## Description

D28CxxM100SN DC/DC converter has input voltage range 16V ~ 40V, output power of 100W, with operating temperature range of -55℃ ~ +105℃. It adopts PCB surface mount technology and is encapsulated with metal case with potting. The weight of the product is about 39g, the input and output are isolated. It is applied in the DC power supply systems to realize the DC voltage conversion function. The module has the following characteristics.

## Product Features

RoHS CE 3 years Warranty

1. Enable control function
2. Over-temperature protection
3. Fixed switching frequency
4. Input undervoltage protection
5. Output short-circuit protection
6. Output over-current protection
7. Withstanding 50V surge voltage
8. Complies with GJB 10164-2021 "General Specifications for Microcircuit Modules"

## 1.Selection Guide

| Product Model | Output Power (W) | Nominal Output voltage/Current | Efficiency (@28VDC, %/Typ.) | Max. Capacitive Load (μF) |
|---|---|---|---|---|
| D28C05M100SN | 100 | 05V/20.0A | 90 | 3300 |
| D28C12M100SN | 100 | 12V/8.33A | 90 | 2200 |
| D28C15M100SN | 100 | 15V/6.67A | 90 | 1800 |
| D28C24M100SN | 100 | 24V/4.17A | 90 | 1000 |
| D28C28M100SN | 100 | 28V/3.57A | 90 | 680 |

## 2.Environmental Specifications

| Item | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|
| Operating temperature | -55 | 25 | 105 | ℃ | Baseplate temperature |
| Storage temperature | -55 | 25 | 125 | ℃ | |
| Relative humidity | - | - | 95 | % | non-condensing |
| Pin Soldering Resistance Temperature | - | - | 300 | ℃ | Soldering time shall not exceed 10 seconds |

## 3.Electrical Specifications

| Input Specifications | | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|
| Input voltage range | | Iout=0～100%Io | 16 | 28 | 40 | V |
| Surge Voltage | | 0.1s | - | - | 50 | |
| Input undervoltage protection | Starting voltage | Iout=0～100%Io | 14 | - | 16 | |
| | Turn-off voltage | | 13 | - | 15 | |
| Enable control voltage[a] (negative logic) | Starting voltage | Ctrl to low or ground | -0.3 | - | 1.2 | |
| | Turn-off voltage | Ctrl to high or floating | 3.5 | - | 12 | |
| No-load power consumption | | No-load | - | - | 10 | W |
| Temperature coefficient | | Full load | - | - | 0.02 | %℃ |

| Output Specifications | | Condition | | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|---|
| Output voltage | | Vin=16V～40V full load | | - | - | ±1 | %Vo |
| Output current | | Vin=16V～40V | | Refer to Selection Guide | | | A |
| Linear Regulation | | Vin=16V～40V full load | | - | - | ±0.5 | % |
| Current regulation | | Vin=16V～40V，Iout=0～100%Io | | - | - | ±0.5 | % |
| Ripple & Noise | | Vin=16V～40V full load BW=20MHz | 05V | - | 70 | 120 | mV |
| | | | 12V | - | 100 | 140 | |
| | | | 15V | - | 100 | 170 | |
| | | | 24V | - | 140 | 240 | |
| | | | 28V | - | 140 | 260 | |
| Over-voltage Protection[bc] | | Vin=16V～40V full load | | 110 | - | 140 | %Vo |
| Over-current Protection | | Hiccup mode, self-recovery after overcurrent removal | | 110 | - | 160 | %Io |
| Efficiency | | Vin=28V full load | | Refer to Selection Guide | | | % |
| Trim | | Guaranteed when output is down Iout≤100%Io, Guaranteed when output is up Po≤75/100W | | 90 | - | 110 | %Vo |
| Sense | | Output power range | | - | - | 105 | %Vo |
| Load dynamic response | Overshoot | Iout:50%load→75%load→50%load，di/dt=0.1A/us | | -5.0 | - | +5.0 | %Vo |
| | Recovery time[d] | | | - | - | 500 | μs |
| Start delay time[e] | | Vin=0V→28V full load | | - | - | 100 | ms |
| Output rise time | | Vout rises from 10% to 90% full load | | - | - | 100 | ms |
| Starting overshoot | | Vin=0V→28V full load | | -5.0 | - | +5.0 | %Vo |
| Capacitive load[f] | | Purely resistive load test,low ESR capacitor,full load | | Refer to Selection Guide | | | μF |
| Short circuit protection | | Hiccup mode | | Automatic recovery after short circuit removal | | | |

