/83 | 1000 |
| | DES3-F2412 | | | 12 | 250/13 | | 81/83 | 680 |
| UL/EN/BS EN | DES3-F2415 | | | 15 | 200/10 | 100/150 | 81/83 | 470 |
| | DES3-F2424 | | | 24 | 125/6 | | 81/83 | 330 |
| -- | DES3-E4805 | 48 (36-75) | 80 | ±5 | ±300/±15 | 40/75 | 77/79 | 1000 |
| | DES3-E4812 | | | ±12 | ±125/±6 | | 80/82 | 470 |
| | DES3-E4815 | | | ±15 | ±100/±5 | | 80/82 | 330 |
| | DES3-F4803 | | | 3.3 | 758/38 | 100/150 | 73/75 | 2700 |
| EN/BS EN | DES3-F4805 | | | 5 | 600/30 | 40/75 | 74/76 | 2200 |
| -- | DES3-F4812 | | | 12 | 250/13 | | 78/80 | 680 |
| | DES3-F4815 | | | 15 | 200/10 | 70/100 | 82/84 | 470 |

Notes:
①Exceeding the maximum input voltage may cause permanent damage;
②For the dual output modules, the capacitive loads of positive and negative outputs are the same;
③Product images are for reference only; the actual product shall prevail.

## Specifications

| Specifications | Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Input Specifications | Input Current (full load/no-load) | 5VDC Input | | -- | 800/60 | 846/65 | mA |
| | | 12VDC Input | 3.3V Output | -- | 277/25 | 286/30 | |
| | | | Others | -- | 314/25 | 338/30 | |
| | | 24VDC Input | 3.3V Output | -- | 140/8 | 145/13 | |
| | | | Others | -- | 154/8 | 163/13 | |
| | | 48VDC Input | 3.3V Output | -- | 69/3 | 72/10 | |
| | | | Others | -- | 78/3 | 85/10 | |
| | Reflected Ripple Current | 5VDC Input | | -- | 20 | -- | |
| | | 12VDC Input | | -- | 20 | -- | |
| | | 24VDC Input | | -- | 55 | -- | |
| | | 48VDC Input | | -- | 55 | -- | |
| | Surge Voltage (1sec. max.) | 5VDC Input | | -0.7 | -- | 12 | VDC |
| | | 12VDC Input | | -0.7 | -- | 25 | |
| | | 24VDC Input | | -0.7 | -- | 50 | |
| | | 48VDC Input | | -0.7 | -- | 100 | |
| | Starting Voltage | 5VDC Input | | 3.5 | 4 | 4.5 | |
| | | 12VDC Input | | 4.5 | 8 | 9 | |
| | | 24VDC Input | | 11 | 16 | 18 | |
| | | 48VDC Input | | 24 | 33 | 36 | |
| | Input Filter | | | Capacitor filter | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Hot Plug | | Unavailable | | | |
| | Ctrl ① | Module turn-on | The Ctrl end is suspended or of high resistance | | | |
| | | Module turn-off | Connect with high level (relative to the input grounding) to make the 5-10mA current flows into the Ctrl end. | | | |
| Output Specifications | Output Voltage Accuracy② | 5%-100% load | -- | ±1 | ±3 | % |
| | Line Regulation③ | Full load, the input voltage is from low to high | -- | ±0.2 | ±0.5 | -- |
| | Load Regulation | 5%-100% load | -- | ±0.4 | ±0.75 | % |
| | Transient Recovery Time | 25% load step change | -- | 0.5 | 3 | ms |
| | Transient Response Deviation | | -- | ±2.5 | ±5 | % |
| | Temperature Coefficient | Full load | -- | ±0.02 | ±0.03 | %/℃ |
| | Ripple & Noise④ | 20MHz bandwidth | See Selection Guide | | | |
| | Short Circuit Protection | | Continuous, self-recovery | | | |
| General Specifications | Insulation Voltage | Input-output, with the test time of 1 minute and the leak current lower than 1mA | 3000 | -- | -- | VDC |
| | Insulation Resistance | Input-output, isolation voltage 500VDC | 1000 | -- | -- | MΩ |
| | Isolation Capacitance | Input-output, 100kHz/0.1V | -- | 30 | 50 | pF |
| | Operating Temperature | see Fig. 1 | -40 | -- | +85 | ℃ |
| | Storage Temperature | | -55 | -- | +125 | |
| | Casing Temperature Rise | Ta=25℃, nominal input, full load output | -- | +25 | -- | |
| | Pin Welding Resistance Temperature⑤ | Soldering spot is 1.5mm away from the case, 10 seconds max. | -- | -- | +300 | |
| | | Wave soldering, maximum 10 seconds | 255 | 260 | 265 | |
| | Storage Humidity | Non-condensing | -- | -- | 95 | %RH |
| | Switching Frequency (PFM Mode) | Full load, nominal input voltage | -- | 250 | -- | kHz |
| | MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | k hours |
| Mechanical Specifications | Casing Material | Black flame-retardant and heat-resistant plastic | | | | |
| | Dimension | 22.00 x 9.50 x 12.00 mm | | | | |
| | Weight | 4.9g(Typ.) | | | | |
| | Cooling Method | Free air convection | | | | |

