50W,wide input isolated & regulated
DIP packaging DC/DC converter


Patent Protection RoHS

## FEATURES

- Wide input voltage range (2:1)
- High efficiency up to 93%
- Isolation voltage :1500VDC
- Input over-voltage, under-voltage protection, output short circuit , over-current and over–voltage protection
- Operating temperature range: -40℃ to +85℃
- Six-sided metal shielding package
- Reverse voltage protection available with A2S(Chassis mounting) or A4S(DIN-Rail mounting)
- International standard pin-out

*VRB_LD-50W series products are of 50W output power, wide range of voltage input of 18-36VDC, 36-75VDC, isolation voltage of 1500VDC, output over-voltage protection and output short circuit protection with the six-sided metal shielding package; these products are widely used in fields such as industrial control, electric power, instruments and communication.*

## Selection Guide

| Part No.① | Input Voltage (VDC) | Output | | Efficiency② (%,Min./Typ.) @ Full Load | Max. Capacitive Load (μF) |
|---|---|---|---|---|---|
| | Nominal (Range) | Output Voltage (VDC) | Output Current (mA) (Max./Min.) | | |
| VRB2403LD-50W | 24 (18-36) | 3.3 | 10000/500 | 89/91 | 27000 |
| VRB2405LD-50W | | 5 | 10000/500 | 91/93 | 18900 |
| VRB2412LD-50W | | 12 | 4167/208 | 91/93 | 3700 |
| VRB2415LD-50W | | 15 | 3333/167 | 91/93 | 2000 |
| VRB2424LD-50W | | 24 | 2083/104 | 89/91 | 1000 |
| VRB4803LD-50W | 48 (36-75) | 3.3 | 10000/500 | 89/91 | 27000 |
| VRB4805LD-50W | | 5 | 10000/500 | 91/93 | 18900 |
| VRB4812LD-50W | | 12 | 4167/208 | 91/93 | 3700 |
| VRB4815LD-50W | | 15 | 3333/167 | 91/93 | 2000 |
| VRB4824LD-50W | | 24 | 2083/104 | 90/92 | 1000 |

Note:
① Series with suffix "H" are heat sink mounting, such as VRB2405LD-50WH; series with suffix "A2S" are chassis mounting, with suffix "A4S" are DIN-Rail mounting, for example VRB2405LD-50WA2S is chassis mounting, VRB2405LD-50WA4S is DIN-Rail mounting; If the application has a higher requirement for heat dissipation, you can choose modules with heat sink;
② The efficiency of "A2S" and "A4S" is approx. 2% lower for the protection of inverse polarity.

## Input Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input Current (full load / no-load) | 24VDC input | 3.3V output | -- | 1511/42 | 1545/55 | mA |
| | | 5V output | -- | 2240/59 | 2289/105 | |
| | | 12V output | -- | 2240/85 | 2289/105 | |
| | | 15V output | -- | 2240/90 | 2289/105 | |
| | | 24V output | -- | 2289/45 | 2341/65 | |
| | 48VDC input | 3.3V output | -- | 756/30 | 773/35 | |
| | | 5V output | -- | 1120/50 | 1144/55 | |
| | | 12V output | -- | 1120/34 | 1144/55 | |
| | | 15V output | -- | 1120/50 | 1144/70 | |
| | | 24V output | -- | 1132/30 | 1157/50 | |
| Reflected Ripple Current | 24VDC input | | -- | 40 | -- | |
| | 48VDC input | | -- | 30 | -- | |
| Input impulse Voltage (1sec. max.) | 24VDC input | | -0.7 | -- | 50 | VDC |
| | 48VDC input | | -0.7 | -- | 100 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Starting Time | Nominal input voltage& constant resistance load | | -- | 10 | -- | ms |
| Input Under-voltage Protection | 24VDC input | Starting Voltage | -- | -- | 18 | VDC |
| | | Under-Voltage Shutdown | 15 | -- | -- | |
| | 48VDC input | Starting Voltage | -- | -- | 36 | |
| | | Under-Voltage Shutdown | 31 | -- | -- | |
| Input Over-voltage Protection | 24VDC input | Starting Voltage | 36 | -- | -- | |
| | | over-voltage Shutdown | -- | -- | 41 | |
| | 48VDC input | Starting Voltage | 75 | -- | -- | |
| | | over-voltage Shutdown | -- | -- | 83 | |
| Input Filter | | | Pi filter | | | |
| Hot Plug | | | Unavailable | | | |
| Ctrl① | Module switch on | | Ctrl suspended or connected to TTL high level (3-12VDC) | | | |
| | Module switch off | | Ctrl pin connected to GND or low level (0-1.2VDC) | | | |
| | Input current when switched off | | -- | 6 | -- | mA |
| Note: ①The voltage of Ctrl pin is relative to input pin GND. | | | | | | |

## Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Accuracy | | | -- | ±1 | ±3 | % |
| Line Regulation | Full load, the input voltage is from low voltage to high voltage | | -- | ±0.2 | ±0.5 | |
| Load Regulation | 5%-100% load | | -- | ±0.5 | ±1 | |
| Transient Recovery Time | Nominal input voltage, 25% load step change | 24VDC output | -- | 500 | 1000 | μs |
| | | Others | -- | 200 | 500 | |
| Transient Response Deviation | Nominal input voltage, 25% load step change | | -- | ±3 | ±5 | % |
| Temperature Drift Coefficient | Full load | | -- | -- | ±0.03 | %/℃ |
| Ripple & Noise① | 20MHz bandwidth | VRB2403LD-50W、VRB4803LD-50W、VRB2405LD-50W、VRB4805LD-50W | -- | 100 | 250 | mVp-p |
| | | VRB4824LD-50W | -- | 200 | 350 | |
| | | Others | -- | 200 | 300 | |
| Output Voltage Regulation (Trim) | | | -- | ±10%Vo | -- | VDC |
| Over-voltage Protection② | Input voltage range | 3.3VDC output | -- | 3.9 | -- | |
| | | 5VDC output | -- | 6.2 | -- | |
| | | 12VDC output | -- | 15 | -- | |
| | | 15VDC output | -- | 18 | -- | |
| | | 24VDC output | -- | 30 | -- | |
| Over-current Protection | Input voltage range | | 120 | -- | 160 | %Io |
| Short circuit Protection | | | Hiccup, continuous, self-recovery | | | |
| Note: ①Ripple and noise are measured by "parallel cable" method, please see DC-DC Converter Application Notes for specific operation; ② After the output over-voltage protection, you need to reboot the module to output properly. | | | | | | |

## General Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Insulation Voltage | Input-output, with the test time of 1 minute and the leak current lower than 1mA | 1500 | -- | -- | VDC |
| Insulation Resistance | Input-output, insulation voltage 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitance | Input-output, 100KHz/0.1V | -- | 2000 | -- | pF |
| Operating Temperature | see Fig. 1 | -40 | -- | 85 | ℃ |
| Storage Temperature | | -55 | -- | 125 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |

| | | | | | |
|---|---|---|---|---|---|
| Pin Welding Resistance Temperature | Welding spot is 1.5mm away from the casing, 10 seconds | -- | -- | 300 | ℃ |
| Vibration | | 10-55Hz, 10G, 30 Min. along X, Y and Z | | | |
| Switching Frequency | PWM mode | -- | 300 | -- | KHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | K hours |

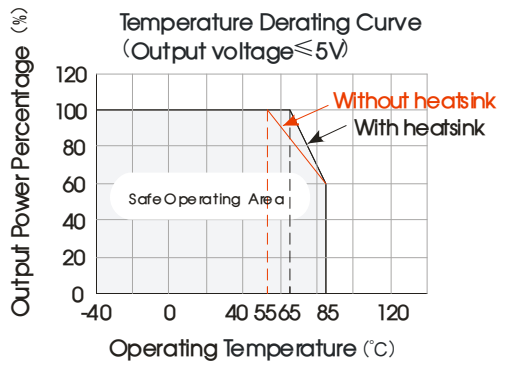
## Physical Specifications

| | | | |
|---|---|---|---|
| Casing Material | Aluminum alloy | | |
| Package Dimensions | without heat sink | Horizontal package | 50.80*25.40*11.80 mm |
| | | A2S wiring package | 76.00*31.50*21.20 mm |
| | | A4S rail package | 76.00*31.50*25.80 mm |
| | with heat sink | Horizontal package | 50.80*25.40*16.30 mm |
| | | A2S wiring package | 76.00*31.50*25.10 mm |
| | | A4S rail package | 76.00*31.50*29.70 mm |
| Weight | without heat sink | Horizontal package/A2S wiring package/A4S rail package | 35.0g/57.0g/77.0g(Typ.) |
| | with heat sink | Horizontal package/A2S wiring package/A4S rail package | 43.0g/65.0g/85.0g(Typ.) |
| Cooling Method | Free air convection | | |

