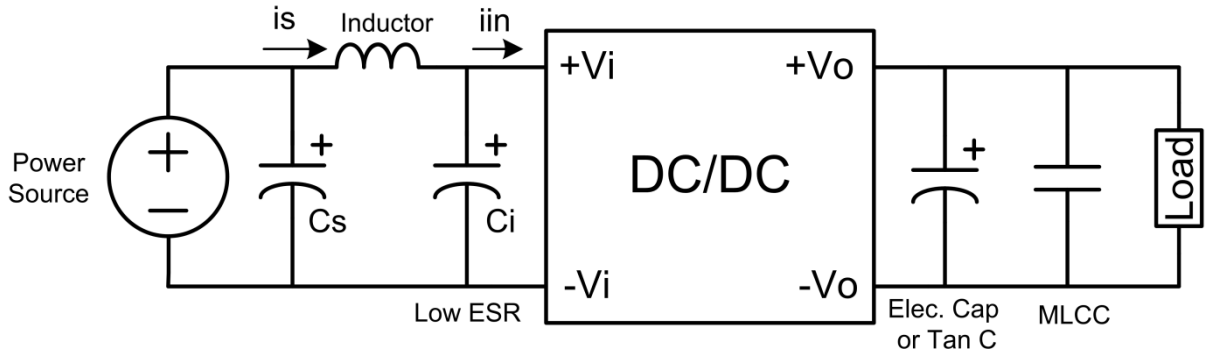
Input source impedance

Chose a low ac-impedance input source because that the DC/DC power modules will affect the module and its stability due to the impedance of the input source. In order to improve the stability, recommend a electrolytic capacitor(Ci) which was closer to the input of module when the source inductance is more than a few μH.

It shows measurement points for Input Terminal Ripple Current(iin) and Input Reflected Ripple Current(is) in this Test set-up diagram.



Measured input reflected-ripple current with a simulated source Inductance. Capacitor(Cs) offset possible Power source impedance

Input Terminal Ripple Current, iin, at full rated output current and nominal input voltage with a source impedance and a electrolytic capacitor.

Input reflected ripple current is through a source inductor at nominal input voltage and rated load current .

Input Voltage Range

DC/DC Module can tolerate between the percentage of the large voltage and the minimum voltage and it maintains the functional performance at full load under the operating temperature range. There are two kinds of input voltage range: Narrow range of input voltage is ±10% and Wide range of input voltage is 2:1, 3:1, 4:1,….

Load Regulation

While the load current is operated at differently, the specified change as a percentage of nominal output voltage. The Load Regulation specified over the load range is from 10% to 100% with a maximum load (this condition is showed in DC/DC datasheet, but each series and each module may be different), usually measure at 25°C, for example, a 0.3V change in output voltage is measured on a 5V device, 6% load regulation. The formula is as follows:

$$\text{Load Regulation} = \frac{(\ V_{out\text{-}10\%Load} - V_{out\text{-}100\%Load}\ )}{V_{out\text{-}100\%Load}} \times 100\%$$

Vout-10%Load: Output Voltage at Input Voltage Nominal line with 10% of rate output load (This condition may be difference by series, it is defined in datasheet.)

Vout-100%Load: Output Voltage at Input Voltage Nominal line with 100% of rate output load.

Line Regulation (OK)

The Input Voltages operates under different of VIN-LOW and VIN-HIGH, usually specified change in output voltage as a percentages. The formulas of Line Regulation are different for Un-regulation and Regulation device, usually measure at 25°C, and the formulas are as follows:

$$\text{Line Reg.} = \frac{\frac{V_{out\text{-}Vin\text{-}H} - V_{out\text{-}Vin\text{-}L}}{V_{out\text{-}VinL}}}{\frac{Vin\text{-}H - Vin\text{-}L}{Vin\text{-}L}} \times 100\%\text{---For Un-Regulation Output Voltage Model}$$

$$\text{Line Reg.} = \frac{V_{out\text{-}Vin\text{-}H} - V_{out\text{-}Vin\text{-}L}}{V_{out\text{-}VinL}} \times 100\%\text{---For Regulation Output Voltage Model}$$

Vout-VIN-L: Output Voltage at Input voltage Low line with rated output load
Vout-VIN-H: Output Voltage at Input voltage High line with rated output load
VIN-H: Input Voltage High line
VIN-L: Input Voltage Low line

Output Voltage Accuracy(OK)

The output voltage accuracy is a measured Output Voltage to the specified nominal value by percentage expression. For example, a 5VDC specified device at Max. Load supply output voltage of 4.99VDC, so the voltage accuracy is -0.2%. Output Voltage Accuracy is then derived by the following formula:

$$\text{Accuracy} = \frac{Vout - V_{out\text{-}Nominal}}{Vout} \times 100\%$$

Vout: Output Voltage, actually measure at device
Vout-Nominal: Nominal Output Voltage, specified in DC/DC converter datasheet.

