

Protect Nano – Adjustable Power Protection Module for 3.3, 5 and 12V DC for Over/Under-Voltage, Overcurrent, Reverse Current and Polarity

1. Features

- Active over/under-voltage detection with auto-recovery
- Suitable for systems operating at 3.3, 5, 12 V at currents of up to 5 A continuous
- Reverse polarity protection (to -12 V) Reverse current blocking (ideal diode) feature
- Latch-off overcurrent protection at adjustable levels of 1, 3 or 6 A
- Electrical or Mechanical reset option
- Digital interface featuring Power Good and Reset signals
- Breadboard-compatible (header pins), SMT-mountable, or usable with included terminal blocks (footprint included)

2. Applications

- Power supply protection for Arduino, ESP32, and other MCUs that operate at 5 or 3.3 V
- Power ORing or Power Multiplexing applications
- Protection from Adjustable PSUs being set incorrectly
- High-side load switch operated via the Reset pin

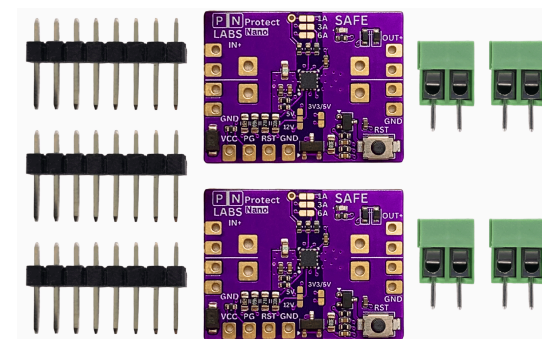
3. Description

The Protect Nano is your essential safeguard for preventing accidental applications of DC power from destroying your electronics. It sits

between your power source and load, continuously monitoring power conditions and disconnecting the load if the input voltage falls outside the allowable window, or the overcurrent threshold is exceeded. It can safely block applied input voltages up to 14 V (3.3 V mode) and 25 V (5 and 12 V modes) with auto-recovery, while also featuring reverse polarity protection to -12 V.

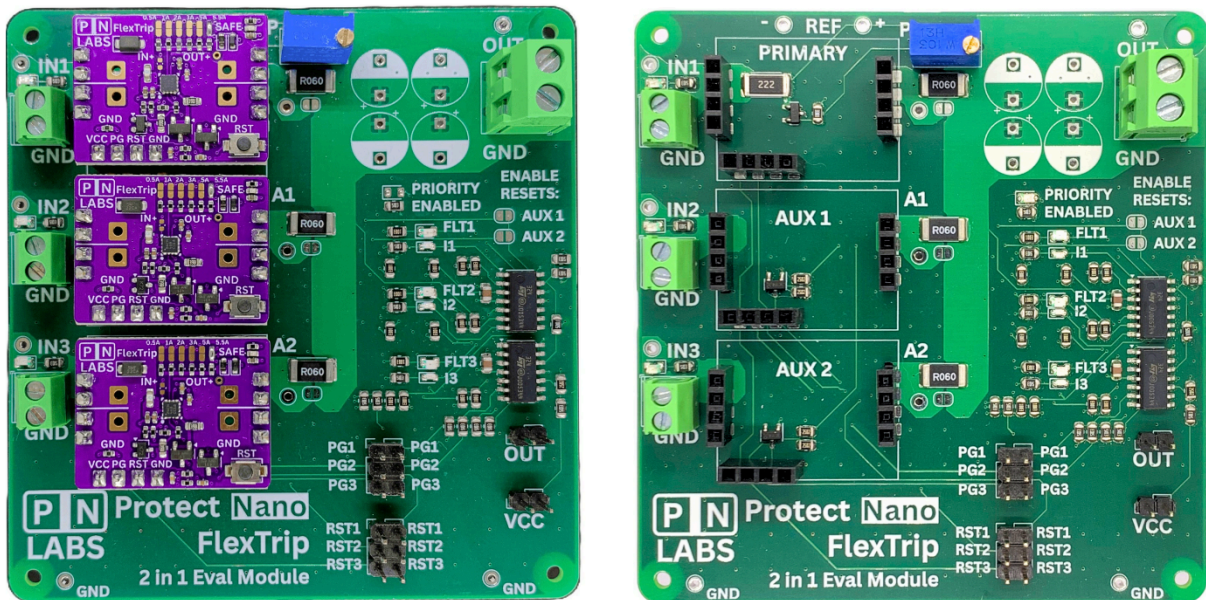
In addition to adding a reliable level of protection to any electronics project, the Protect Nano's ideal diode and reset functionality can also be used to parallel multiple supplies in a power ORing or power multiplexing configuration. This makes it an excellent choice for configuring your projects to work from multiple power supplies for redundancy, to extend battery life, or to prioritize power from an external source instead of an onboard battery.

