Protect – 5-30 V DC Power Protection Module for Over-Voltage, Reverse Polarity, and Reverse Current Protection

1. Features

- Active over-voltage detection module with auto-recovery
- 5 to 30 V Input Voltage
- 2S-6S Lithium Battery Input
- 25 A continuous current rating
- >96% efficient over all ranges, with >98% typically achievable
- Soft-start power-on
- Optional Enable function using low-power switch
- Optional open-drain fault signal pulled high to Vcc.
- Reverse Current Blocking due to ideal diode functionality
- Reverse Polarity Protection to -40 V
- High-Current XT-60 Connectors rated for 30 A continuous – with connecting pair included

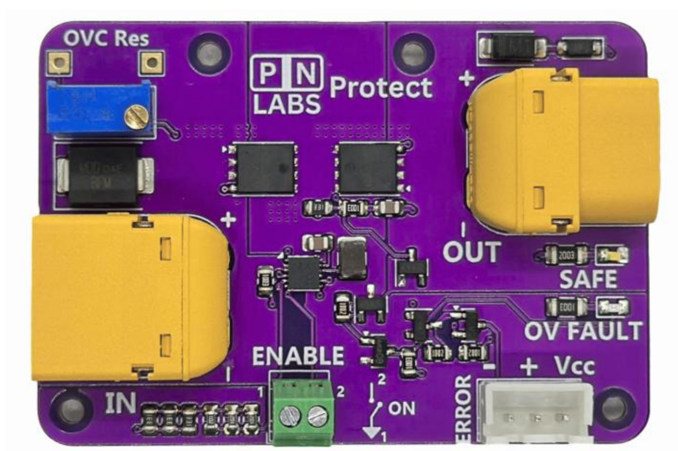
2. Applications

- Testing Equipment
- Robotics
- Protection from Adjustable PSUs being set incorrectly
- Power Paralleling/ORing multiple supplies

3. Description

The PN Labs Protect is your essential safeguard for preventing accidental incorrect applications of DC power from destroying your electronics. It sits between your power source and load, continuously monitoring input conditions and disconnecting the load if unsafe voltages are detected—preventing costly damage. It supports a 5 to 30 V input range and can be adjusted to block any voltage between those values, while withstanding applied voltages up to 40 V. With >98% typical efficiency, ± 3% over-voltage cutoff accuracy obtainable via adjusting the OVC resistor, it adds a reliable level of protection to any electronics project and should be a no-brainer for protecting systems that may be exposed to over-voltage conditions. Its compact, high current design with its ideal diode functionality also allows it to be used to isolate multiple power supplies in parallel – known as power ORing.

Product Photo

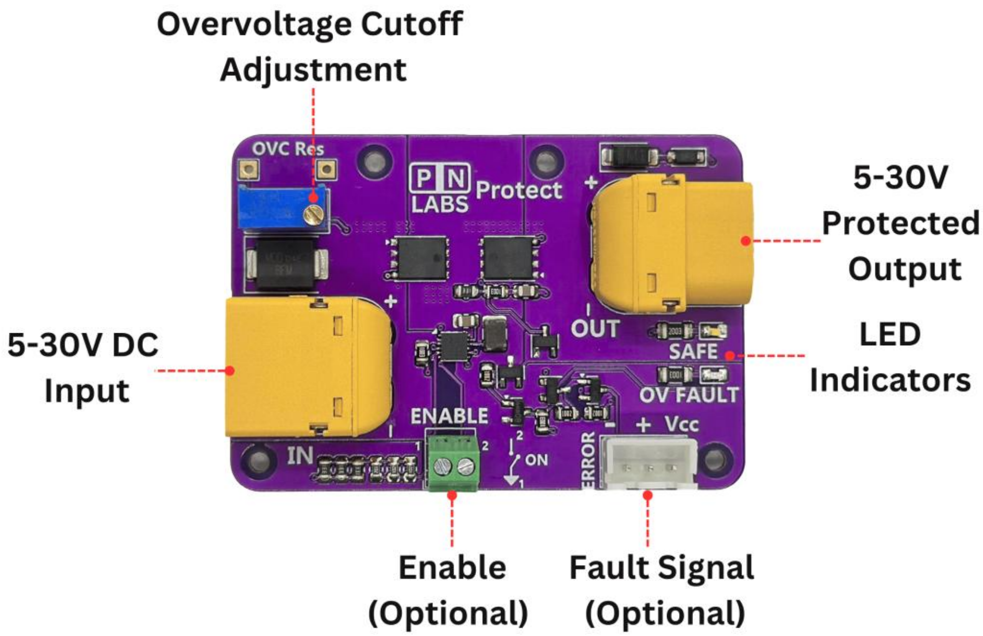


The PN Labs Protect

4. Revision History

- January 2025 - Released
- August 2025 – Updated Applications section and added more photos