a) When the Ctrl pin is connected to a low level (-0.3V～1.2V), the product operates normally. When it is connected to a high level (3.5V～12V) or left floating, the product has no output.
b) After the overvoltage protection is released, the output voltage test result meets the electrical characteristic requirements.
c) The parameters are guaranteed by the design and are only tested during identification and design or process changes.
d) Recovery time refers to the time from the beginning of the transition until the output voltage returns to the corresponding stable value within ± 1%.
e) The start-up delay time can be calculated either from the power supply's transition or from the time when the ctrl terminal is connected to a low level, until the output voltage rises to 10% Vout.
f) Capacitive loads do not affect the DC parameters.
Note: The above specification parameter test circuit refers to the typical application 4.2 and 4.3.

| General Specifications | | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|
| Insulation resistance[g] | | Add 500VDC between input and output, between input and shell, between output and shell for 10s | 100 | - | - | MΩ |
| Switching frequency | | Full load | - | 300 | - | kHz |
| Isolation voltage[gh] | Input-Output | t=1min set the leakage curInsulatiorent to 1mA | 1500 | - | - | VDC |
| | Input-Housing | | 1000 | - | - | VDC |
| | Output-Housing | | 1000 | - | - | VDC |

g) The input leads are pins 1, 2 and 3, and the output leads are pins 4, 5, 6,7,8. During the test, the input leads need to be shorted together, and the output leads need to be shorted together;
h) Judgment criteria: the module shall be free of breakdown and arcing.

| Physical characteristics | |
|---|---|
| Dimension | 36.47*26.31*12.70mm |
| Weight | 39g±5g（Type） |

| Cooling Method | Conduction Heat Dissipation |
|---|---|

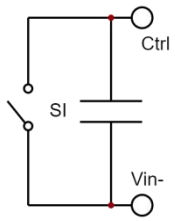
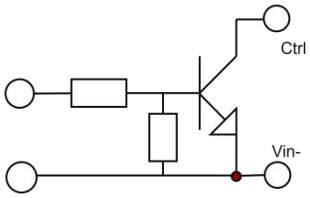
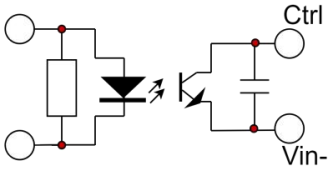
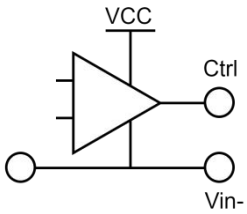
# 4.Typical Applications

## 4.1 Enable Control

The function of the positive and negative enable logic is as follows:

For positive logic enable, the module works normally when the control pin is connected to high level or floating, and is turned off when grounded or low level. For negative logic enable, the module works normally when the control pin is grounded or at low level, and is turned off when connected to high level or floating;

The enable pin of this model is negative logic. When the enable pin is left floating (or connected to high level), the product has no output. When not in use, the enable pin can be left floating; when using the enable pin, the product has output when the enable pin is connected to the input ground (or connected to low level) by means of a switch, etc.

| Switching mode | Triode control mode | Optocoupler isolation control mode | Logic gate control mode |
|---|---|---|---|
|  |  |  |  |