Product Photo



Check out our 2-in-1 Evaluation Module for evaluating and to assist in understanding of FlexTrip and Protect Nano. This is a helpful tool for understanding how power-good and reset signals on the board behave, and features:

- Current indicator LEDs
- Fault, Input, and Priority Enabled LEDs
- External comparator with adjustable threshold for creating a priority power multiplexing scheme between the Primary (top) and Auxiliary (two bottom) channels.

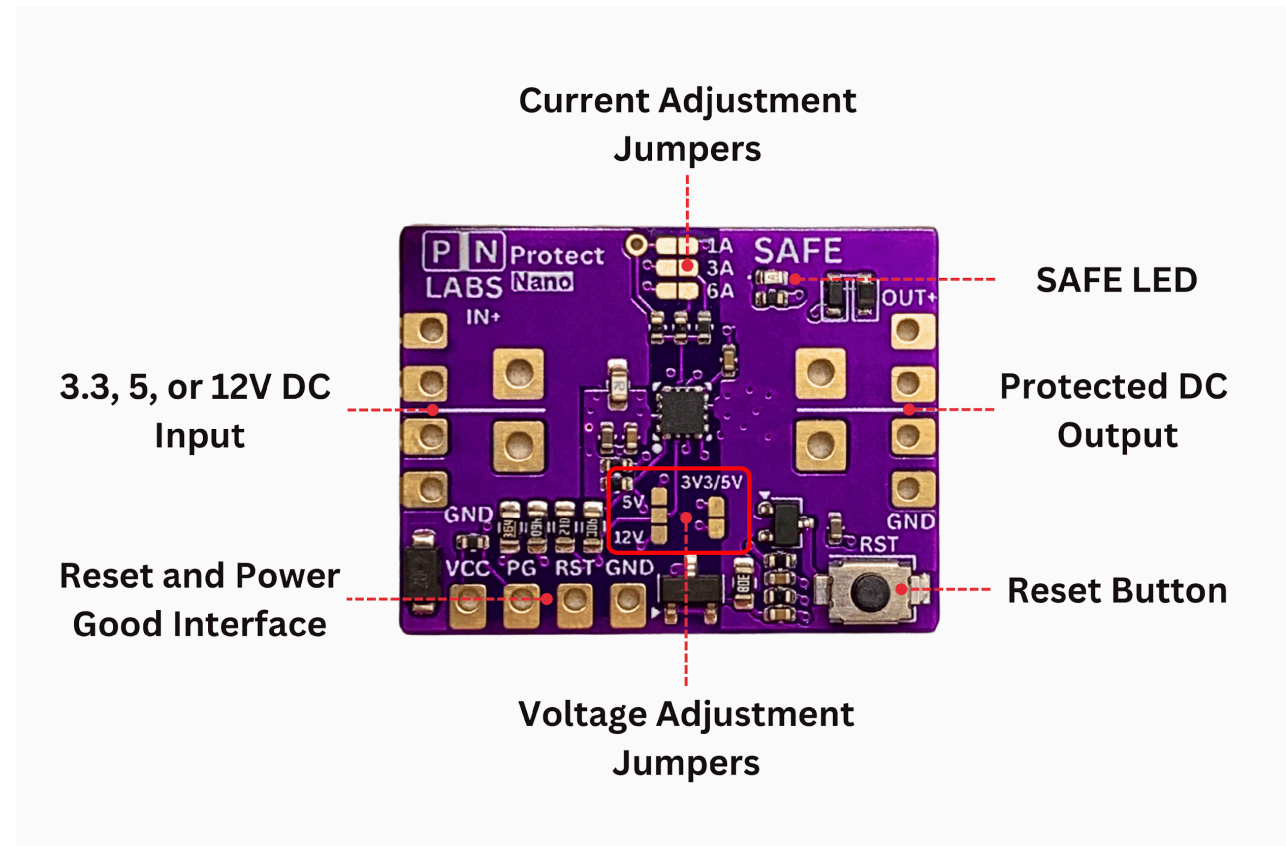


You can use it with up to three Protect Nano/FlexTrip modules.

