Size: 2.39in x 0.98~1.45in x 0.50in
(60.8mm x 25-36.83mm x 12.7mm)

## FEATURES

- Input Voltage Range: 9-60V
- Output Voltage Range: 0-60V
- Output Current Range: 0-10A
- Both Output Voltage and Current are Adjustable
- High Efficiency
- Input Under Voltage Protection
- Output Short Circuit and Over Temperature Protection
- Industry Standard 1/8 Brick Package and Pin Out
- Design Refers to UL/EN62368 Standards

## DESCRIPTION

The DCBB10A series consists of non-isolated buck-boost DC/DC in an industry standard 1/8 brick package and pin-out. This series consists of adjustable output voltage and current and a wide input voltage range of 9-60V. Features of this series include input under voltage protection, output short circuit and over temperature protection, and high efficiency. This series design refers to UL/EN62368 standards and is RoHS compliant.

## MODEL SELECTION TABLE

| Model Number[1] | Input | | | Output | | | Typ. Ripple & Noise | Full Load Efficiency[3] | |
|---|---|---|---|---|---|---|---|---|---|
| | Nominal (Range) | Max.[2] | Current Limit Typ. | Nominal (Range) | Current Limit | Current Setting Range | | Min. | Typ. |
| DCBB10A-48S36 | 48VDC (9-60VDC) | 65VDC | 12.5VDC | 36VDC (0-60VDC) | 12.5A | 0-10A | 100mVp-p | 93% | 95% |
| DCBB10A-48S36RS | | | 12.5VDC | 36VDC (0-60VDC) | 12.5A | 0-10A | 100mVp-p | 93% | 95% |

## SPECIFICATIONS

All specifications are based on 25°C, Humidity <75%, Nominal Input Voltage, and Rated Output Load unless otherwise noted.
We reserve the right to change specifications based on technological advances.

| SPECIFICATION | TEST CONDITIONS | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **INPUT SPECIFICATIONS** | | | | | | |
| Input Voltage Range | 3.3VDC Nominal Input | | See Table | | | |
| Input Current | Nominal Input Voltage, nominal output voltage | Full Load | | 7895 | 8065 | mA |
| | | No Load | | 25 | 50 | |
| Surge Voltage (1 sec. max.) | | | -0.7 | | 65 | VDC |
| Start-Up Voltage | | | | | 9 | VDC |
| Under Voltage Protection | | | 6 | 7 | | VDC |
| Input Filter | | | C Filter | | | |
| Ctrl[4] | Module On | | Ctrl Pin Connected to -Vin or Low Level (0-0.8VDC) | | | |
| | Module Off | | Ctrl Open Circuit or Connected to TTL High level (1.8-5.0VDC) | | | |
| | Input Current When Off | | | 5 | 15 | mA |
| Input Current Limit | Input Voltage Range | | 11 | 12.5 | 14 | A |
| Hot Plug | | | Unavailable | | | |
| Input Reverse Polarity Protection | | | Unavailable | | | |
| **OUTPUT SPECIFICATIONS** | | | | | | |
| Output Voltage | | | See Table | | | |
| Voltage Accuracy | Constant voltage model, input voltage range, nominal output voltage, 0-100% | | | ±1 | ±3 | % |
| Current Accuracy | Constant current model, nominal input voltage, nominal output voltage, 100% load | | | ±5 | ±8 | |
| Output Voltage Adjustment | Vset Setup | | See Vset Function for Output Voltage Adjustment | | | |
| | Adjustable Range of Output Voltage | | 3.3[5] | | 60 | VDC |
| Output Current Adjustment | Iset Setup | | See Iset Function for Output Current Adjustment | | | |
| | Adjustable Range of Output Current | | 0 | | 10 | A |
| Output Current | | | See Table | | | |
| Ripple & Noise[6] | 20MHz Bandwidth, constant voltage model, nominal input voltage, nominal output voltage | | | 100 | 300 | mVp-p |
| Temperature Coefficient | Constant voltage model, nominal input voltage, nominal output voltage, 100% load | | | | ±0.03 | %/°C |
| Start Up Time | Nominal input voltage, constant resistance load | | | | 100 | ms |
| **PROTECTION** | | | | | | |
| Short Circuit Protection | Input Voltage Range | | Constant Current Output, Continuous Self-Recovery | | | |
| Output Current Limit | Input Voltage Range | | 10.5 | 12.5 | 14.5 | A |
| Over Temperature Protection[7] | Max. Case Temperature | | | 120 | | °C |