Note:

①For use of Ctrl, please refer to the "design reference" in this manual.

②Under the of 5%-100% load, the maximum output voltage accuracy of DES3-E2405 auxiliary circuit is ±4%;

③Linear Regulation for 100% load, DES3-E2405 increases to ±1%;

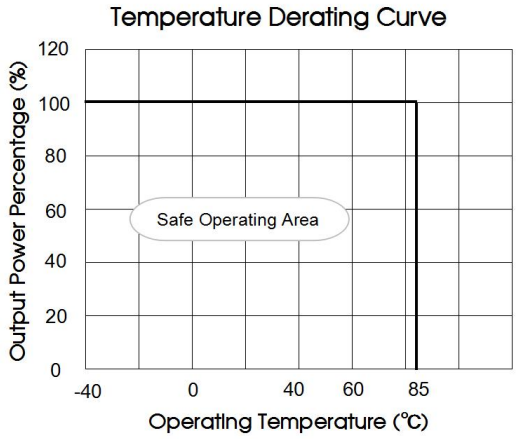
④Ripple and noise are measured by "parallel cable" method,The DES3-E2405 ripple maximum is 65 mVp-p;

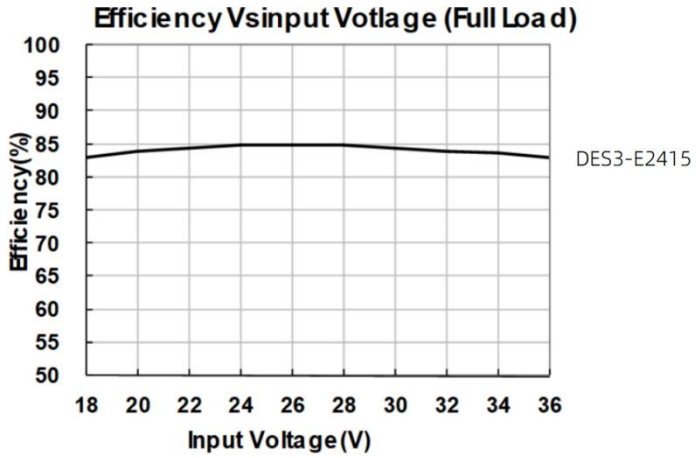
⑤The pin soldering temperature tolerance is not the actual temperature set by the soldering iron but the temperature required for proper solder joints. The actual temperature set by the customer should be determined comprehensively based on factors such as PCB thickness, copper coverage, soldering iron power, and soldering iron tip selection.

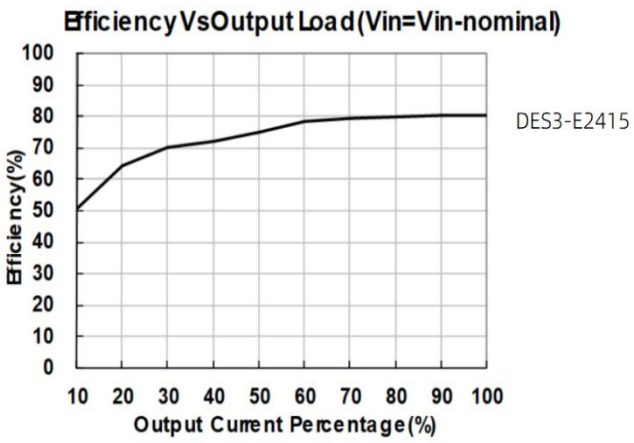
## Electromagnetic Compatibility (EMC)