4. Revision History

- October 2025 – Released

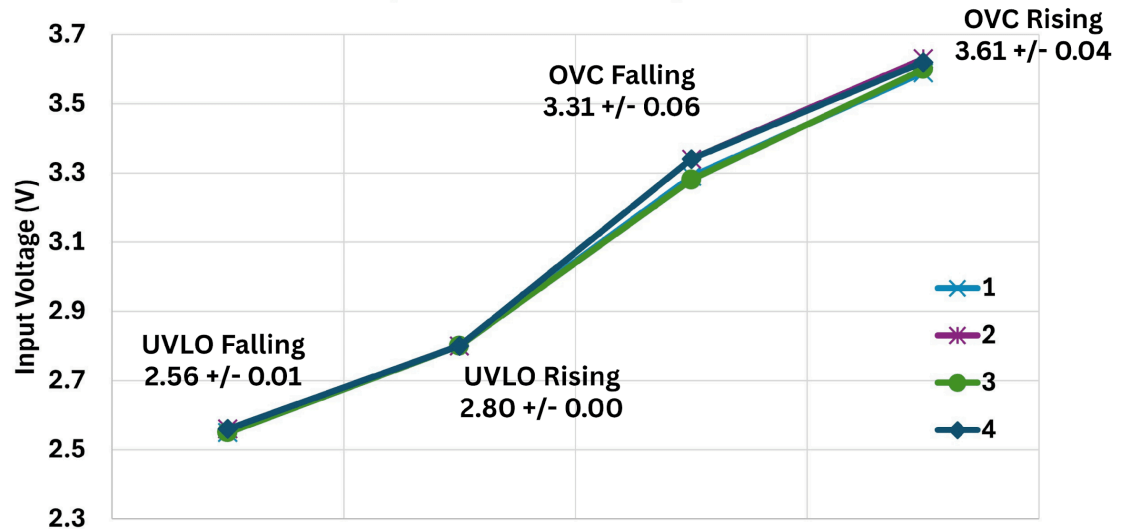
5. Board Diagram and Set-up Guide



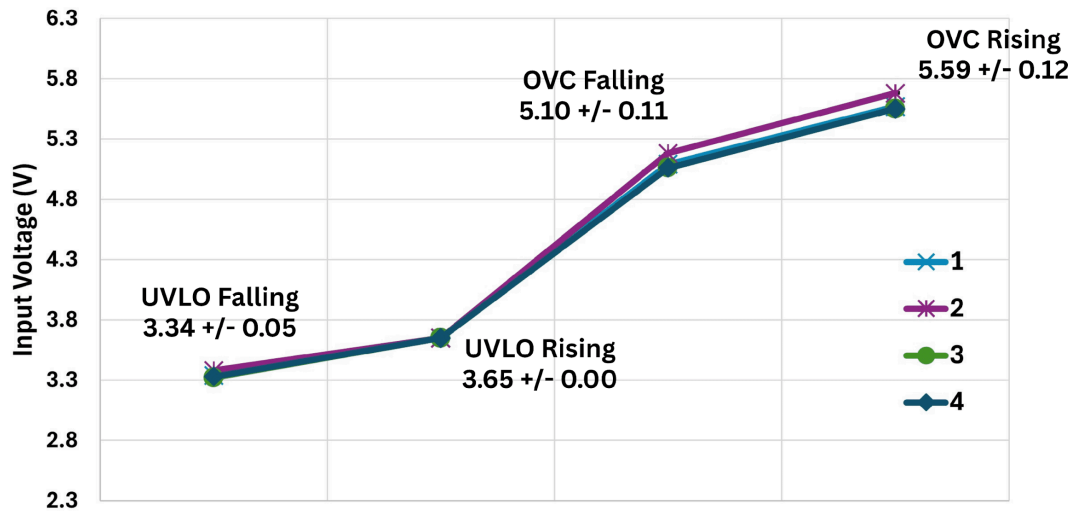
To set up the Protect Nano module for **protection operation**, do the following:

1. View the three selectable voltage windows shown below and determine which of the 3.3, 5 or 12 V settings is most appropriate for your application. Also consider which current setting jumper to solder, as **the board will not operate without one of these jumpers connected**.