## SPECIFICATIONS

All specifications are based on 25°C, Humidity <75%, Nominal Input Voltage, and Rated Output Load unless otherwise noted.
We reserve the right to change specifications based on technological advances.

| SPECIFICATION | TEST CONDITIONS | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| ENVIRONMENTAL SPECIFICATIONS | | | | | | | |
| Operating Temperature | See temperature derating curves | | | -40 | | 105 | ºC |
| Storage Temperature | | | | -55 | | 125 | ºC |
| Storage Humidity | Non-Condensing | | | 5 | | 95 | %RH |
| Pin Soldering Resistance Temperature | Wave-Soldering, 10s | | | | | 260 | °C |
| | Soldering spot is 1.5mm away from case for 10 seconds | | | | | 300 | |
| Shock and Vibration | | | | IEC/EN61373 – Category 1, Grade B | | | |
| Pollution Level | | | | PD 3 | | | |
| Altitude | | | | Altitude: ≤2000m, atmospheric pressure: 80~110KPa | | | |
| MTBF | MIL-HDFK-217F@25ºC | | | 500 | | | K Hours |
| GENERAL SPECIFICATIONS | | | | | | | |
| Efficiency | | | | See Table | | | |
| Switching Frequency | | | | | 160 | | KHz |
| Isolation | Input/Output-Case, Electric Strength Test for 1 minute with a leakage current of 1mA max. | | | 1500 | | | VDC |
| PHYSICAL SPECIFICATIONS | | | | | | | |
| Weight | DCBB10A-48S36(RS) | | | 1.87oz (53g) | | | |
| | DCBB10A-48S36F(RS) | | | 2.05oz (58.2g) | | | |
| Dimensions (L x W x H) | DCBB10A-48S36(RS) | | | 2.39in x 0.98in x 0.50in (60.8mm x 25mm x 12.7mm) | | | |
| | DCBB10A-48S36F(RS) | | | 2.39in x 1.45in x 0.50in (60.8mm x 36.83mm x 12.70mm) | | | |
| Cooling | | | | Free Air Convection (20LFM) | | | |
| Case Material | | | | Aluminum Alloy | | | |
| SAFETY CHARACTERISTICS | | | | | | | |
| Safety Approvals | Design Refers to UL/EN62368 Standards[10] | | | | | | |
| Emissions | CE | | CISPR32/EN55032[9] | Class B | | | |
| | RE | | CISPR32/EN55032[9] | Class B | | | |
| Immunity | ESD | IEC/EN61000-4-2 | Contact ±6kV/Air ±8kV | Perf. Criteria B | | | |
| | RS | IEC/EN61000-4-3 | 10V/m | Perf. Criteria A | | | |
| | EFT | IEC/EN61000-4-4 | ±2kV[9] | Perf. Criteria A | | | |
| | Surge | IEC/EN61000-4-5 | Line to Line ±2kV[9] | Perf. Criteria B | | | |
| | CS | | 10Vr.m.s | Perf. Criteria A | | | |