5. Board Diagram and Set-up Guide



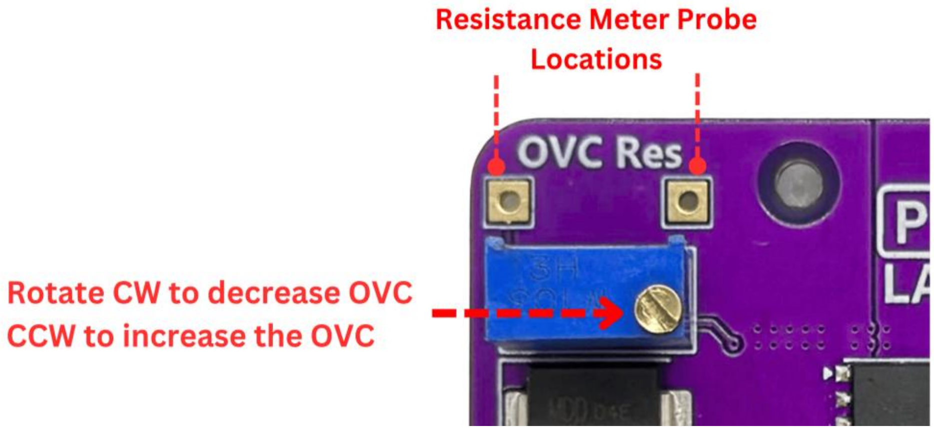
To set up the Protect module for **protection operation**, do the following:

1. Calculate the required value of the OVC resistor from the equation, where X is the value of the cutoff voltage in volts:

$$\mathbf{OVC\ Res\ (k\Omega) = (X - 1.95)/2.89}$$

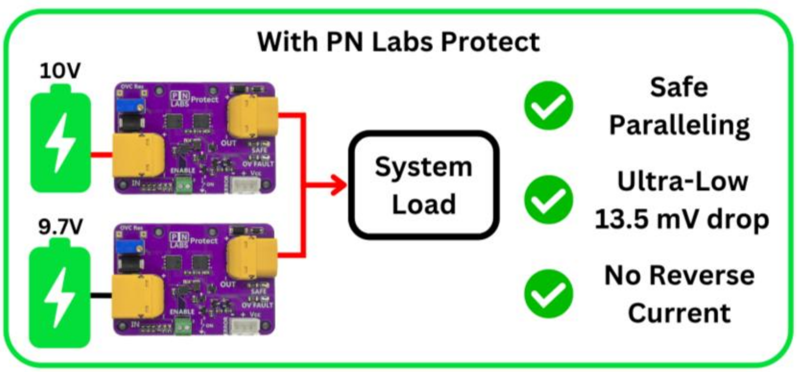
   This equation is accurate to 2-3 % between all modules for various resistances based on internal testing. If you want higher accuracy, we recommend calibrating the unit with the potentiometer and then soldering a fixed 0.1% tolerance or better through-hole resistor between the OVC Res pads.

2. With the power turned off so you don't apply any external voltage to your multimeter, probe the OVC pads in resistance mode and adjust the potentiometer to set the OVC Resistor to its required value:



3. With the OVC resistor now set, you can now plug it into your circuit and turn the power on. If you are using the fault signal or attaching a SPST switch to the enable terminal block for power path control, now is the time to do it. When the module is off, the fault signal will come on and light the fault LED. When the module is turned back on, the safe LED will come on as the fault LED turns off.

For **parallel operation**, you can use the over-voltage cutoff or set the OVC Resistor to be 10k, effectively rendering it ~31 V. Use one Protect module per power source, and connect them to a common bus using wires that are roughly equal length so that voltage drop across the cabling is similar.



Please note that the Protect module does not ensure that the supplies share the current equally when put in parallel- that comes from ensuring both supplies are near the same voltage, about 50 mV or so. We found during testing that the supplies need to be within 0.5 V of each other to be able to share the load at all.

6. Specifications

Stresses beyond those listed under Section 6.1 may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Section 6.2. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

6.1 Absolute Maximum ratings

At 25 °C ambient temperature.