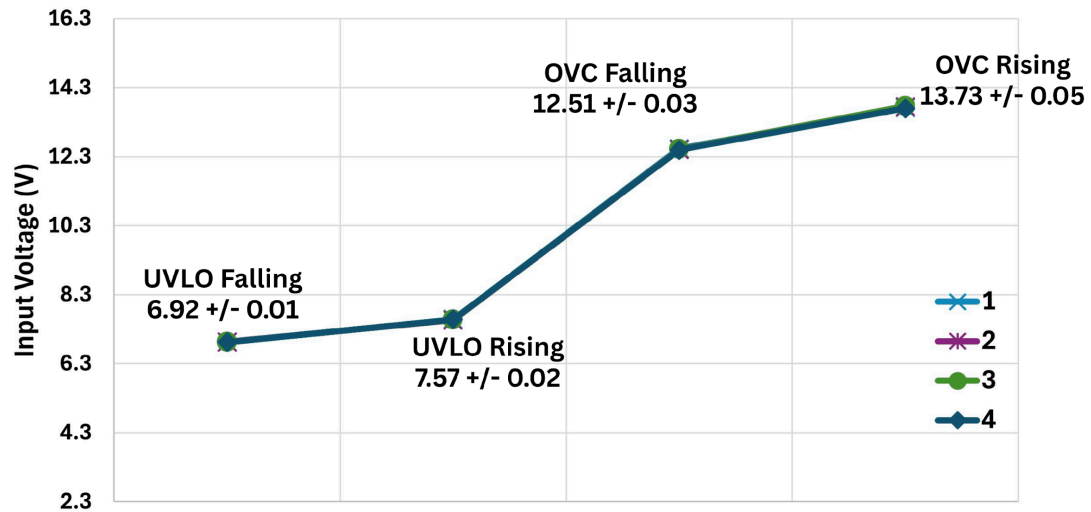
3V3 Operation Auto-Retry Behaviour



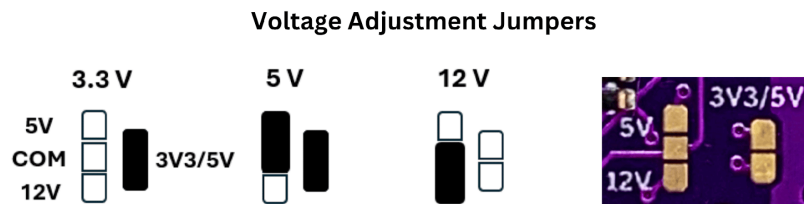
5V Operation Auto-Retry Behaviour



12V Operation Auto-Retry Behaviour

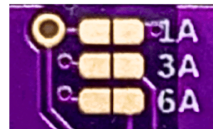


2. Solder the selected current and voltage jumpers, the configurations which are shown below:



Current Selection Jumpers

Only one jumper should be connected.



3. Solder the header pins or screw terminal connectors to the board. For pin headers, we recommend using a breadboard to hold them in place while you solder them.

Overcurrent Response Behavior:

The overcurrent threshold is defined solely by soldering the corresponding solder jumper.

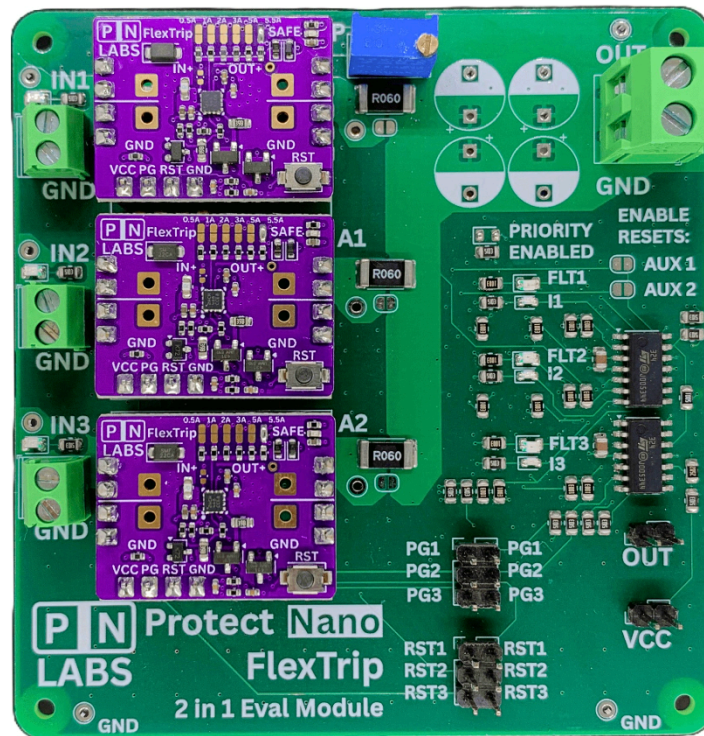
- If downstream loads attempt to exceed the set current limit, the device will actively regulate the input voltage in an attempt to keep the current within the

limit. If enough heat is dissipated in the device such that its over-temperature feature activates, it will latch off.

- If the overcurrent event is severe enough that it exceeds double the set current limit, the device will skip current limiting and immediately shut down, latching off.