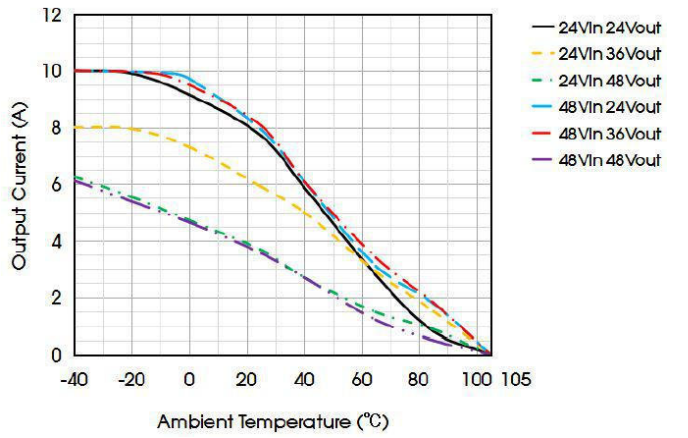
## NOTES

1. Use “F” suffix to indicate heat sink mounting. Use “RS” suffix to indicate Resistance Set.
2. Exceeding maximum input voltage may cause permanent damage.
3. Efficiency is measured at nominal input voltage, nominal output voltage, and max output load.
4. The Ctrl pin voltage is referenced to input -Vin. When Pin of Vset and Iset are floating, there will be voltage and current output after power on. Please put the Ctrl pin in a high impedance state or connect to a high level before the product is powered on.
5. The product can work in constant current mode when the output voltage at 0-3.3V
6. Tip and barrel method is used for ripple & noise test, see Fig. 6. Contact factory for more specific information.
7. Over temperature protection is in the form of product output shutdown
8. The voltage of the Ctrl pin is relative to input pin GND.
9. See Fig. 7 for recommended circuit
10. This product is Listed to applicable standards and requirements by UL.
11. Product customization available.
12. Product should be classified according to ISO14001 and related environmental laws and regulations and should be handled by qualified units.

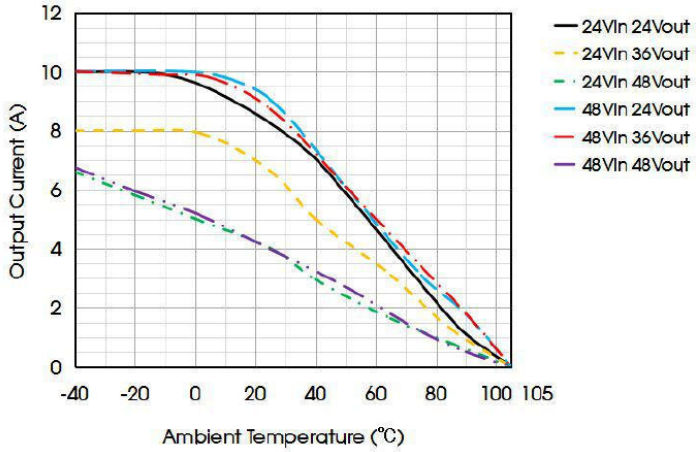
**Due to advances in technology, specifications subject to change without notice.*

## DERATING CURVE

DCBB10A-48S36(RS) Temperature Derating Curves (20LFM)

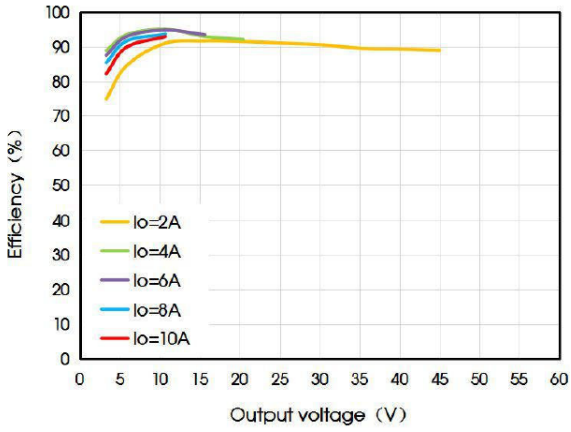



DCBB10A-48S36F(RS) Temperature Derating Curves (20LFM)

