

### Typical Features

- ◆ Wide input voltage range 2:1, Output Power 50W
- ◆ Ultra thin Package:9.5mm
- ◆ Transfer Efficiency up to 90%
- ◆ Stand-by Power Consumption as low as 0.3W
- ◆ Output super-fast start up as low as 20ms
- ◆ Continuous Short Circuit protection, Self-recovery
- ◆ Protection: Input under voltage, output over voltage, short circuit, over current
- ◆ Switching Frequency 350KHz
- ◆ Isolation Voltage 1500VDC
- ◆ Operating Temperature: -40°C~+85°C
- ◆ Good EMI performance
- ◆ International standard pin-out



**FD50-XXSXXB3(C)** is a new designed 50W output DC/DC Converter with wide input voltage range(2:1), super-fast start up, isolated& regulated output, DIP/chassis mounting/DIN-Rail mounting, single output, isolation 1500VDC. It features the protection function of input under-voltage, output over current, short circuit, over voltage. It is widely used in the industrial control, electrical power, communication, railway engine, industrial robot, etc. For harsh EMC environment, the application circuit in the datasheet is strongly recommended.

### Typical Product List

| Part No          | Input Voltage Range (VDC) |       | Output Voltage/Current (Vo/Io) |             | Input Current (mA) (Nominal Voltage) |              | Max. Capacitive Load<br>u F | Ripple & Noise<br>20MHz (MAX)<br>mVp-p (mV) | Efficiency (%) |      |
|------------------|---------------------------|-------|--------------------------------|-------------|--------------------------------------|--------------|-----------------------------|---|----------------|------|
|                  | Nominal                   | Range | Voltage (V)                    | Current (A) | Full load(mA)                        | No Load (mA) |                             |   | Min            | Typ. |
| FD50-24S3V3B3(C) | 24                        | 18-36 | 3.3                            | 12          | 1885                                 | 50           | 10000                       | 100   | 84             | 87   |
| FD50-24S05B3(C)  |                           |       | 5                              | 10          | 2315                                 | 50           | 8000                        | 100   | 87             | 90   |
| FD50-24S12B3(C)  |                           |       | 12                             | 4.16        | 2350                                 | 2            | 2000                        | 100   | 86             | 89   |
| FD50-24S15B3(C)  |                           |       | 15                             | 3.33        | 2315                                 | 2            | 1000                        | 100   | 87             | 90   |
| FD50-24S24B3(C)  |                           |       | 24                             | 2.08        | 2315                                 | 2            | 500                         | 100   | 87             | 90   |
| FD50-48S3V3B3(C) | 48                        | 36-75 | 3.3                            | 10          | 790                                  | 50           | 10000                       | 100   | 84             | 87   |
| FD50-48S05B3(C)  |                           |       | 5                              | 10          | 1158                                 | 50           | 8000                        | 100   | 85             | 87   |
| FD50-48S12B3(C)  |                           |       | 12                             | 4.16        | 1158                                 | 2            | 2000                        | 100   | 87             | 89   |
| FD50-48S15B3(C)  |                           |       | 15                             | 3.33        | 1158                                 | 2            | 1000                        | 100   | 87             | 90   |
| FD50-48S24B3(C)  |                           |       | 24                             | 2.08        | 1158                                 | 2            | 500                         | 100   | 87             | 90   |

1. Suffix "C" is with CTRL function; without "C" means no CTRL control function;
2. Suffix "-H" is with heatsink, "-T(H)" for chassis mounting(with heatsink), "-TS(H)" suffix for DIN-Rail mounting(with heatsink), DIN-Rail width is: 35mm;
3. Max capacitive load is, when the power supply is fully loaded, the max capacity could be connected to output, if exceed, the power supply cannot start-up;
4. To reduce no load power consumption and improve efficiency of light-load, IC will be flitter frequency under no-load and light-load Operating;
5. Output cannot be no load, at least with 5% load or above 470uF high frequency low resistance electrolytic capacitor, otherwise the output ripple will rise;