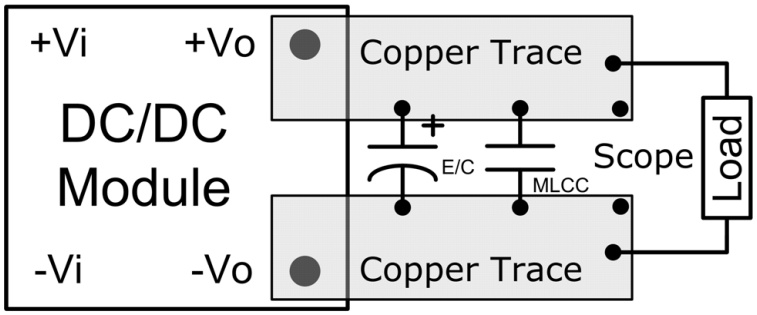
Efficiency

The ratio of output load power consumption to input power consumption presented a percentage. Normally measured is at full rated output power and nominal line conditions , the formula following :

$$\text{Efficiency} = \frac{Vout \times Iout}{Vin \times Iin} \times 100\%$$

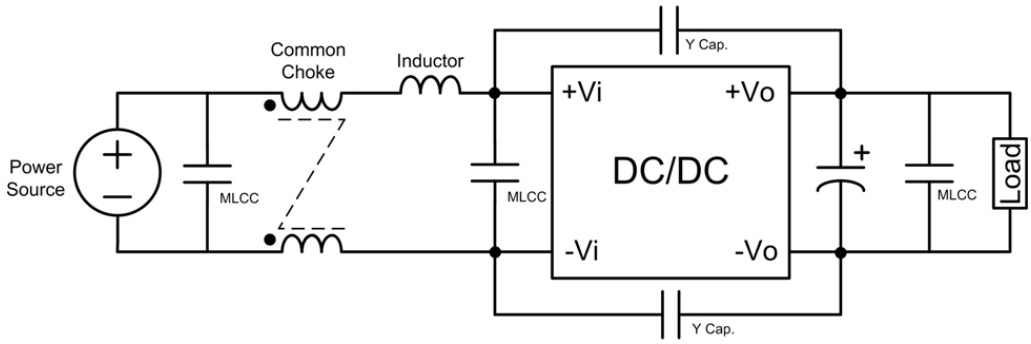
Output Ripple & Noise

Output voltage Ripple & Noise test Load capacitance with a few μF ceramic capacitor and a few μF tantalum capacitor(or Elec. Cap) , ex : 1μF ceramic capacitor and 10μF Elec. Capacitor.
Scope measurements should be made using a BNC cable (length shorter than 20 inches) and Bandwidth should be 20 MHz..
Set the load between 51 mm to 76 mm (2 inches to 3 inches) from the module.
The lead of



Layout and EMI considerations

E-Chin's DC/DC power modules are designed to operate in a wide variety of systems and applications. For design assistance with EMC compliance and related PCB layout issues, please contact E-Chin's technical support team. An external input filter module maybe available for easier EMC compliance design. Below is the reference design for an input filter to pass EN55022 (VDE0878) class A ,even Class B(both q. peak and average).



It is suggested to use multiple layers PCB and large size copper on system board which connects to pins of module, that can achieve better thermal performance.

Over-Current Protection

When the output overloading, the module will bear current limiting for an unlimited duration, because our module include an internal output over-current protection circuit. And the modules will shut down when the output current exceeds the OCP set point.

After shutdown, the module will try to restart. If the overload condition occurs again, the modules will also shut down and restart again and again until the condition is corrected.

Over-voltage protection

An internal output over-voltage protection circuit in the modules can monitors the voltage on the output terminals. When the voltage exceeds the over-voltage set point, the module

will be clamped、latched up or other protection.

Operating Temperature Range

The range of ambient or case temperature within a power supply at which it operates safely and meets its specifications.

Storage Temperature Range

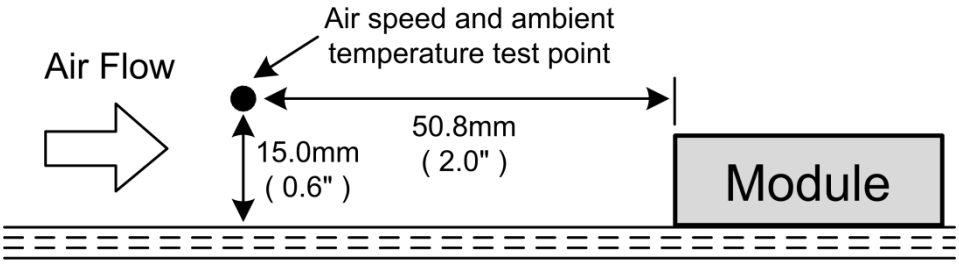
The range of ambient temperatures within a power supply at non-operating condition, with no degradation in its subsequent operation.

Over-temperature protection

When the thermal damage occurs, the over-voltage protection system will protect the modules. Thus, when the temperature exceeds the over-temperature set point, the module will shut down and restart until the temperature is corrected.