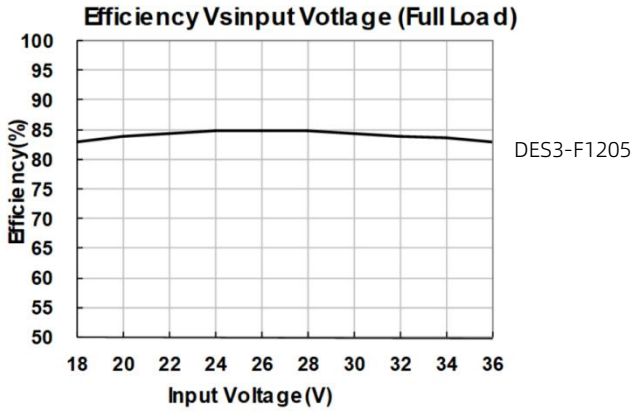
| | | | |
|---|---|---|---|
| EMI | CE | CISPR32/EN55032 CLASS B (see Fig. 3-② for recommended circuit) | |
| | RE | CISPR32/EN55032 CLASS B (see Fig. 3-② for recommended circuit) | |
| EMS | ESD | IEC/EN61000-4-2 Contact ±4kV | perf. Criteria B |
| | RS | IEC/EN61000-4-3 10V/m | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 ±2kV (see Fig. 3-① for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN61000-4-5 line to line ±2kV (see Fig. 3-① for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN61000-4-6 3 Vr.m.s | perf. Criteria A |
| | Voltage dips, short interruptions and voltage variations immunity | IEC/EN61000-4-29 0%, 70% | perf. Criteria B |

## Characteristic Curve

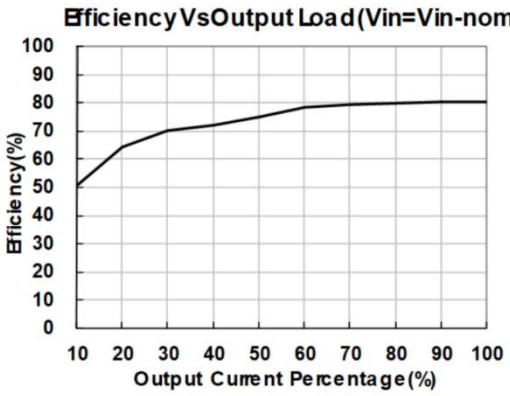





DES3-F1205




DES3-F1205

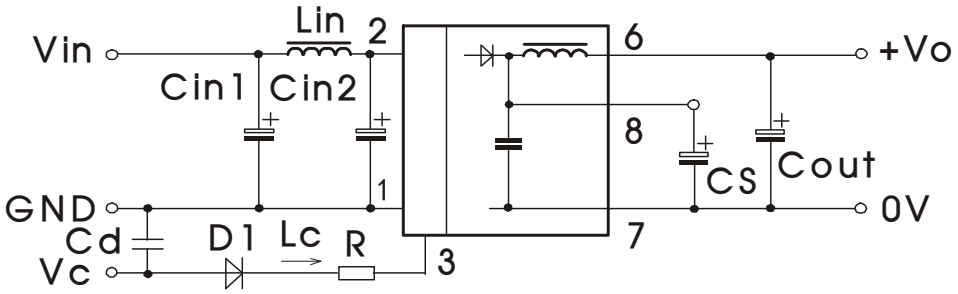
## Design Reference

1. Typical application

①All the DC/DC converters of this series are tested according to the recommended circuit (see Fig. 2) before delivery.

②If a further decrease of the input and output ripple is required, properly increase the input & output of additional capacitors Cin1, Cin2, Cs and Cout; or select capacitors of low equivalent impedance like series capacitor, etc. Cs is used to reduce ripple. No need to add Cs, if ripple meets the demand .Appropriate filter capacitance shall be chosen, start-up problems may be caused if the capacitance is too large. For each output circuit, under the condition of safe and reliable operation, the max. capacity of its filter capacitor should be lower than the max. capacitive load.

Single




Double

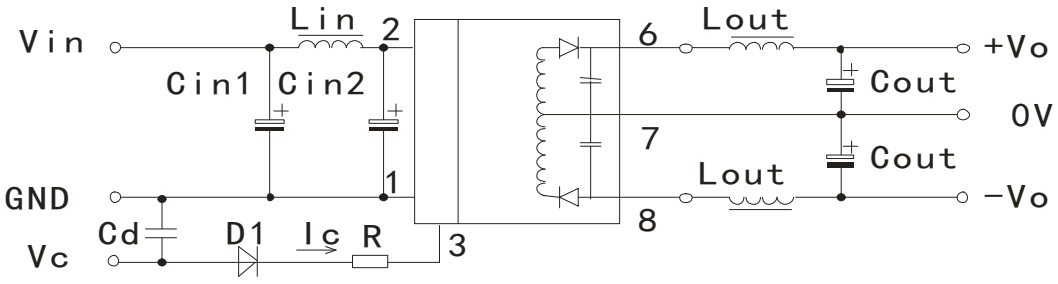



Fig. 2

| Vin | 5VDC&12VDC | 24VDC&48VDC |
|---|---|---|
| Cin1 | 100μF/25VDC | 10μF/100VDC |
| Cin2 | 47μF/25VDC | 1μF/100VDC |
| Lin | 4.7μH-12μH | |
| Cs | 10μF-22μF/50VDC | |
| Cout | 100μF/50VDC(Typ.) | |
| Cd | 47nF/100V | |