### Input Specification

|                               |  |  |
|-------------------------------|--|--|
| Input Surge Voltage<br>(1Sec) | 24Vdc Input                              | 50Vdc (Max)  |
|                               | 48Vdc input                              | 100Vdc (Max)                                       |
| Under-Voltage Turn-off        | 16VDC (24Vdc Input) /32VDC (48Vdc Input) |  |
| Start-up Time                 | 20ms (Typ.)                              |  |
| Input Filter                  | Pi filter                                |  |
| CTRL                          | Module turn-on                           | Suspended or connect to High level(3.5V-12VDC)     |
|                               | Module turn-off                          | Connect to -Vin or connect to low level (0-1.2VDC) |
|                               | Input current when switched off          | 1mA(Typ.)  |
| Reflected Ripple Current      | Input full range, connect to test tools  | 150mA  |

Note: \*The voltage of CTRL pin is relative to -Vin pin.

### Output Specification

|                                 |                                   |                             |              |
|---------------------------------|-----------------------------------|-----------------------------|--------------|
| Output Voltage Accuracy         | Full voltage full load            | Vo                          | ≤±2.0% (Max) |
| Line Regulation                 | Nominal load, full voltage range  | Vo                          | ≤±1.0%       |
| Load Regulation                 | 10%~100% nominal load             | Vo                          | ≤±2.0%       |
| Ripple & Noise                  | Nominal load, nominal voltage     | ≤100mVp-p (20MHz bandwidth) |              |
| Output Over-voltage Protection  | 110%~200%Vo                       |                             |              |
| Output Voltage Adjustment       | Trim-pin function                 | ±10%(Typ.)                  |              |
| Output Short circuit Protection | Hiccup, continuous, self-recovery |                             |              |
| Output Over-current protection  | 110%~200%Io (150% Io(Typ))        |                             |              |
| Dynamic Response                | 25% nominal load step change      | ΔVo/Δt                      | ≤±8.0%/500μs |

### General Specification

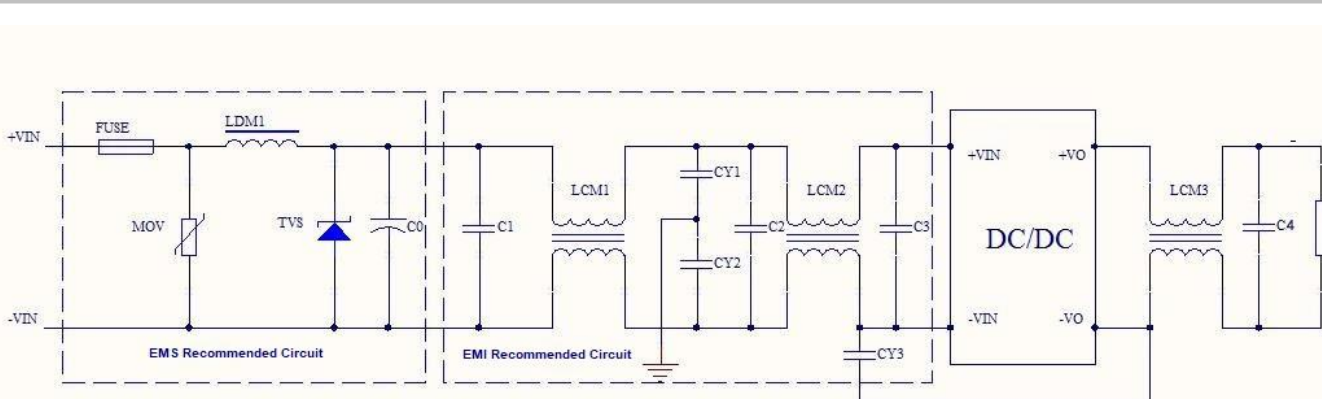
|                     |         |        |
|---------------------|---------|--------|
| Switching Frequency | Typical | 350KHz |
| Isolation Capacitor | Typical | 2000pF |