	MIN	NOM	MAX	UNIT
Input Voltage	4	-	35	V
MOSFET Drain-Source Voltage	-	-	40	V
Vcc	-	-	30	V
Output Current	-	-	30	A

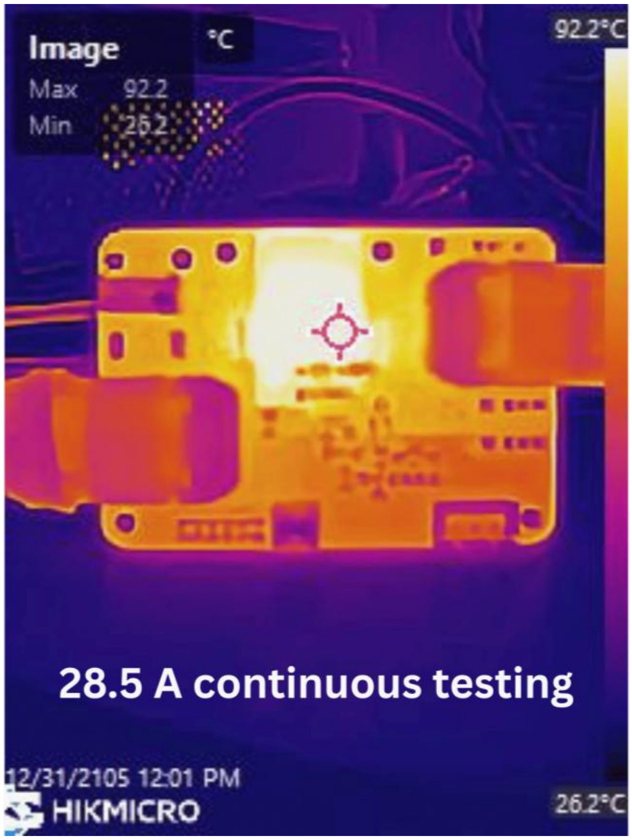
6.2 Recommended Operating Conditions

At 25 °C ambient temperature.

	MIN	NOM	MAX	UNIT
Input Voltage	5	-	30	V
Vcc	-	-	25	V
Output Current	0	-	25	A

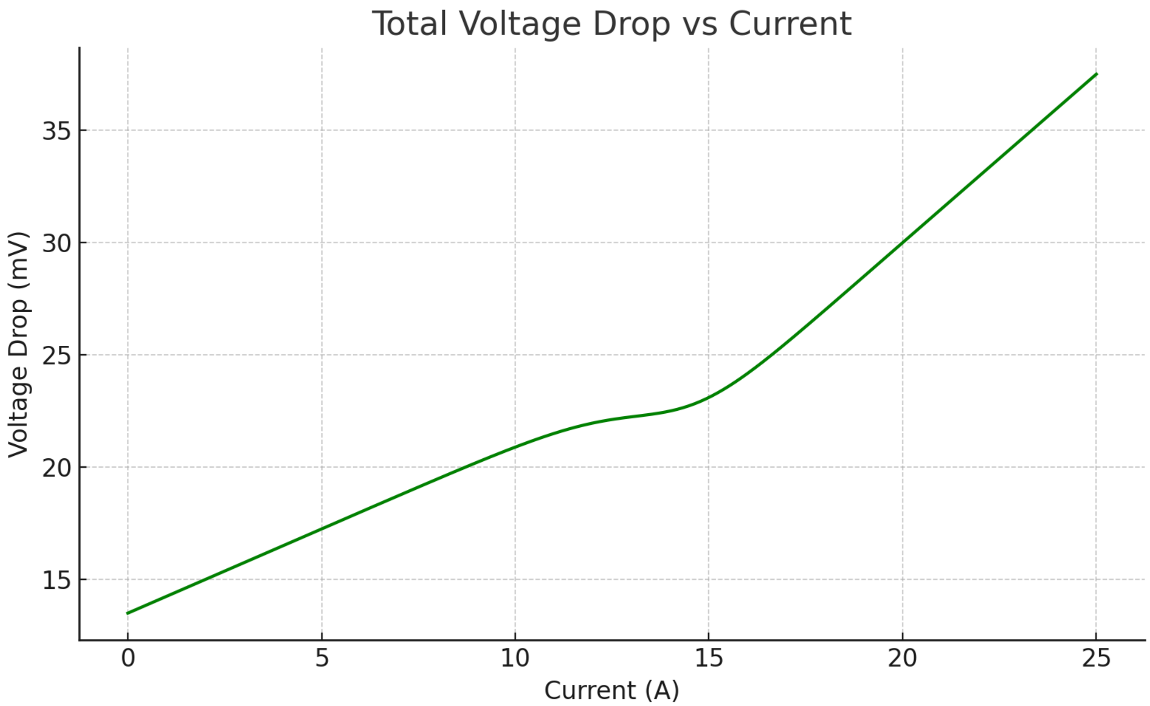
6.3 Thermal Information

5V input, drawing 28.5 A for around 5-8 minutes.