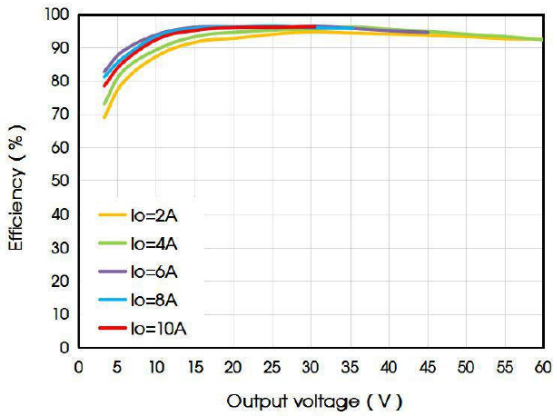



## EFFICIENCY CURVES

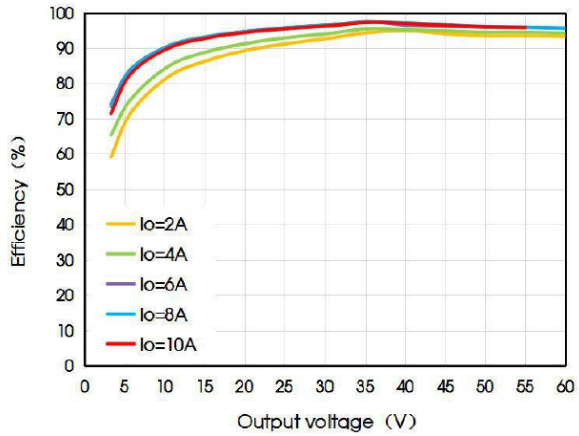
Efficiency vs Output Voltage (Vin=9V)



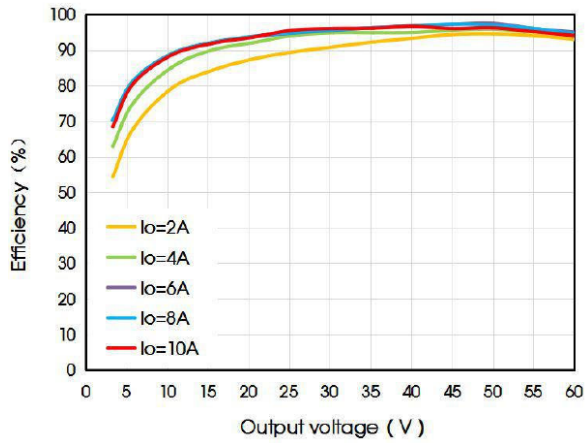

Efficiency vs Output Voltage (Vin=24V)




Efficiency vs Output Voltage (Vin=48V)