|                              |                                     |                        |
|------------------------------|-------------------------------------|------------------------|
| Operating Temperature        | Refer to Temperature Derating Curve | -40°C ~ +85°C          |
| Storage Temperature          | -                                   | -55°C ~ +125°C         |
| Max Case Temperature         | Within Operating Curve              | +105°C                 |
| Pin withstand soldering Temp | Distance to case 1.5mm, 10seconds   | 300°C MAX              |
| Relative Humidity            | No condensing                       | 5%~95%                 |
| Case Material                | -                                   | Aluminum Metal Case    |
| Isolation Voltage            | Input to Output                     | 1500Vdc ≤ 0.5mA / 1min |
| MTBF                         | MIL-HDBK-217F@25°C                  | 2X10 <sup>5</sup> Hrs  |
| Product Weight               | Average                             | 28g                    |

### EMC Characteristics

|     |   |   |                 |
|-----|---|---|-----------------|
| EMI | CE  | CISPR22/EN55032 CLASSB (external circuit is needed) |                 |
|     | RE  | CISPR22/EN55032 CLASSB (external circuit is needed) |                 |
| 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 (external circuit is needed)   | perf.Criteria B |
|     | Surge   | IEC/EN61000-4-5 ±2KV (external circuit is needed)   | perf.Criteria B |
|     | Voltage dips, short interruptions and voltage variations immunity | IEC/EN61000-4-6 3Vr.m.s                             | perf.Criteria A |