For **paralleling operation**, use one Protect Nano module per individual power supply.

1. Set each of their voltage and current settings to be the same (mandatory for paralleling operation).
2. Connect them in a common bus configuration, with the outputs tied together. One example is shown on our Eval module below:



This configuration isolates the power paths by virtue of the internal ideal diode to the Protect Nano IC. Both paths should share the current equally if the input voltages are the same, with current sharing ceasing if the voltages have a difference greater than ~0.6 V.

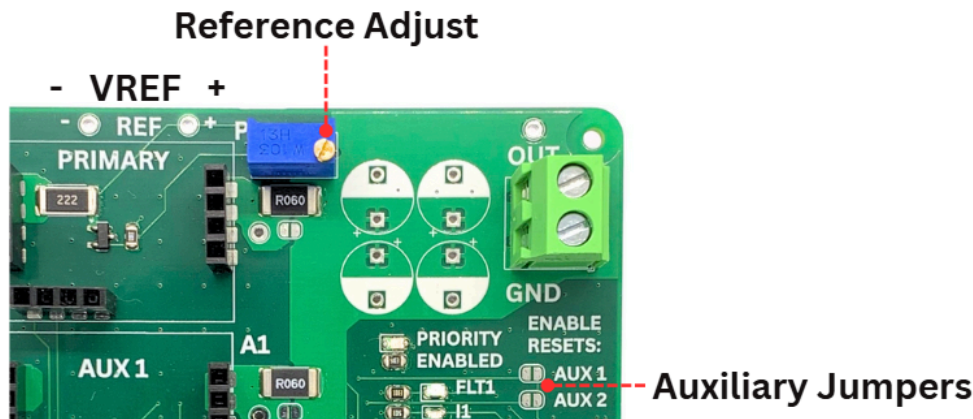
3. Turn on your supplies and hook up the load, you can watch them share the current in real time by adjusting the voltages of your supplies! If you're using the demo module, the blue LEDs show the active path where current is flowing.

Another very popular configuration is called Priority Power Multiplexing, which prioritizes one power path when available, disabling the others. If the preferred path falls below a voltage threshold, only then do the auxiliary supplies turn on.

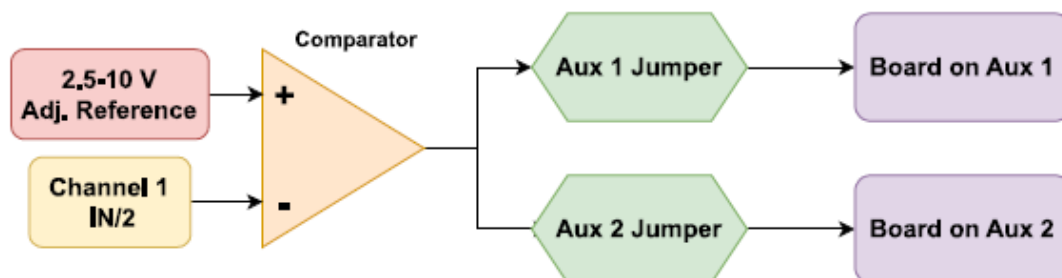
To operate the Protect Nano in Priority Power Multiplexing (PPM) configuration, a reset signal between 3 – 15 V must be sent to the reset (RST) pins of the lower priority supplies when the priority supply is valid. This is done on the Eval module using a comparator and adjustable voltage reference:

Aux channels turn off when:

- Input to Primary channel is $< 2 \cdot V_{REF}$
- Corresponding aux jumper is soldered



A block diagram of this situation is shown to aid in understanding:



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 can affect device reliability.

6.1 Absolute Maximum ratings

At 25 °C ambient temperature.

	MIN	NOM	MAX	UNIT
Input Voltage (3V3 Mode)	-	-	15	V
Input Voltage (5 V and 12 V Mode)	-	-	25	V
Vcc	-	-	20	V
Output Current	-	-	5.5	A

6.2 Recommended Operating Conditions

At 25 °C ambient temperature.