## 4. 2 Application Diagram

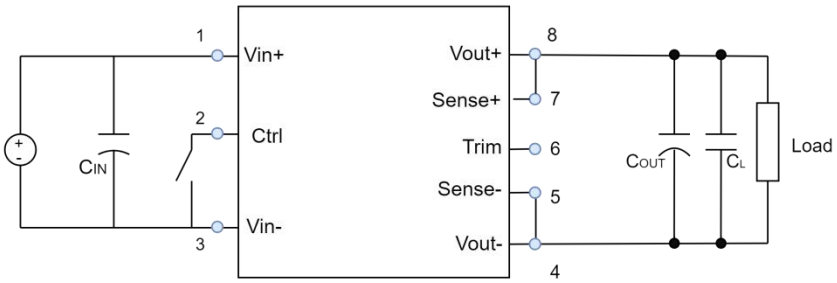



Fig.1 Application

Fig. 1 shows the typical application connection method of the module. The input terminals of the module power supply will have significant differences due to the length of the input source leads. In order to prevent input oscillation caused by excessively long input lines, it is recommended to add input capacitors near the input pins of the module. Similarly, an output capacitor should be added at the output end of the module:

| Recommend parameters | | | | | | |
|---|---|---|---|---|---|---|
| $C_{IN}$ | Input capacitor: 100μF solid-state capacitor | | | | | |
| Cout | Output Capacitance: (Solid State Capacitor) | 05V | 12V | 15V | 24V | 28V |
| | | 470μF | 330μF | 330μF | 220μF | 220μF |
| $C_L$ | Output capacitor: 1μF ceramic capacitor | | | | | |
| The above parameters can be adjusted according to the actual system application requirements, select the appropriate parameter values. | | | | | | |

## 4. 3 Output Ripple Voltage Test Diagram

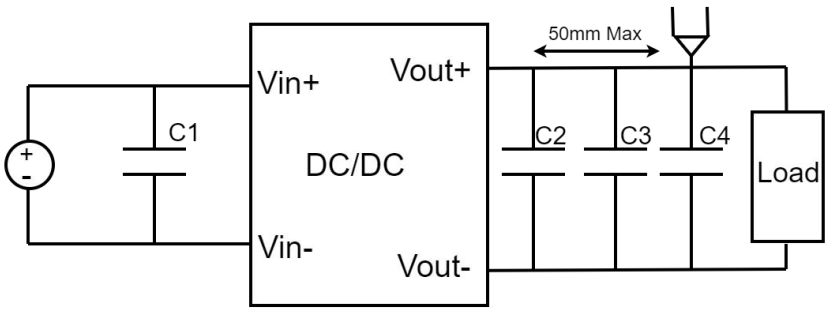



Fig.2: Schematic diagram of output ripple voltage

Ripple measurement is generally measured under the condition of rated input and output, the oscilloscope bandwidth is set to 20MHz, and the oscilloscope probe with the ground clamp removed is used to measure at a distance of about 3~5cm from the output end.

Note: The oscilloscope uses a bandwidth of 20MHz.

| Recommend parameters | | | | | |
|---|---|---|---|---|---|
| C1 | Requires mounting close to the input pins of the module, recommend 100 μF solid-state capacitor | | | | |
| C2 | 05V | 12V | 15V | 24V | 28V |
| | 470μF | 330μF | 330μF | 220μF | 220μF |
| | Solid-state capacitors, which are required to be installed close to the output pins of the module to better reduce the output ripple voltage and improve the output characteristics of the product in high and low temperature environments. | | | | |
| C3 | 1μF ceramic capacitor | | | | |
| C4 | 10μF tantalum capacitor or ceramic capacitor | | | | |