THERMAL CONSIDERATIONS

By increasing airflow over the module, heat can be removed. To improve the system reliability, the temperature in the case of power module should always be set below 105℃. If the case temperature exceeds the maximum operating temperature, reliability of the unit may be affected.



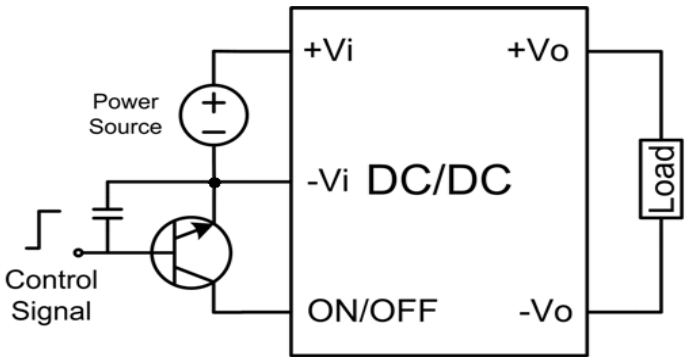
Remote on/off

The module can be either negative or positive logic due to the remote on/off function, and it mainly depends on the part number options on the last page.

- Considering to the negative logic version, when the external logic is low, turn on the module. And when the external logic is high, turn off the module. If the remote on/off function isn't used, please short the on/off pin to Vi(-).
- Considering to the positive logic version, when the external logic is high, turn on the module. And when the external logic is low, turn off the module. If the remote on/off function isn't used, please short the on/off pin to floating.

External switch between the on/off terminal and the Vi(-) terminal can control remote on/off. The switch can be an open collector or open drain.

Recommend circuit is following:



Output voltage adjustment(TRIM)

When the module is with TRIM pin, Output Voltage of the module is adjustable by external component .

Normally, the module connect an external resistor($R_{Trim\ up}$) between the TRIM pin and the Vout(-) in order to increase the output voltage set point.

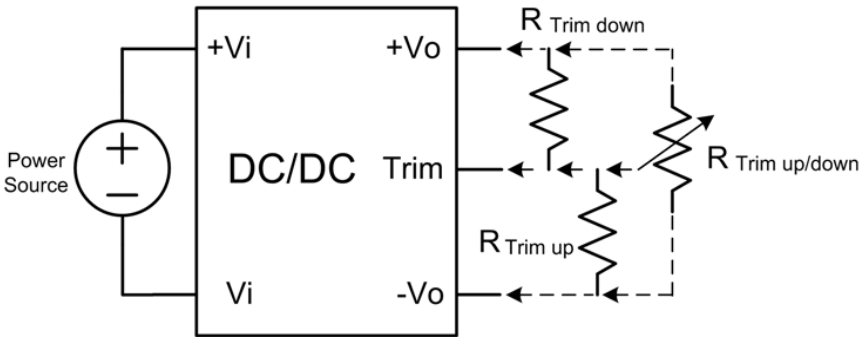
The module connect an external resistor($R_{Trim\ down}$) between the TRIM pin and the Vout(+) in order to decrease the Output Voltage set point.

Also can connect an external adjusted resistor ($R_{Trim\ up/down}$)between the TRIM pin , Vout(+) and Vout(-), then Output Voltage can be adjusted up or down .

Normal, the maximum adjust range is ±10%, if this function is not used, the trim pin should be left open.

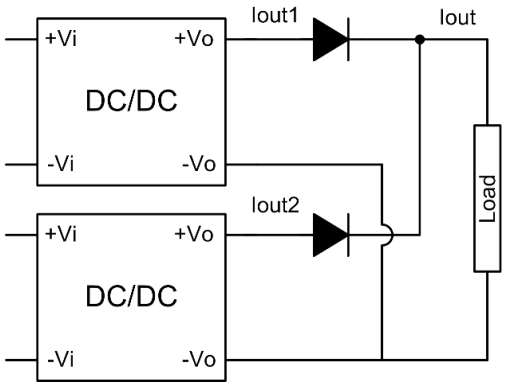
For example:

If you have trim rise up to 3.4V, then the external resistor should be 100Kohm which is between trim pin and Vout- pin. If you had trim fall down to 3.1V, then the external resistor should be 40Kohm between trim pin and Vout+ pin, applicative circuit is following:



Redundancy Operation

Providing power redundancy is great for parallel operation of power converters. Modules can be wired in redundancy operation as shown below:



- Even a slight difference in output voltage can affect the balance between the values of I1 and I2.
  You should ensure that the value of I3 does not exceed the rated current for each power supply.

Isolation Voltage

The insulator breakdown strength could be endured between input and output circuits. This is the isolation voltage is capable of withstanding for a specified time The specification of generally is DCV or ACV, the common specification is 500VDC, 1KVDC, 1.5KVDC, 8KVDC , and so on. It is able to decide by the markets for the customer demands.

Isolation Resistance

The resistance separation is between input and output of a converter. The common specification is often for 1GΩ, 10GΩ.

Isolation Capacitance

The capacitance diffuse between the input and output circuits. Isolation capacitance is typically measured at 1 MHz to reduce the possibility capacitors of the filter on board that affecting the results.