6.4 Inline Voltage Drop vs Current Supplied Characteristics

The total voltage drop of the unit is given by the drops across the two MOSFETs in series with the power path. The first MOSFET that is used for reverse current blocking is held at a drop of 13.5 mV until about 14 A of continuous current is reached, upon which it starts increasing corresponding to its fully enhanced drain-source resistance of 0.75 milliohm. The second MOSFET used for power path control should always be fully enhanced, so the overall drop should theoretically be:



6.5 Soft-start Behavior on Start-up

The soft-start protection window is shown below, first in the case where the OVC threshold is exceeded, and then during a successful turn-on when the voltage is less than the threshold.

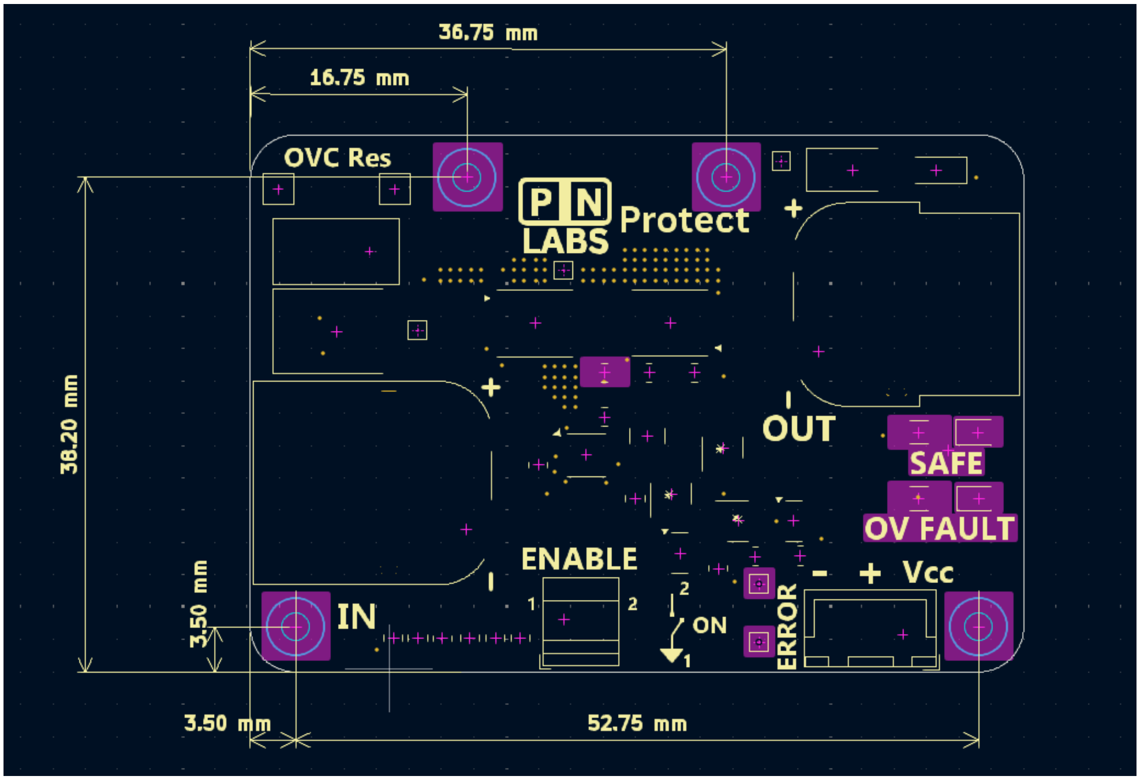
The input is 24.75 V and the OVC threshold is around 22 V, and the output of the Protect is unloaded:

As can be seen, there is a 10 ms transitory period where the Protect is turning on but the MOSFETs have not fully been enhanced, then when the threshold is exceeded it stops the turn-on process. In the capture below, the input voltage was dropped below the threshold and a successful turn-on is shown:

As can be seen, the output voltage becomes ramped to the final value over about 60 ms.

7. Mechanical Dimensions

Reach out to us get the STEP file to load into your favorite CAD software.



Further Questions? Reach out to us and we'll answer!