	MIN	NOM	MAX	UNIT
Input Voltage (3V3 Mode)	2.8*	3.3	14	V
Input Voltage (5 V Mode)	3.65*	5	23	V
Input Voltage (12 V Mode)	7.57*	12	23	V
Vcc	3	-	15	V
Continuous Output Current	0	-	5	A

*Given by UVLO (Rising) – See previous plots

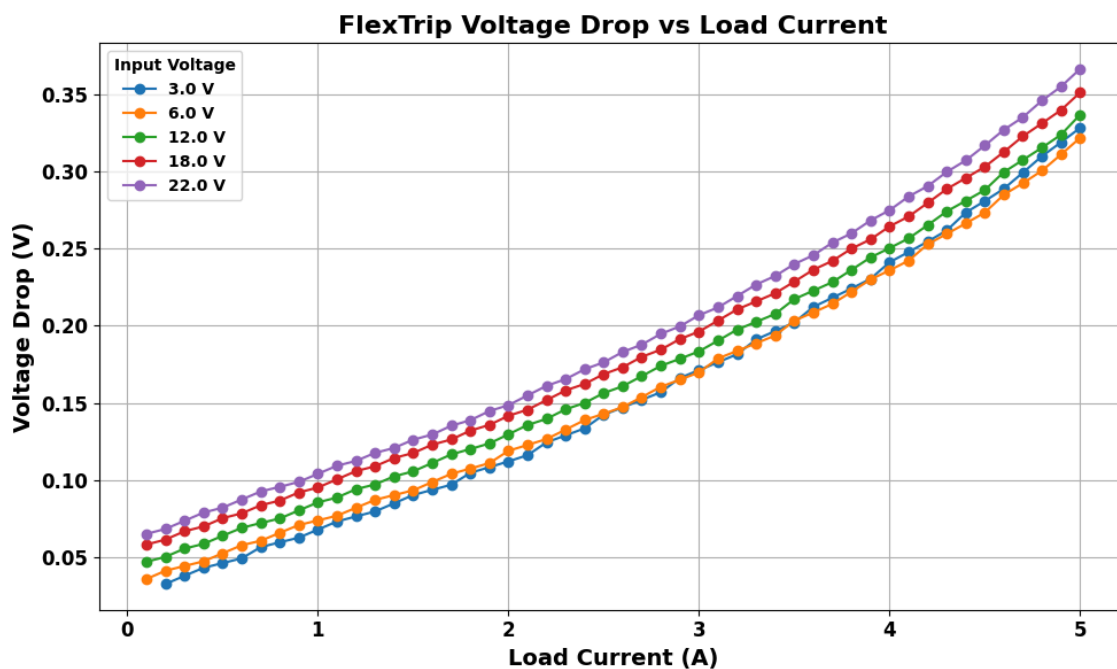
6.3 Thermal Information

Shown below is the thermal profile of the Protect Nano running 5 A continuously for about 8 minutes at about 5 V input voltage.



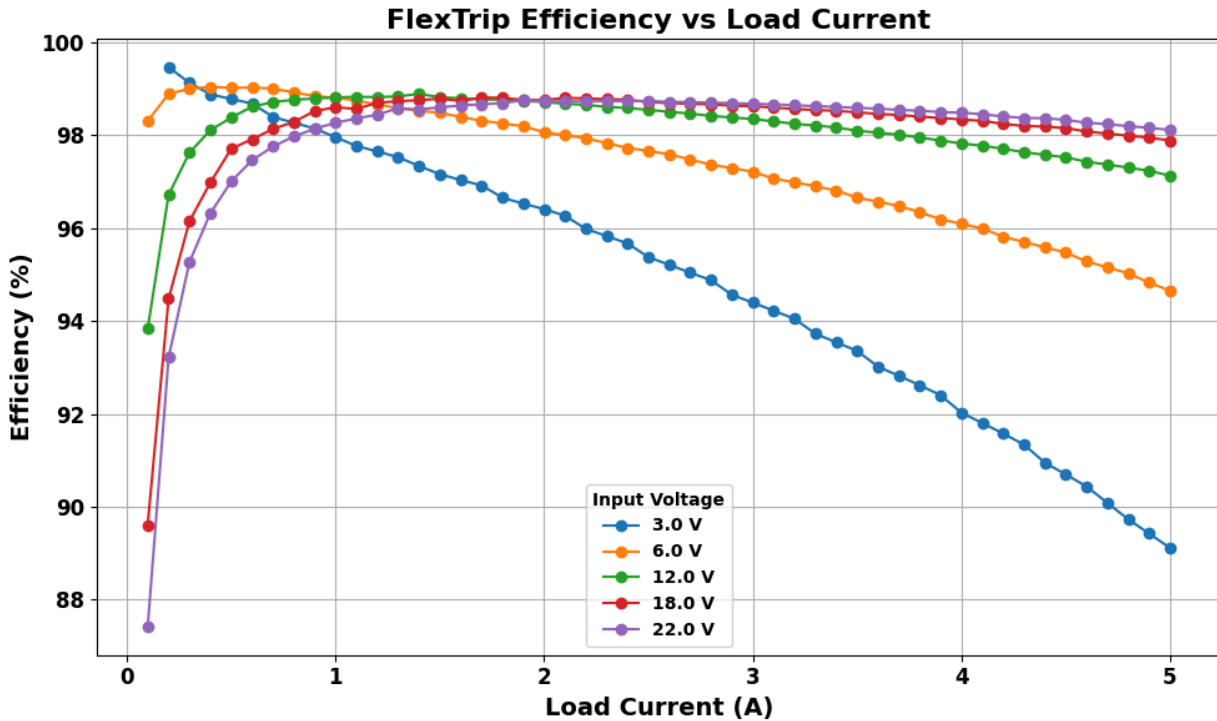
6.4 Inline Voltage Drop and Efficiency vs Load Current Characteristics