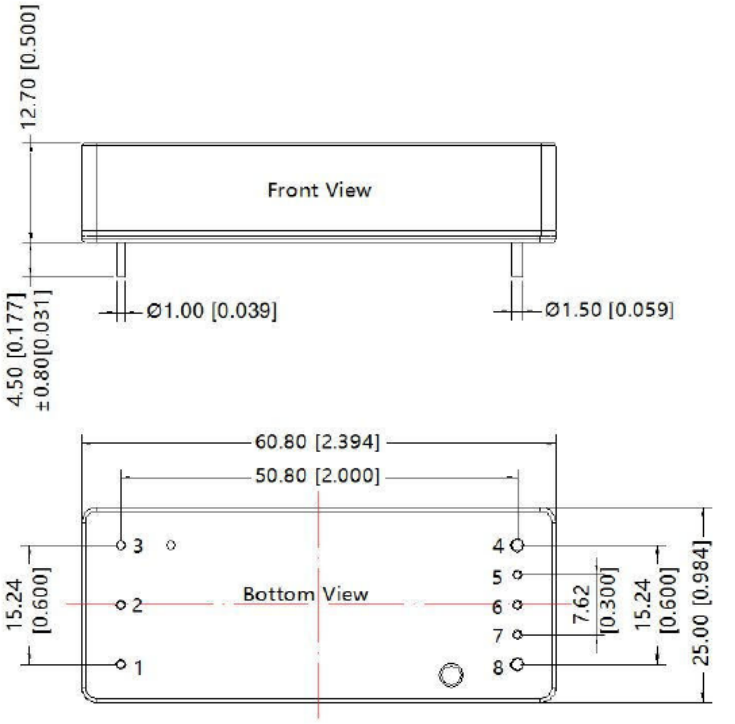


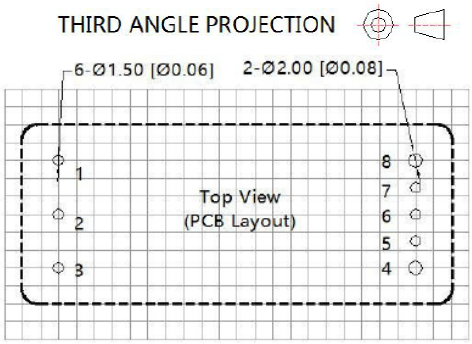

Efficiency vs Output Voltage (Vin=60V)



## MECHANICAL DRAWINGS

DCBB10A-48S36(RS) Drawing



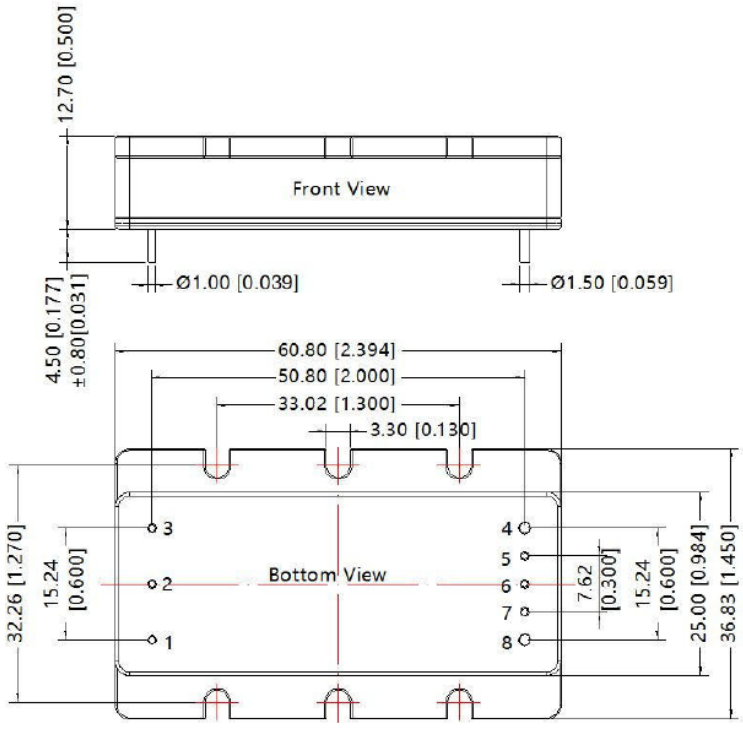

Note: Grid 2.54*2.54mm

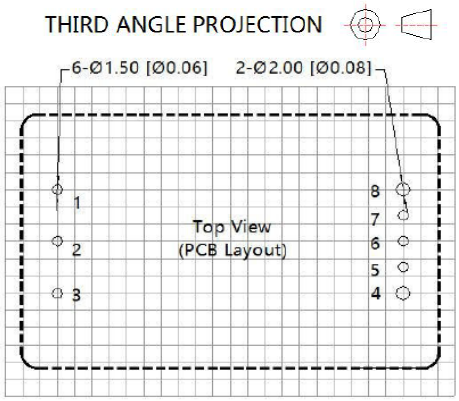
Pin-Out

| Pin | Mark | Pin | Mark |
|---|---|---|---|
| 1 | +Vin | 5 | Iset |
| 2 | Ctrl | 6 | Vset |
| 3 | -Vin | 7 | Imon |
| 4 | 0V | 8 | +Vo |

Notes:
Unit: mm[inch]
Pin 1,2,3,5,6,7 diameter: 1.0 [0.039]
Pin 4,8 diameter: 1.5 [0.059]
Pin diameter tolerances: ±0.10 [±0.004]
General Tolerances: ±0.5 [±0.020]