## EMC Specifications

| | | | | |
|---|---|---|---|---|
| EMI | CE | CISPR22/EN55022 | CLASS B (see Fig.3-② for recommended circuit) | |
| | RE | CISPR22/EN55022 | 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 |

## Product Characteristic Curve



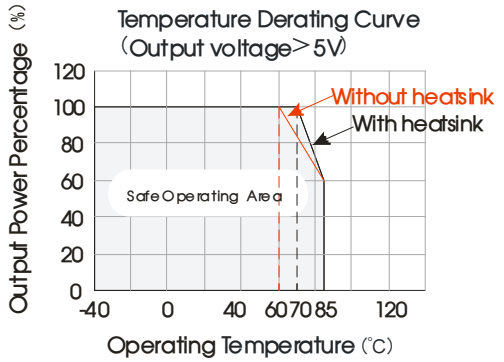
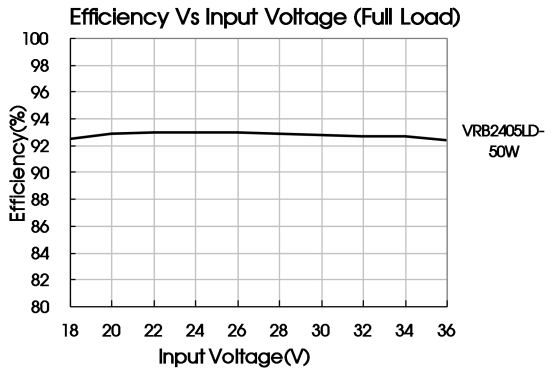
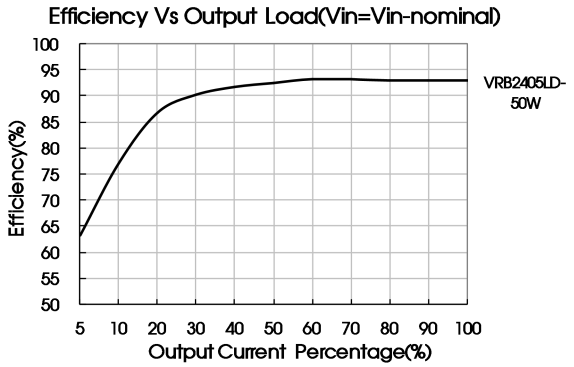




Fig. 1



## Design Reference

### 1.Typical application

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

If it is required to further reduce input and output ripple, properly increase the input & output of additional capacitors Cin and Cout or select capacitors of low equivalent impedance provided that the capacitance is no larger than the max. capacitive load of the product.

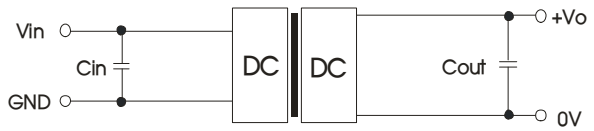



Fig. 2

| Vout(VDC) | Cin(μF) | Cout(μF) |
|---|---|---|
| 3.3/5 | 100 | 220 |
| 12/15 | | 100 |
| 24 | | 47 |

### 2.EMC solution-recommended circuit

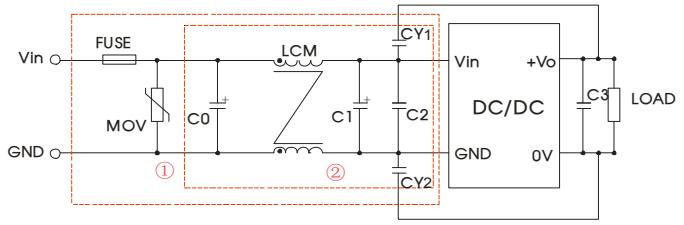


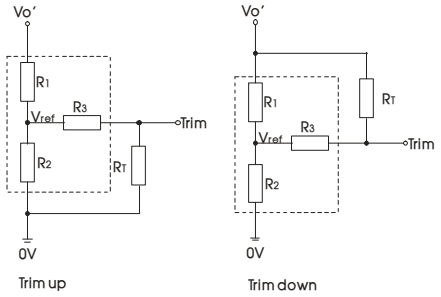

Fig. 3

Notes: Part ① in the Fig. 3 is used for EMS test and part ② for EMI filtering; selected based on needs.