The total voltage drop was measured using a programmable electronic load and power supply for a similar product, FlexTrip, which is equivalent to the Protect Nano with its voltage cutoffs removed:



For the Protect Nano, the curves of interest would be the 3, 6, 12 V operating curves corresponding similarly to the 3.3, 5 and 12 V modes of operation.

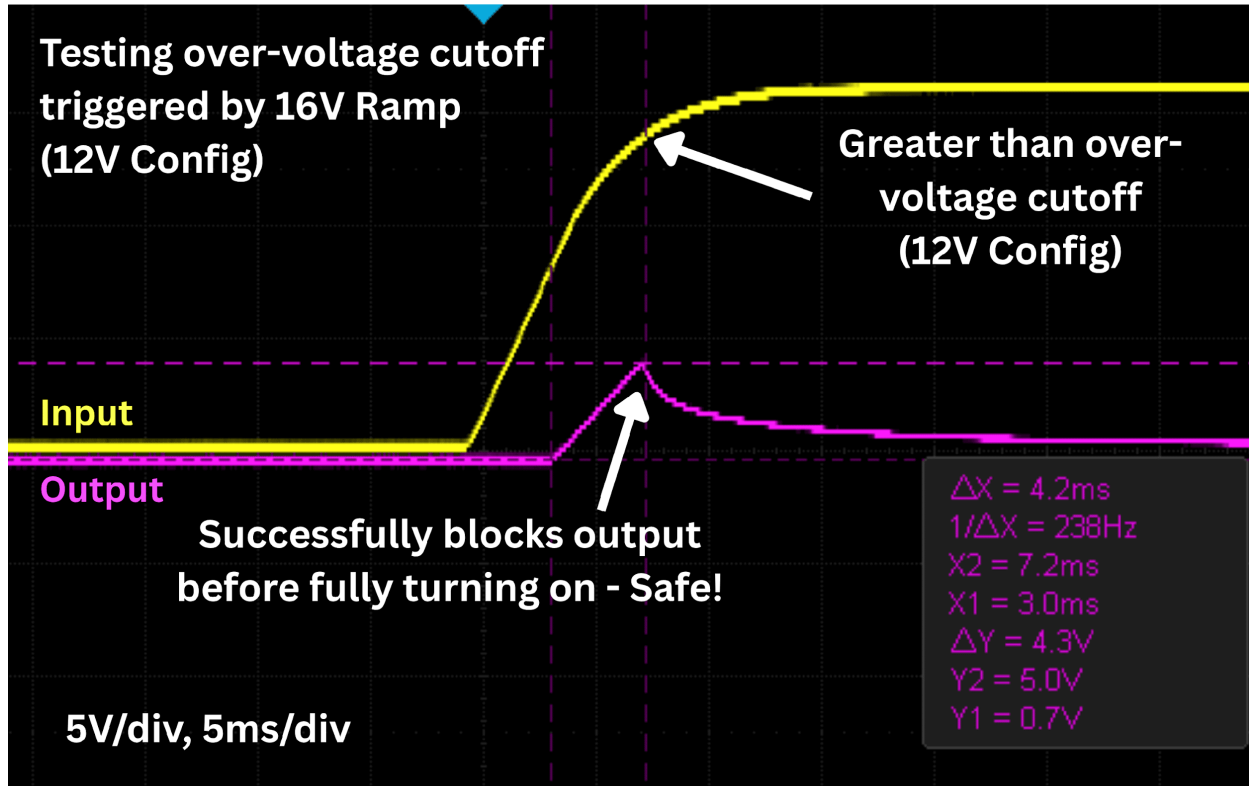
The efficiency was similarly measured and is shown below:



The efficiency was measured as a standard DC:DC converter. A 4-wire measurement of the output voltage on the electronic load was made, and the output of the power supply was compensated to account for the voltage drop in the wires going to the device.