DCBB10A-48S36F(RS) Drawing




Note: Grid 2.54*2.54mm

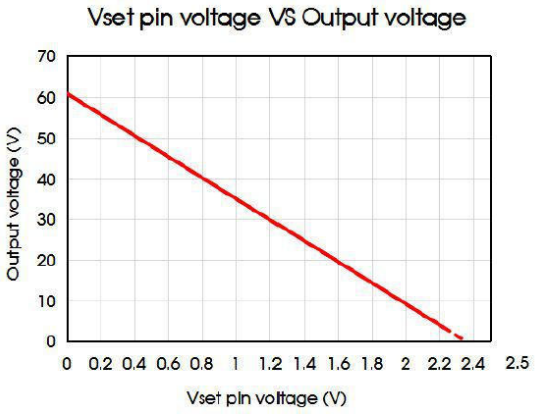
Pin-Out

| Pin | Mark | Pin | Mark |
|---|---|---|---|
| 1 | +Vin | 5 | Iset |
| 2 | Ctrl | 6 | Vset |
| 3 | -Vin | 7 | Imon |
| 4 | 0V | 8 | +Vo |

Notes:
Unit: mm[inch]
Pin 1,2,3,5,6,7 diameter: 1.0[0.039]
Pin 4,8 diameter: 1.5[0.059]
Pin diameter tolerances: ±0.10 [±0.004]
General Tolerances: ±0.5 [±0.020]

## VSET FUCNTION FOR OUTPUT VOLTAGE ADJUSTMENT

### 1. DCBB10A-48S36F: The Vset pin is connected to the external voltage Vf for adjustment



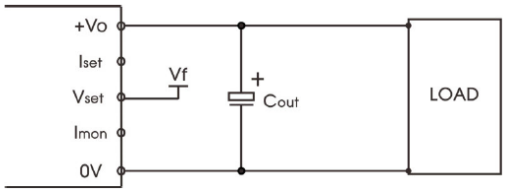
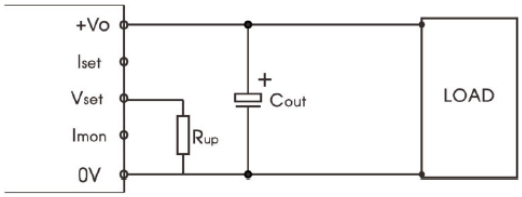




Fig. 1

Calculation formula of output voltage adjustment:
$Vo=60.9-25.9V_f$

Notes:
1. Adjustable range of output voltage: 3.3-60V
2. Vf is the externally supplied voltage which range from 0V to 2.5V. The Vf voltage is referenced to output 0V.
3. Vset pin must not be opened.

### 2. DCBB10A-48S36RS(F): The Vset pin is connected to the external resistance for adjustment



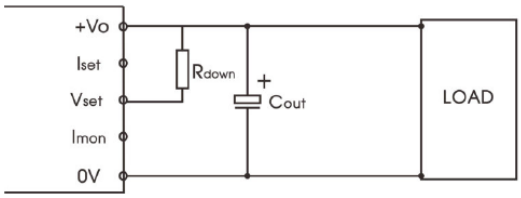




Fig. 2

Calculation formula of output voltage adjustment:

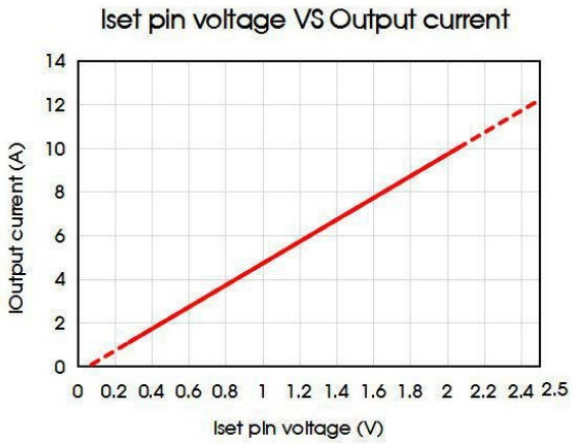
up: $Vo= 60 - \frac{29.934R_{up}}{2.87 + R_{up}}$

down: $Vo= \frac{30.066R_{down} + 172.19}{74.046 + R_{down}}$

Notes:
1. Adjustable range of output voltage: 3.3-60V
2. When the Vset pin is open, the output voltage of the product is 30V
3. Rup and Rdown are external resistance, in kΩ