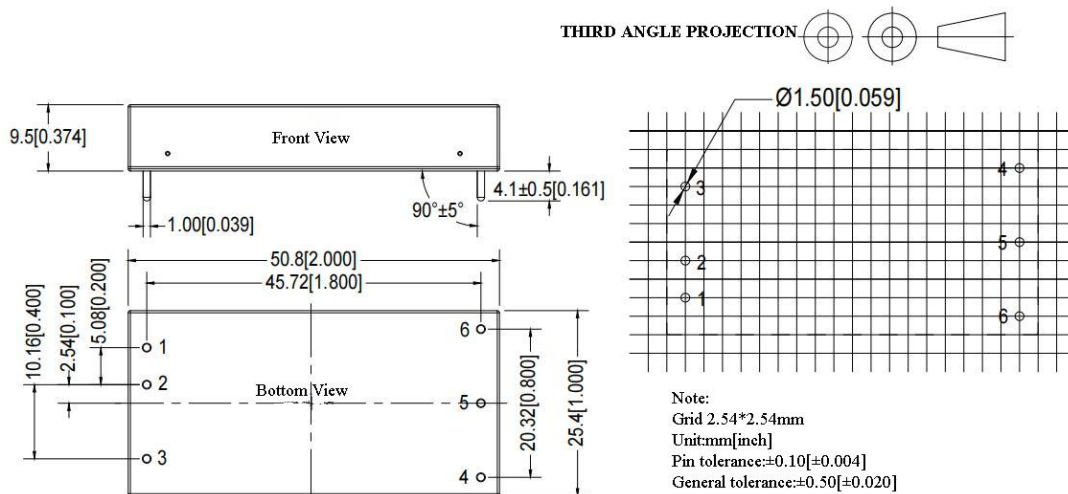
### EMC External Recommended Circuit



**Recommended Parameter: :**

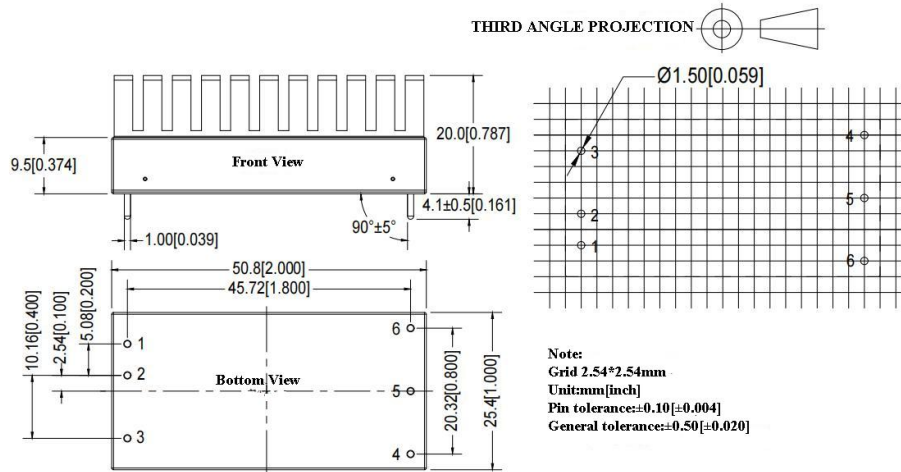
| Component   | 48V Input                       | 24V Input  |
|-------------|---------------------------------|------------|
| FUSE        | According to customer's request |            |
| MOV         | 14D101K                         | 14D470K    |
| LDM1        | 56uH                            |            |
| TVS         | SMCJ80A                         | SMCJ40A    |
| C0          | 560uF/100V                      | 680uF/100V |
| C1,C2,C3    | 4.7uF/100V                      | 4.7uF/100V |
| LCM1        | 15mH                            |            |
| LCM2        | 56uH                            |            |
| LCM3        | 20uH~30uH                       |            |
| C4          | 47uF/50V                        |            |
| CY1,CY2,CY3 | 1nF/2KV                         |            |

**B3 Package(without Heat Sink) Dimension and Pin Function**

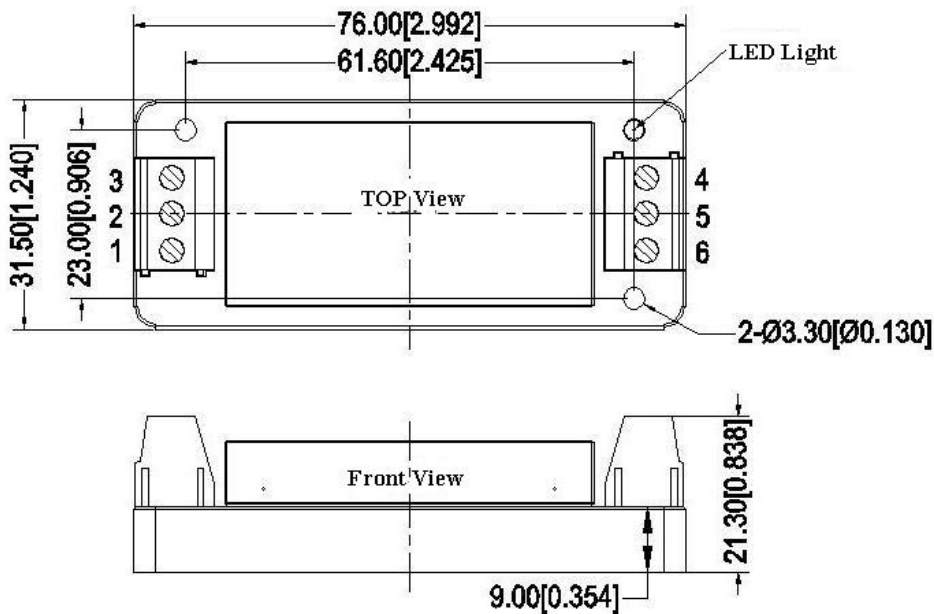


| Single (S) | 1    | 2    | 3    | 4    | 5   | 6   |
|------------|------|------|------|------|-----|-----|
|            | +Vin | -Vin | CTRL | Trim | -Vo | +Vo |