Parameter description

| Model | Vin:24V | Vin:48V |
|---|---|---|
| FUSE | Choose according to actual input current | |
| MOV | S20K30 | S14K60 |
| C0 | 680μF/50V | 330μF/100V |
| LCM | 2.2mH(FL2D-30-222) | |
| C1 | 330μF/50V | 330μF/100V |
| C2 | 4.7uF/50V | 2.2uF/100V |
| CY1、CY2 | Y1 Safety capacitor 3.3nF/250VAC | |
| C3 | Refer to the Cout in Fig.2 | |

### 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:

up: $R_T = \frac{aR_2}{R_2 - a} - R_3$ $\quad a = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$

down: $R_T = \frac{aR_1}{R_1 - a} - R_3$ $\quad a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$

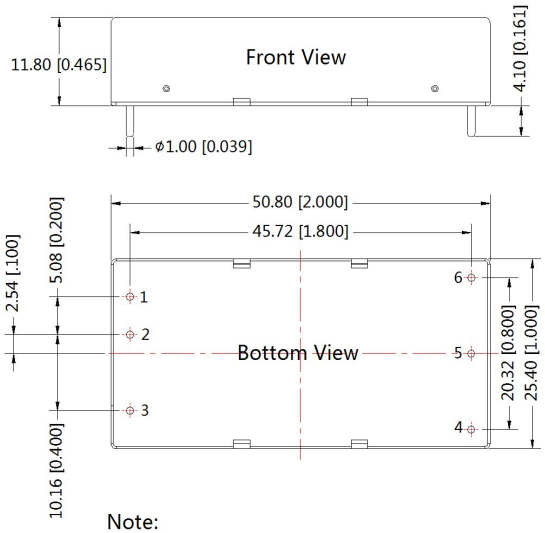
$R_T$ is Trim resistance
a is a self-defined parameter, with no real meaning.

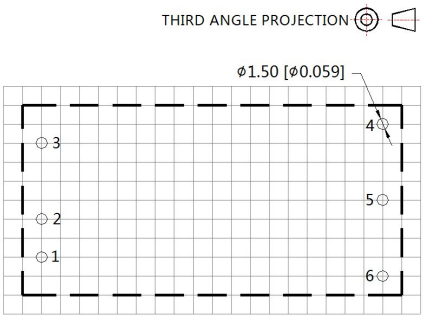
| Vout | R1(KΩ) | R2(KΩ) | R3(KΩ) | Vref(V) |
|---|---|---|---|---|
| 3.3 | 4.788 | 2.87 | 12.4 | 1.24 |
| 5 | 2.87 | 2.87 | 10 | 2.5 |
| 12 | 11 | 2.87 | 15 | 2.5 |
| 15 | 15 | 3 | 17.4 | 2.5 |
| 24 | 20 | 2.308 | 15 | 2.5 |

4. It is not allowed to connect modules output in parallel to enlarge the power

5.For more information please find the application notes on www.mornsun-power.com