6.5 Soft-start Behavior on Start-up

Upon start-up, the Protect Nano will ramp the output at approximately 1 V/ms after the under-voltage condition is exceeded until the output reaches its final value. During this ramp, the Protect Nano is checking the input voltage to see if it ever exceeds the OVC limit defined by its operating mode, shown previously, and will pause the turn-on process if the input voltage ever exceeds the threshold, as shown below:

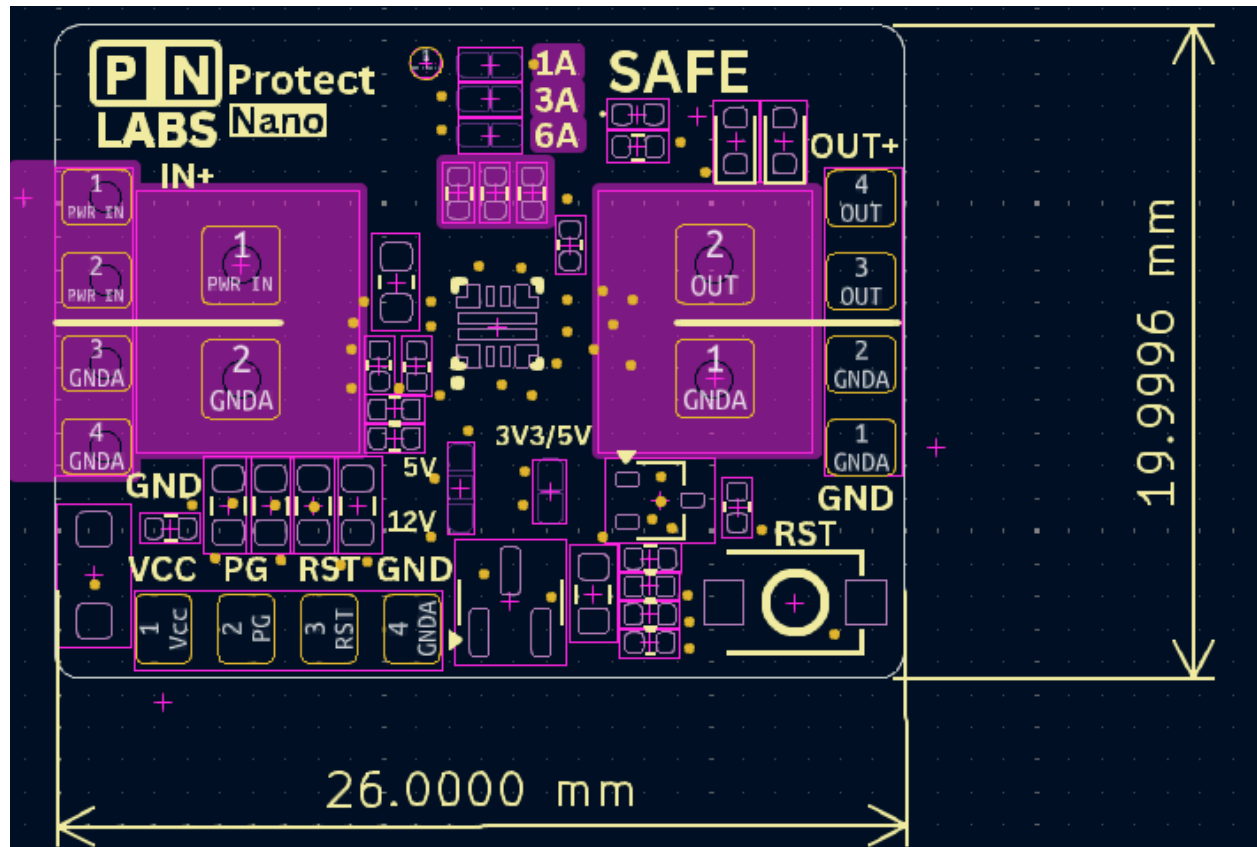


As can be seen in the photo above, when the 13.5 V OVC threshold is exceeded in 12 V mode, the turn-on process is paused and the voltage falls from its peak value at 5.0 V, so the downstream devices never see this 16 V setting that otherwise would have been applied!

Note that the voltage cutoffs operate with auto-recovery behavior, it is only the over-current response that is latch-off, i.e., if the voltage falls back down to within normal limits, the Protect Nano will turn on again.

7. Mechanical Dimensions

Download the STEP file from our website for integration into your favorite CAD software!



Further questions? Found an error or need clarification?

Reach out to us at support@pnlabs.ca!