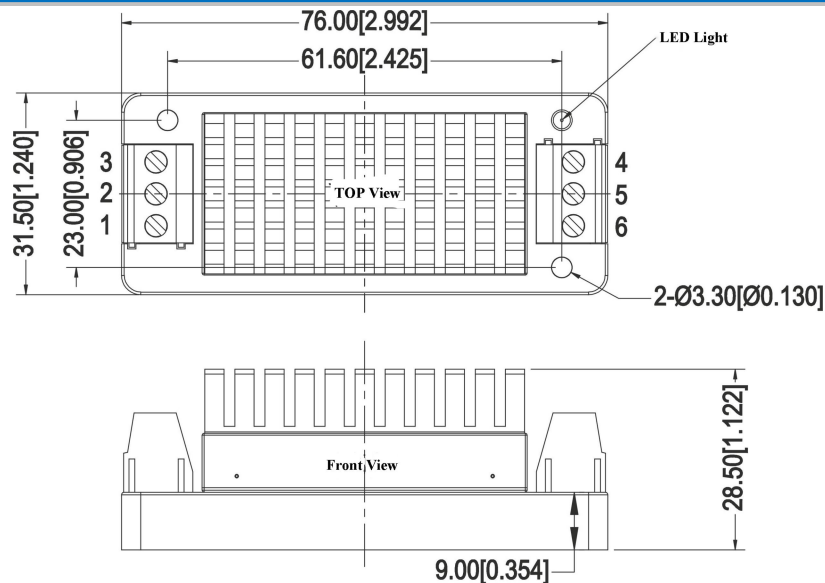
**B3-H Package(with Heat Sink) Dimension and Pin Function**



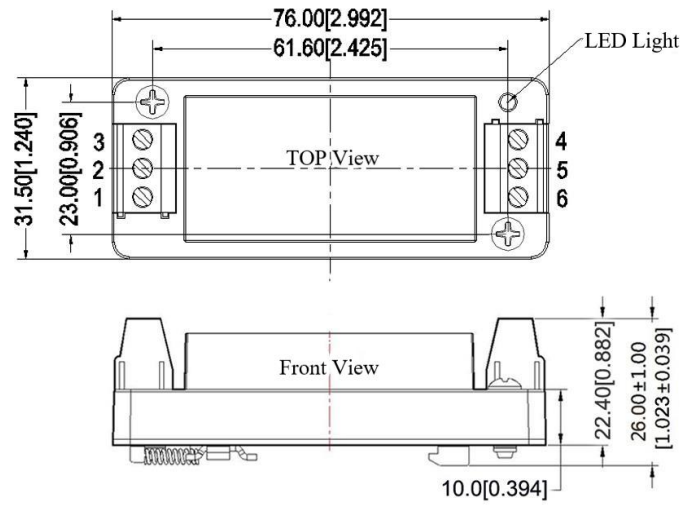
**B3-T Package(without Heat Sink) Dimension**



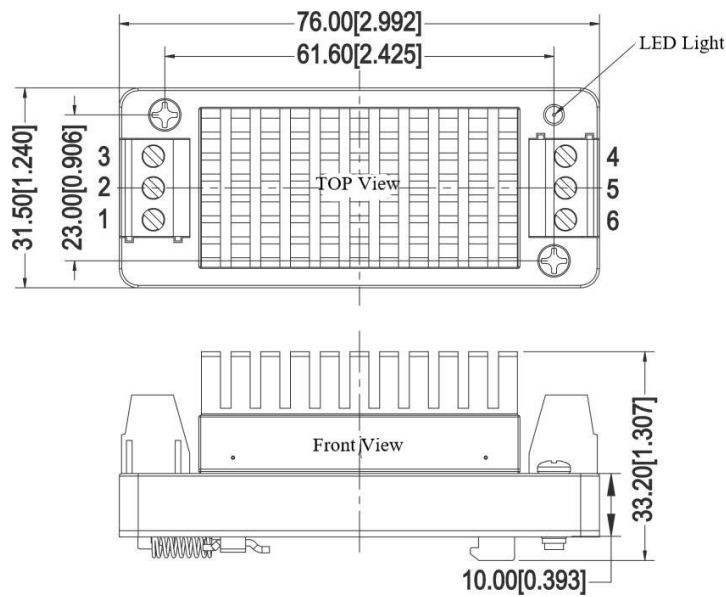
**B3-TH Package(with Heat Sink) Dimension**