## Dimensions and Recommended Layout (Horizontal package without heat sink)



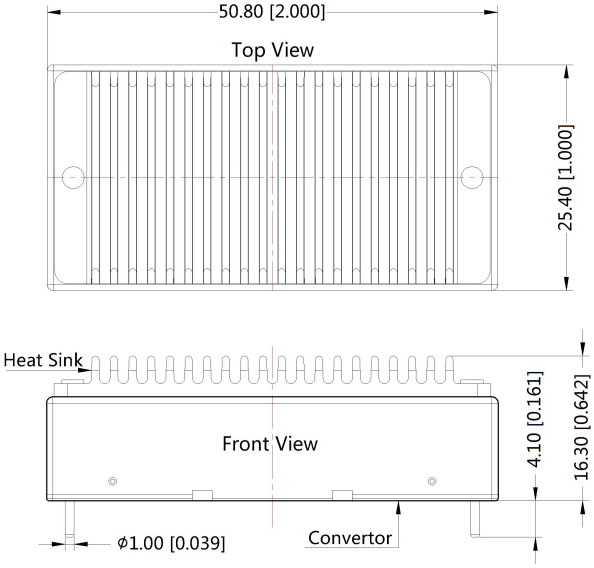



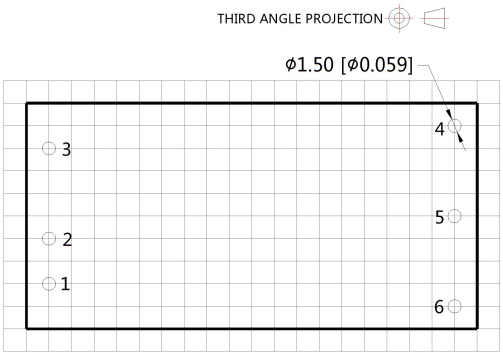

Note : Grid 2.54*2.54mm

| Pin-Out | |
|---|---|
| Pin | Function |
| 1 | Vin |
| 2 | GND |
| 3 | Ctrl |
| 4 | Trim |
| 5 | 0V |
| 6 | +Vo |

Note:
Unit :mm[inch]
Pin diameter tolerances :±0.10[±0.004]
Pin height tolerances :±0.50[±0.020]
General tolerances:±0.30[±0.012]

## Dimensions (Horizontal package with heat sink)



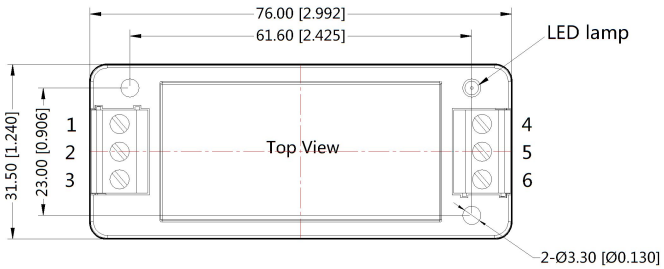

Note : Grid 2.54*2.54mm

| Pin-Out | |
|---|---|
| Pin | Function |
| 1 | Vin |
| 2 | GND |
| 3 | Ctrl |
| 4 | Trim |
| 5 | 0V |
| 6 | +Vo |

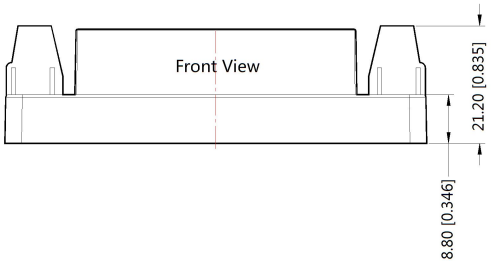
Note:
Unit :mm[inch]
General tolerances:±0.50[±0.020]
If use heatsinks,make sure there is enough space for a special size in ther above graph

## A2S Wiring Package Dimensions (without heat sink)

THIRD ANGLE PROJECTION



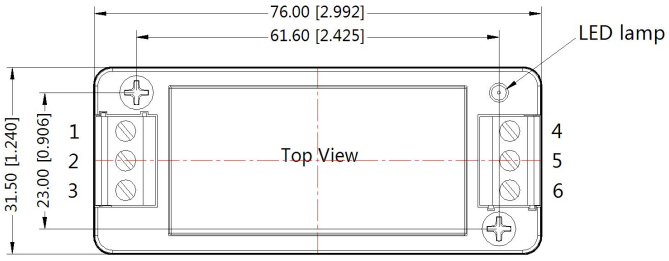

| Pin-Out | | | | | | |
|---|---|---|---|---|---|---|
| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
| Connection | Ctrl | GND | Vin | Trim | 0V | +Vo |



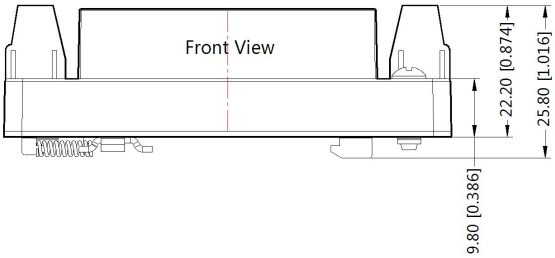

Note:
Unit:mm[inch]
Wire range : 24~12 AWG
If use heat sink,the product height is 25.10[0.988]
General tolerances:±0.50[±0.020]