2. EMC compliance recommended circuit

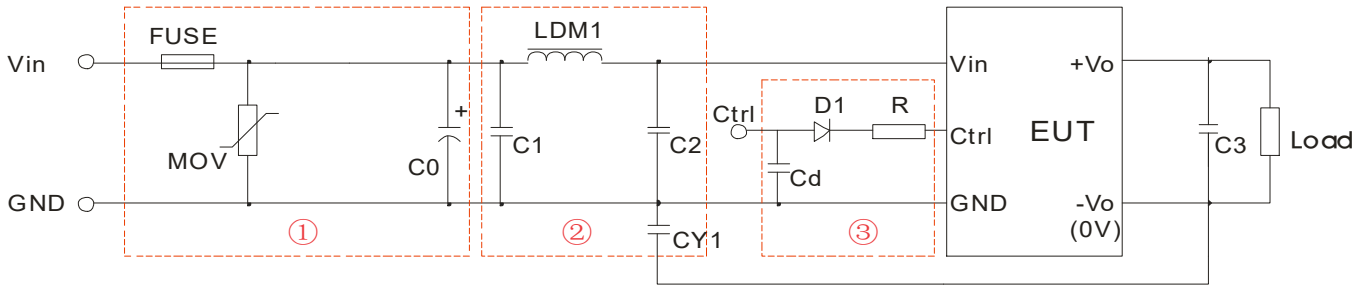



Fig 3

Parameter description:

| Model | Vin: 5VDC | Vin:12VDC | Vin: 24VDC | Vin: 48VDC |
|---|---|---|---|---|
| FUSE | Selecting based on needs | | | |
| MOV | -- | S14K20 | S20K30 | S14K60 |
| LDM1 | 12μH | 12μH | 12μH | 12μH |
| C0 | 680μF/25V | | 330μF/50V | 330μF/100V |
| C1 | 4.7μF/50V | | | 4.7μF/100V |
| C2 | 4.7μF/50V | | | 4.7μF/100V |
| C3 | Refer to the Cout in Fig.2 | | | |
| CY1 | 1nF/3kV | | | |
| D1 | RB160M-60V/1A | | | |
| R | In accordance with the formula: $R=\frac{V_C-V_D-1.0}{I_C}-300$ | | | |
| Cd | 47nF/100V | | | |

Notes:

① Part ① in Fig. 3 is used for EMS test while part ② is used for EMI filtering; and parts ① and ② may be selected based on needs.

② $V_C$ is the voltage of the Ctrl end relative to the GND of the input grounding; $V_D$ is the positive-going conduction pressure drop of D1; $I_C$ is the current flows into the Ctrl end and its value is generally 5-10mA, see Fig. 3-③ for the peripheral circuit of Ctrl end;

③ If there is no recommended parameters, no external component is required.

## 3.Ctrl end

The modules are of normal output when the Ctrl end is suspended or of high resistance; the modules turn off when connecting with high level (relative to the input grounding); notice that the current flows into the pin shall be 5 - 10mA, the modules will be permanently damaged if the current exceeds its max. value (20mA in general).

The value of R can be derived as follows:

$$R = \frac{V_C - V_D - 1.0}{I_C} - 300$$

For Detailed parameter, please refer to EMC solution-recommended circuit in this manual.

## 4.Input current

When the electricity is provided by the unstable power supply, please make sure that the range of the output voltage fluctuation and the ripple voltage of the power supply do not exceed the indicators of the modules. Input current of power supply should afford the flash startup current of this kind of DC/DC module(see Fig. 5).