**B3-TS Package(without Heat Sink) Dimension**



**B3-TSH Package(with Heat Sink) Dimension**



**Package Description**

| Packing Code             | L x W x H          |                       |
|--------------------------|--------------------|-----------------------|
| B3(without Heat Sink)    | 50.80X25.40X9.5mm  | 2.000X1.000X0.374inch |
| B3(with Heat Sink)       | 50.80X25.40X19.5mm | 2.000X1.000X0.767inch |
| B3-T(without Heat Sink)  | 76X31.5X21.3mm     | 2.99X1.24X0.838inch   |
| B3-T(with Heat Sink)     | 76X31.5X28.5mm     | 2.99X1.24X1.122inch   |
| B3-TS(without Heat Sink) | 76X31.5X26mm       | 2.99X1.24X1.023inch   |
| B3-TS(with Heat Sink)    | 76X31.5X33.2mm     | 2.99X1.24X1.307inch   |



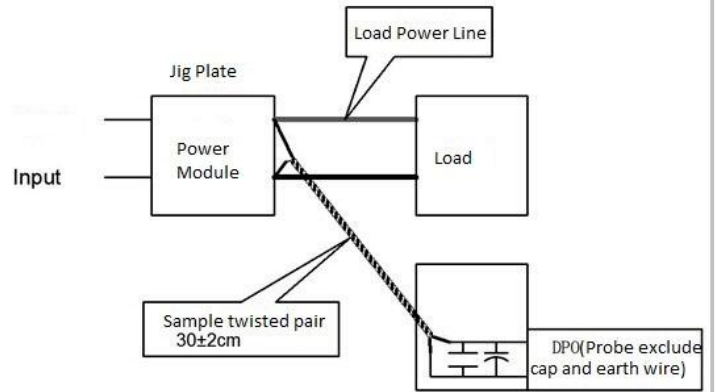
**Ripple & Noise Test(Twisted Pair Method 20MHz bandwidth)**

**Test Method:**

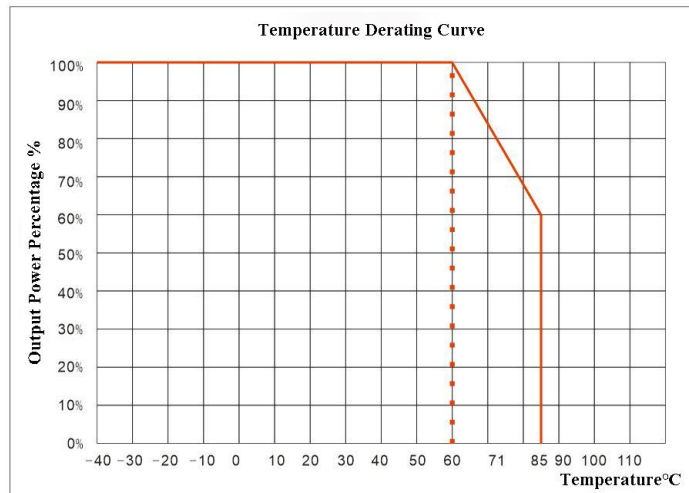
1.12# twisted pair to connect, Oscilloscope bandwidth set as 20MHz, 100M bandwidth probe, terminated with 0.1uF polypropylene capacitor and 47uF high frequency low resistance electrolytic capacitor in parallel, oscilloscope set as Sample pattern.