## A4S Rail Package Dimensions (without heat sink)

THIRD ANGLE PROJECTION



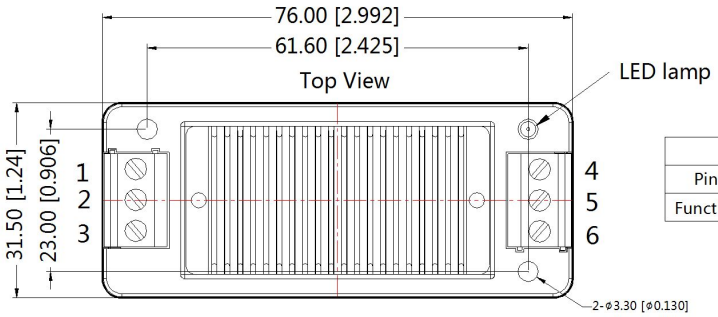

| Pin-Out | | | | | | |
|---|---|---|---|---|---|---|
| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
| Connection | Ctrl | GND | Vin | Trim | 0V | +Vo |



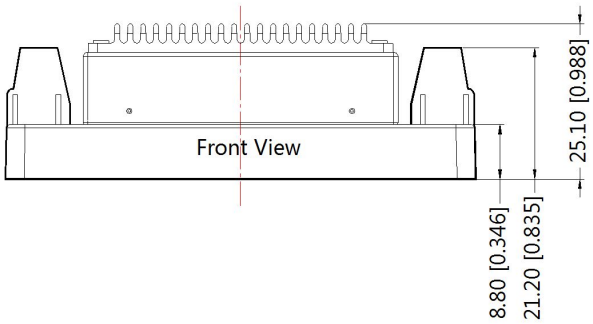

Note:
Unit:mm[inch]
Wire range : 24~12 AWG
If use heat sink,the product height is 29.70[1.169]
General tolerances:±0.50[±0.020]

## A2S Wiring Package Dimensions (with heat sink)

THIRD ANGLE PROJECTION



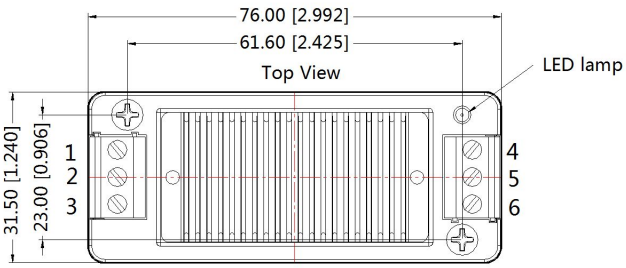

| Pin-Out | | | | | | |
|---|---|---|---|---|---|---|
| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
| Function | Ctrl | GND | Vin | Trim | 0V | +Vo |



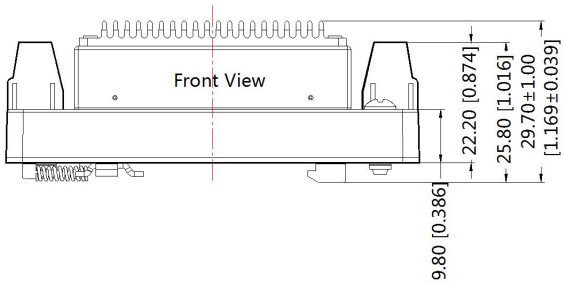

Note:
Unit:mm[inch]
Wire range:24~12 AWG
General tolerances:±0.50[±0.020]

## A4S Rail Package Dimensions (with heat sink)

THIRD ANGLE PROJECTION




| Pin-Out | | | | | | |
|---|---|---|---|---|---|---|
| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
| Function | Ctrl | GND | Vin | Trim | 0V | +Vo |




Note:
Unit:mm[inch]
Wire range:24~12 AWG
General tolerances:±0.50[±0.020]

Notes:
1. Packing Information please refer to 'Product Packing Information'. The Packing bag number of Horizontal package :58200035(without heatsink), 58200051(with heatsink), the Packing bag number of A2S/ A4S package:58220022(without heatsink and with heat sink);
2. 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;
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's corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Specifications-are subject to change without prior notice.

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