## 4. 4 EMI Filter Circuit Connection Diagram

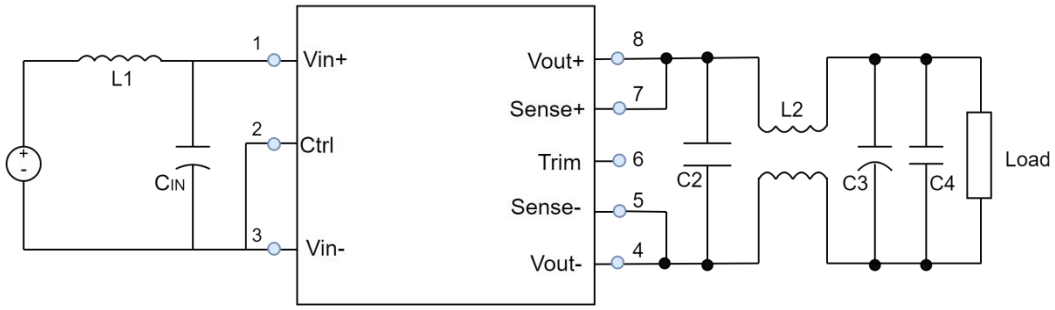



Fig.3 Link diagram of EMI filter circuit

L1, Cin and C2 should be connected close to the product pins, while C3 and C4 should be connected close to the load.. The inductance of L1 and L2 and the capacity of Cin ~ C4 should be selected according to the actual situation to meet the application requirements of the whole machine.

## 4. 5 Sense Function Application Description

### 4. 5. 1. Do not use remote compensation

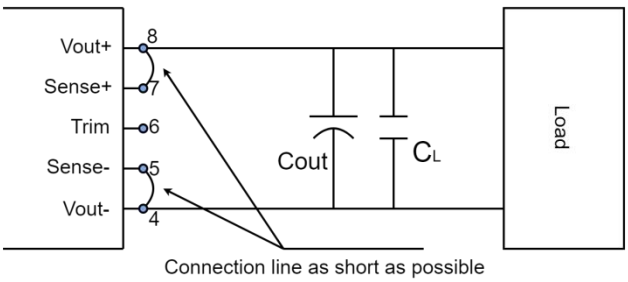



Fig. 4 Schematic Diagram of Sense Terminal Wiring

Note：

1) When remote compensation is not used, ensure that Vout and Sense ,Vout-and Sense-are shorted, and the compensation pin is not left floating. If there is no connection or wrong connection, it may cause permanent damage to the power module;

2) The connection between Vout and Sense, Vout-and Sense-is as short as possible and close to the terminal to avoid forming a large loop area. When noise enters this loop, it may cause instability of the module.

### 4. 5. 2. Using Remote Compensation

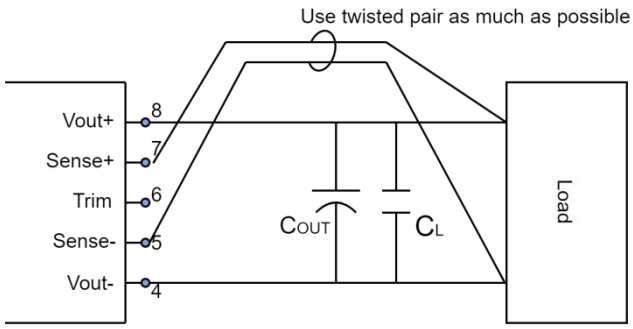



Fig. 5 Schematic Diagram of Sense Terminal Wiring

Note:

1) If the use of remote compensation lead is relatively long, it may lead to unstable output voltage. If you must use a longer remote compensation lead, please contact our technical staff;

2) If you use remote compensation, please use twisted pair or shielded wire, and make the lead as short as possible.