## ISET FUCNTION FOR OUTPUT CURRENT ADJUSTMENT

### 1. DCBB10A-48S36F: The Iset pin is connected to the external voltage Vf for adjustment



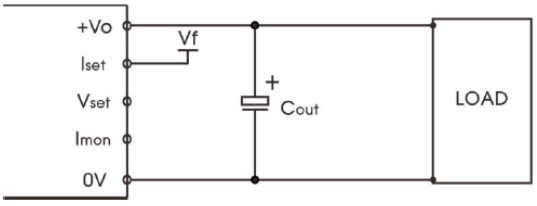




Fig. 3

Calculation formula of output voltage adjustment:

$$Io=5V_f - 0.3$$

Notes:
1. Adjustable range of output voltage: 0-10V
2. Vf is the externally supplied voltage which range from 0V to 2.5V. The Vf voltage is referenced to output 0V.
3. Iset pin must not be opened.

### 2. DCBB10A-48S36RS(F): The Iset pin is connected to the external resistance for adjustment

1. When the maximum output current is set between 0-10A:

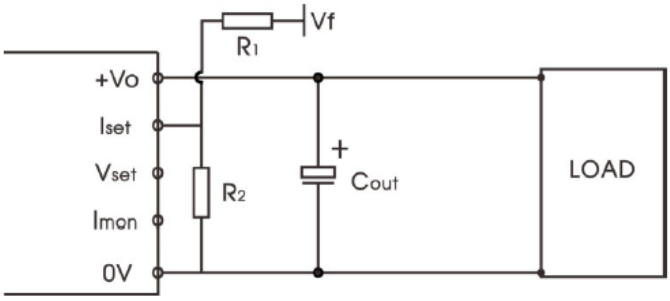



Fig. 4

Recommended Parameter Setting:
1. Vf is 5V
2. R1 is 10kΩ

Calculation formula of output current adjustment:

$$Io= 11.925 - \frac{270.73R_2}{10.59R_2 + 88.79}$$

Notes:
1. Adjustable range of output voltage: 0-10A
2. When using external resistance to adjust Iset current, external auxiliary power supply and regulating resistance are needed. Please ensure that external resistance meets the power and withstand voltage requirements.
3. R2 is external resistance, in kΩ. When R2 value range is 0-10kΩ, it can meet the requirements of output current regulation range.
4. When the Iset pin is opened, the ouput current ≤7A

2. When the maximum output current is set between 5-10A:

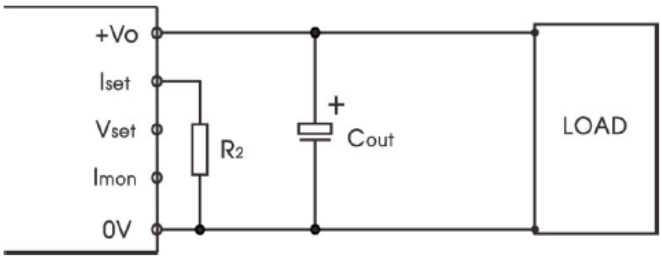


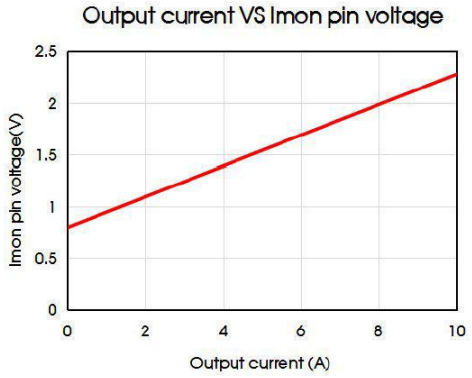

Fig.5

Calculation formula of output current adjustment:

$$Io= \frac{1209}{3R_2 + 155.82} + 4.87$$

Notes:
1. Adjustable range of output current: 0-10A
2. R2 is external resistance, in KΩ
3. When the Iset pin is opened, the output current ≤7A