**2. Output Ripple& Noise Test Method:**

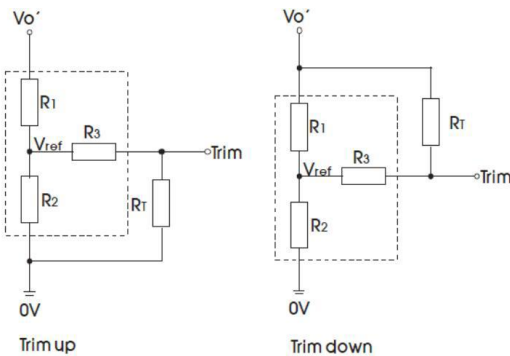
Input terminal connect to power supply, output terminal connect to electronic load through jig plate, Use 30cm±2 cm sampling line, Power line selected from corresponding diameter wire with insulation according to the flow of output current.



**Temperature Derating Curve**



**The usage of Trim and Calculating Trim resistor values**



Calculating Trim resistor values:

up:  $R_T = \frac{aR_2}{R_2 - a} - R_3$

$a = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$

down:  $R_T = \frac{aR_1}{R_1 - a} - R_3$

$a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$

RT= Trim Resistor value;  
a= self-defined parameter, no actual meaning;  
Vo' is the actula voltage to increas or desearse;

The usage circuit of the Trim circuit(dashed line shows inside of product)

| Vout(VDC) | R1(KΩ) | R2(KΩ) | R3(KΩ) | Vref(V) |
|-----------|--------|--------|--------|---------|
| 3.3       | 24     | 14.53  | 68     | 1.25    |
| 5         | 24     | 24     | 68     | 2.5     |
| 9         | 12.1   | 4.62   | 30     | 2.5     |
| 12        | 18     | 4.7    | 30     | 2.5     |
| 15        | 24     | 4.78   | 30     | 2.5     |
| 24        | 25.5   | 2.955  | 18     | 2.5     |

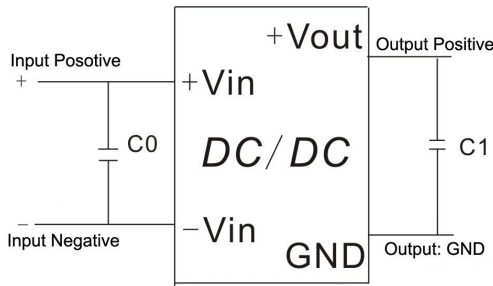
### Design and Application Reference

#### Recommended circuit

1. DC/DC test circuit:

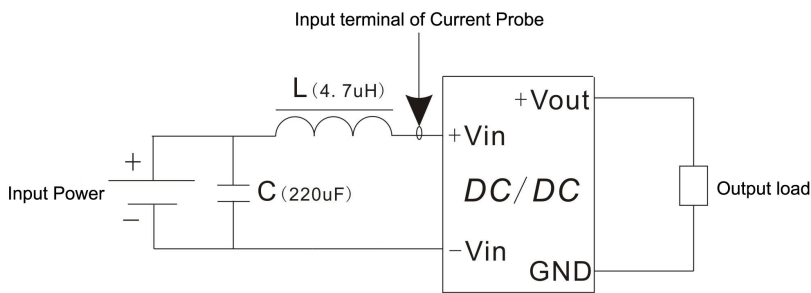
Normal recommended capacitors:

C0: 47-100uF; C1:10-22uF.



2. Input reflecting ripple current test circuit:

Capacitor C choose low ESR ones, withstand voltage value should be bigger than max input voltage;



#### Application Reference :

1. The recommended minimum load is 10% or high frequency low resistance electrolytic capacitor above 470uF, or output ripple will rise;
2. Recommend the unbalance loads of dual output to be  $\pm 5\%$ ;
3. The maximum capacitive load is tested under pure resistance and full load condition;
4. Our company could provide whole power supply solution, or customized made items;
5. Due to space limitation, please contact our team for more information;
6. If no special specified, all parameters tested under nominal input voltage, pure resistance rated load and  $T_a=25^\circ\text{C}$  conditions.



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