## 4. 6 Trim Function Application Note

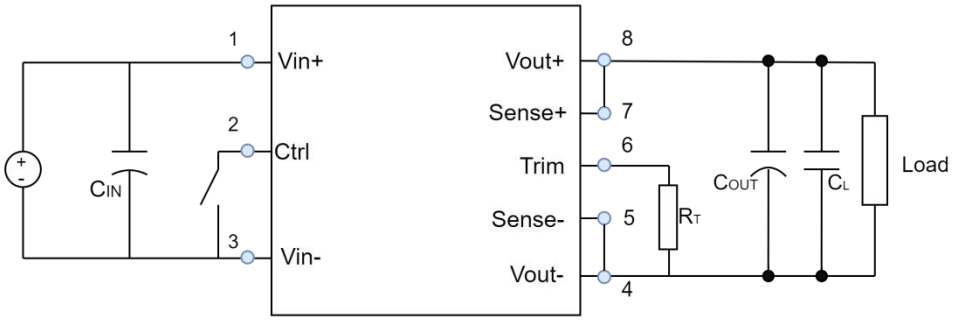



Fig. 6 Output Voltage Forward Regulation

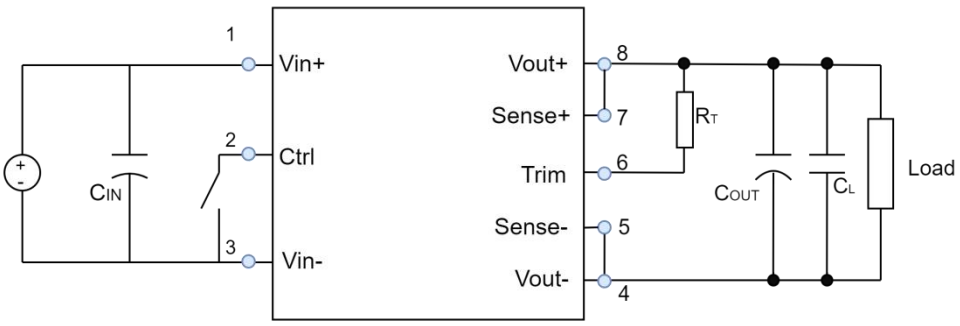



Fig. 7 Negative Regulation of Output Voltage

The output voltage can be fine-tuned through external connection. The specific method is: 6-pin Trim is connected to 4-pin Vout through adjusting resistor for positive adjustment, and 6-pin TRIM is connected to 8-pin Vout through adjusting resistor for negative adjustment

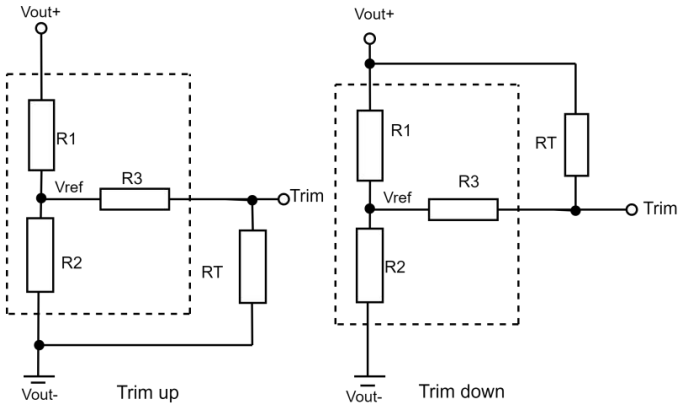



Fig. 8 Trim circuit (dashed box is inside the product)

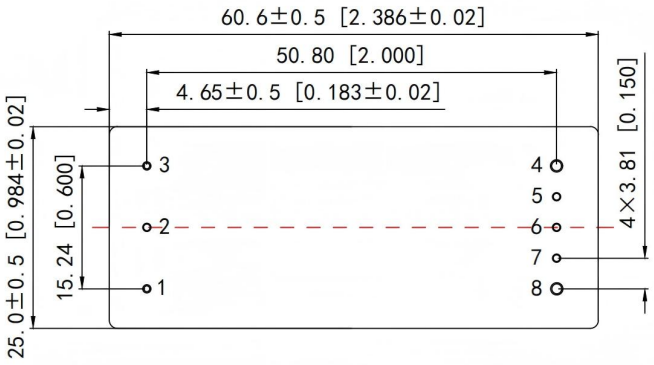
Trim resistance calculation formula:

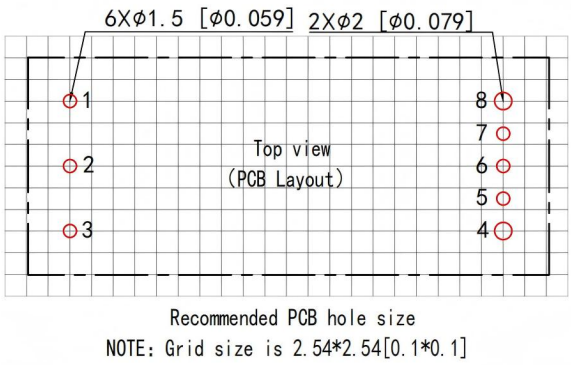
up: $R_T = \frac{aR2}{R2-a} - R3$ $\quad a = \frac{Vref}{Vo'-Vref} \cdot R1$ RT is Trim resistance