## OUTPUT CURRENT DETECTION IMON




Calculation formula of the Imon pin voltage and output current:

$$V_{Imon}= \frac{3.64 + 0.676Io}{4.568}$$

Notes:
1. VImon is the Imon pin voltage, in V. The VImon voltage is referenced to output 0V.
2. Io is the output current, in A.

## DESIGN REFERENCE

### 1. Typical Application

1. During testing and application, please follow the recommended test circuit (Fig. 6); be sure to connect an electrolytic capacitor Cin (≥220μF) at the input to suppress the surge voltage that may be generated at the terminal, and connect an electrolytic capacitor Cout(≥220μF) at the output, used for output filtering.
2. If the input terminal of the product is connected in parallel with a circuit with large transient energy (such as a parallel motor drive circuit), it may cuase the input voltage of the product to be pulled down. Please pay attention to the fluctuation of the input voltage of the product, and it is recommended to increase the electrolytic capacitor at the input terminal appropriately. The capacitance value of Cin is to ensure the stability of the input terminal voltage and avoid the situation that the input voltage is lower than the undervoltage protection point and the product restarts repeatedly.
3. If the output terminal of the product is an inductive load (such as a relay, a motor), it is recommended to increase the value of the output capacitor Cout and add a TVS to filter out the voltage spikes.
4. Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance)

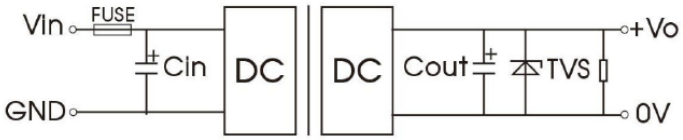



Fig 6

| Fuse | Cin(1) | Cout | TVS |
|---|---|---|---|
| 20A, slow | 220μF/100V | 200μF/100V | 85V |

Note:
1. Please pay attention to the ambient temperature of the product when using an external capacitor, increase the electrolytic capacitor values to at least 1.5 times the original parameter if the ambient temperature is low.

### 2. EMC Solution-Recommended Circuit

We recommend using the circuit shown in Fig. 7 during product EMC testing and application.

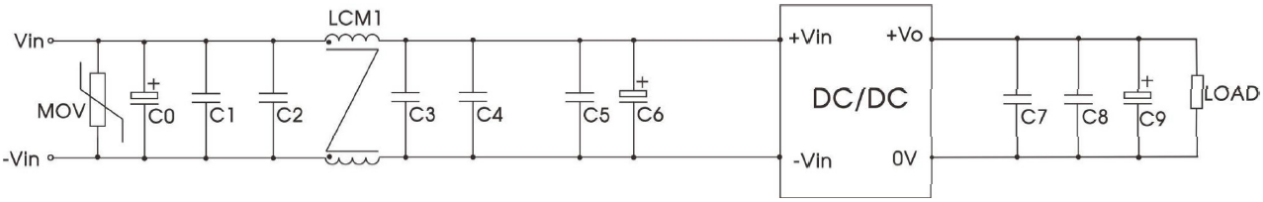



Fig. 7

| Components | Recommended Component Value |
|---|---|
| MOV | S14K60 (Varistor) |
| C0 | 680μF/100V Electrolytic Capacitor |
| C6 | 470μF/100V Electrolytic Capacitor |
| C9 | 470μF/100V Electrolytic Capacitor |
| C1, C2, C3, C4, C5, C7, C8 | 4.7μF/100V Ceramic Capacitor |
| LCM1 | T24 x 23.5 x 19/4mH/35mΩ max |

### 4. Products do not support parallel connection of their output.

## COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001: 2015 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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