Generally: Vin= 5V series Iave =1315mA

Vin=12V series Iave =631mA

Vin=24V series Iave =303mA

Vin=48V series Iave =158mA

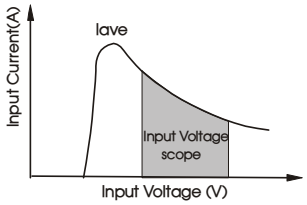
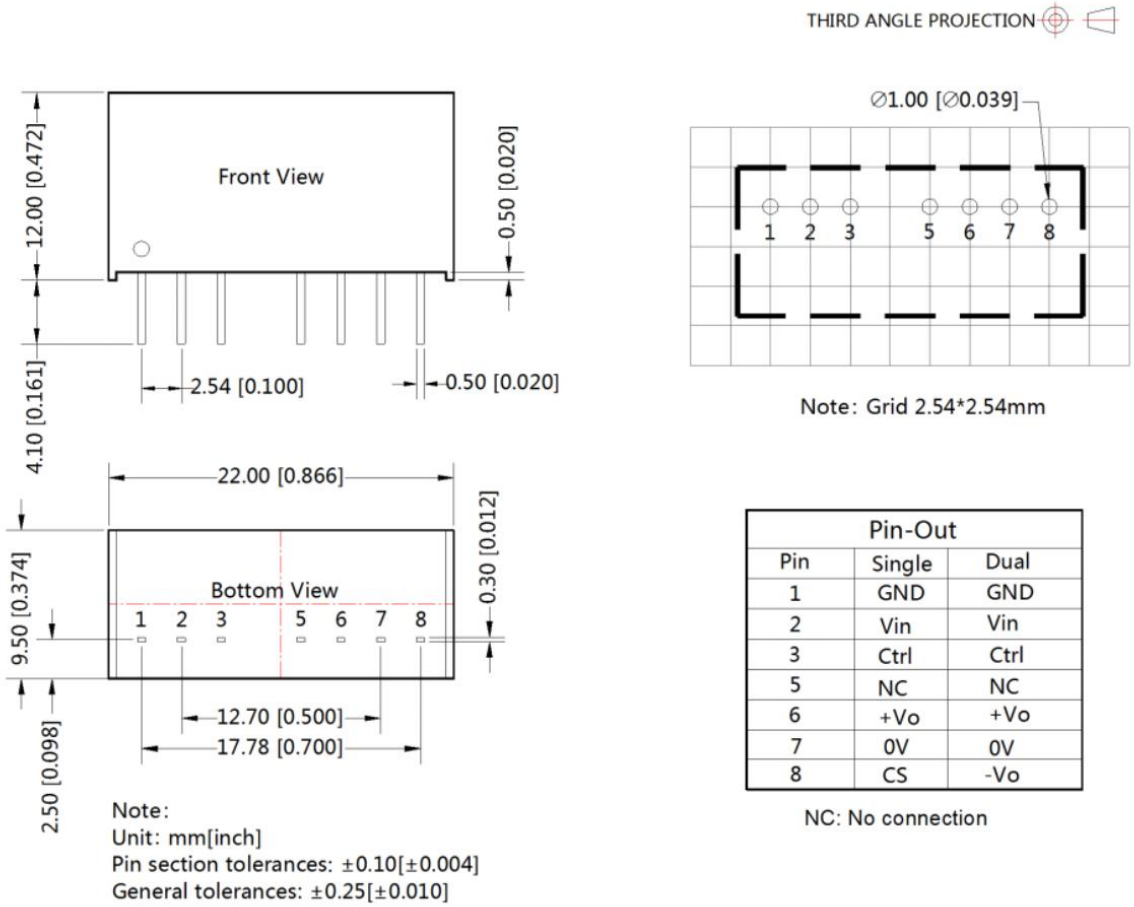



Fig. 5

## 5.Output load requirements

When using, the minimum load of the module output should not be less than 5% of the nominal load. In order to meet the performance parameters of this datasheet, please connect a 5% dummy load in parallel at the output end, the dummy load is generally a resistor, please note that the resistor needs to be used in derating.

## Dimensions and Recommended




| Pin-Out | | |
|---|---|---|
| Pin | Single | Dual |
| 1 | GND | GND |
| 2 | Vin | Vin |
| 3 | Ctrl | Ctrl |
| 5 | NC | NC |
| 6 | +Vo | +Vo |
| 7 | 0V | 0V |
| 8 | CS | -Vo |

NC: No connection

Notes:

1. Recommend to use module with more than 5% load, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
2. The recommended unbalance degree of the dual output module load is ≤±5%; if the degree exceeds ±5%, than the product performance cannot be guaranteed to comply with all parameters in the datasheet;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on company corporate standards;
6. The image certification marks are for reference only; please refer to the selection table for actual specifications. Certification is based on the physical mark or packaging label.