$R_T = \frac{aR1}{R1-a} - R_3$ $\quad a = \frac{Vo'-Vref}{Vref} \cdot R2$ a is a custom parameter and has no actual meaning.

| Model | R1(kΩ) | R2(kΩ) | R3(kΩ) | Vref(V) |
|---|---|---|---|---|
| D28C05M100SN | 2.52 | 2.49 | 6.8 | 2.495 |
| D28C12M100SN | 9.50 | 2.49 | 6.8 | 2.495 |
| D28C15M100SN | 12.5 | 2.49 | 6.8 | 2.495 |
| D28C24M100SN | 21.4 | 2.49 | 6.8 | 2.495 |
| D28C28M100SN | 25.5 | 2.49 | 6.8 | 2.495 |

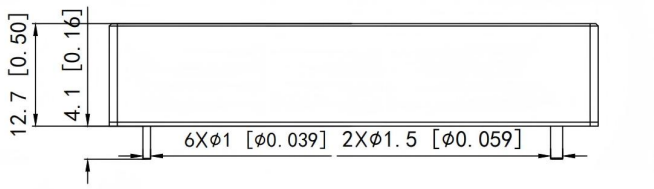
## 5. Dimension and Terminal Definition




Recommended PCB hole size

NOTE: Grid size is 2.54*2.54[0.1*0.1]




NOTES:

1) First angle projection
2) Five-sided metal aluminum, anodized matte black
3) All dimension in mm[inches]
4) Pins 4 and 8 are 1.5[0.059] dia
5) Pins diameter tolerance: ±0.1[0.004]
6) No specification for tolerance:
   X.X±0.5[X.XX±0.02], X.XX±0.25[X.XXX±0.01]

| No. | Symbol | Function |
|---|---|---|
| 1 | Vin+ | Input positive end |
| 2 | Ctrl | Enable control end |
| 3 | Vin- | Input negative terminal |
| 4 | Vout- | Negative output terminal |
| 5 | Sense- | Output Sense negative terminal |
| 6 | Trim | Output voltage adjustment terminal |
| 7 | Sense+ | Output Sense positive end |
| 8 | Vout+ | Output positive terminal |

Fig. 9 Terminal Arrangement (Top View, Pin Up) and Appearance Dimension

# 6. Precautions

6.1. Do not reverse the polarity of the power supply. Pay attention to the input voltage range, which is 16V～40V;
6.2. Please use wide PCB leads or thick wires between the power module and the load, and keep the line voltage drop below 1% Vo to ensure that the output voltage of the power module remains within the specified range;
6.3. The measurement of voltage must be conducted at the root of the module terminals, eliminating the measurement errors caused by the test tooling fixtures;
6.4. The impedance of the lead may cause output voltage oscillation or large ripple. Please make sufficient evaluation before use;
6.5. Prevent product collision;
6.6. Pay attention to the "1" pin (or ESD) identification, and weld according to the correct installation direction on the board;
6.7. Heat sink or other heat dissipation measures should be installed to ensure that the shell temperature is lower than the maximum operating temperature specified by the product. The operating temperature range of the product is: -55℃≤TC≤105℃;
6.8. Lead welding temperature is less than 300℃, and welding time should not exceed 8 seconds;

Note:
1. Our products shall be classified and stored according to ISO14001 and relevant environmental laws and regulations after being scrapped, and shall be handled by qualified units;
2. Except for special instructions, all indicators in this manual are measured when Ta = 25 ℃, humidity <75%, nominal input voltage 24V and output rated load;
3. The test methods of all indicators in this manual are based on the company's enterprise standards;
4. Our company can provide customized products, specific needs can directly contact our technical personnel;
5. If the product involves multi-brand materials, please refer to the manufacturer's standards for differences such as different colors.