

# **MPPT Leaf**

## **Users Manual**

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# 1 Copyright

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## 3 Safety

The hardware described here is an electrostatic sensitive device. This means it can be damaged by common static charges which build up on people, tools and other non-conductors or semiconductors. To avoid such a damage, it has to be handled with care and including all relevant procedures (like proper grounding of people handling the devices, shielding/covering to not to let a person touch the device unwanted, proper packaging in ESD-bags, ...). For more information please refer to related regulations and standards regarding handling of ESD devices.

The hardware described here is a component which is intended to be used as part of a larger device.

This document describes the MPPT Leaf-hardware but may contain errors or may be changed without further notice.

## 4 Overview

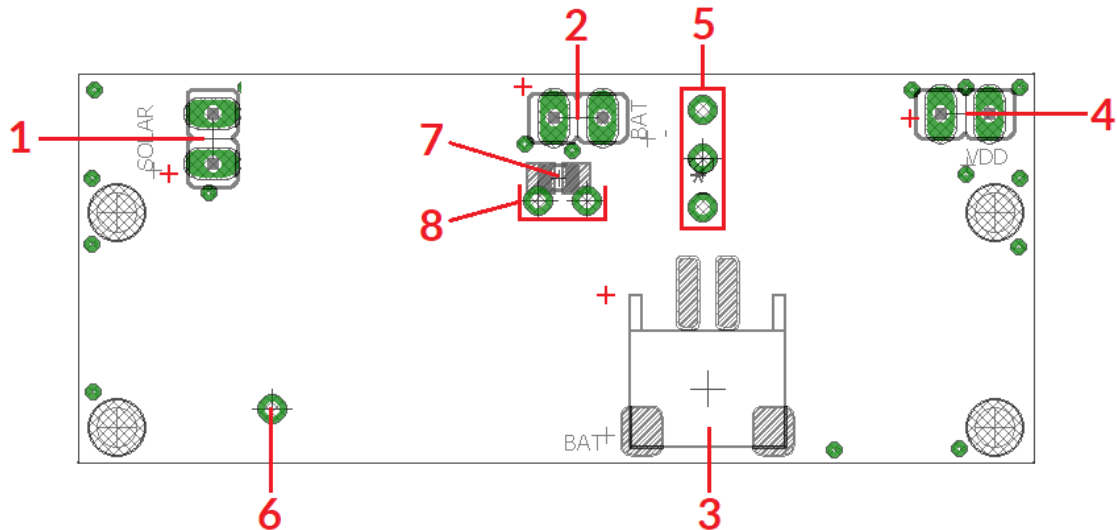
This document describes the MPPT Leaf wide-range power supply module, its electrical characteristics and usage. It is designed for various applications which gain their power from solar cells or any other (variable) power sources and can be used with a battery optionally to bridge input power failures. It is not a ready-to-use device but a component which is intended to be integrated in larger devices.

### 4.1 Features

The MPPT Leaf solar energy harvester provides the following features:

- wide input voltage of 4,95 .. 32 V which makes it possible to use a wide range of solar cells or other (variable) power sources
- modern MPPT (Maximum Power Point Tracking) technology to gain power also when solar cell is partially covered or not placed in full sunlight
- charge controller for optional LiPo batteries
- up to 900 mA battery charging current
- deep-discharge-protection to save battery
- stabilised 5 V output with up to 800 mA
- can be extended by optional board that provides an additional 3.3 V output

## 5 Boards And Connectors



The MPPT Leaf board is an all-in-one solar charging controller which provides following connectors and interfaces:

1. Solar power input to be used with a solar cell or with any other power supply. Here DC with a voltage of up to 32 V can be provided, a voltage range of 4,95 V .. 32 V is used effectively by charging the battery and providing power.  
On this connector positive pole (+) is the lower one, negative (-) the upper.
2. Optional: battery connection for a single 3.7 V LiPo battery cell. When a battery is connected, it is charged with a maximum current of about 900 mA and up to a maximum charging voltage of 4.2 V. During operation and discharging the voltage of the battery is checked, the following hardware is turned off when dropping below a voltage of 3.0 V. Other maximum charging voltages and other deep-discharge-thresholds for other kinds of batteries are available on request.  
Please note: also when the main hardware is turned off, there is still a minimal current of about 50  $\mu$ A still pulled out of the battery. So in case of dropping below the lower limit, ensure to provide power soon in order to avoid a deep discharge and damage of the battery! Alternatively the board also can be turned off via a switch (8) in order to cut off the load completely.  
Please note: choose a suitable LiPo battery with a capacity that fits to the maximum charge current mentioned above in order to avoid damage from the battery!  
**Please note: when no battery is used, here a capacitor of about 100  $\mu$ F has to be placed. In case of an electrolytic capacitor please note the polarity, placing it wrong can damage the board!**  
On this connector positive pole (+) is the left one, negative (-) the right.
3. Optional: battery connection via a standard JST connector. This connection is completely parallel to the one described at (2) and can be used for pre-manufactured battery cells that come with a JST connector. It is recommended to use only one of both connectors (2) or (3). For a description of this connector, please refer to (2).
4. 5 V voltage output which allows a maximum current of up to 800 mA.  
On this connector positive pole (+) is the left one, negative (-) the right.
5. Extension connector, reserved for future use. Here an other power converter can be added in order to provide e.g. an additional 3.3 V output in addition to the on-board 5 V
6. Optional: Thermistor connector, to be used with a 10 kOhm NTC connected to ground and to measure battery temperature. When this thermistor is used, the battery charge controller takes the actual temperature of the battery into account and limits the charging current when it becomes too hot. Can be left open otherwise.

7. Solder jumper to permanently power the connected electronics from power input and/or battery. When a switch via connection at (8) is used, this solder jumper has to be removed/opened.
8. Optional: solder pads for a two-pole header which can be used to connect a switch to cut off solar input and battery charging part. Using such a switch the whole 5 V part can be turned off leaving only the solar and battery-charging function active. This ensures the battery is still charged also when the connected control electronic is not used. Before connecting such a connector, the solder jumper (7) has to be removed, elsewhere the switching function is not guaranteed as this solder jumper bypasses these two solder pads and therefore the function of the switch.



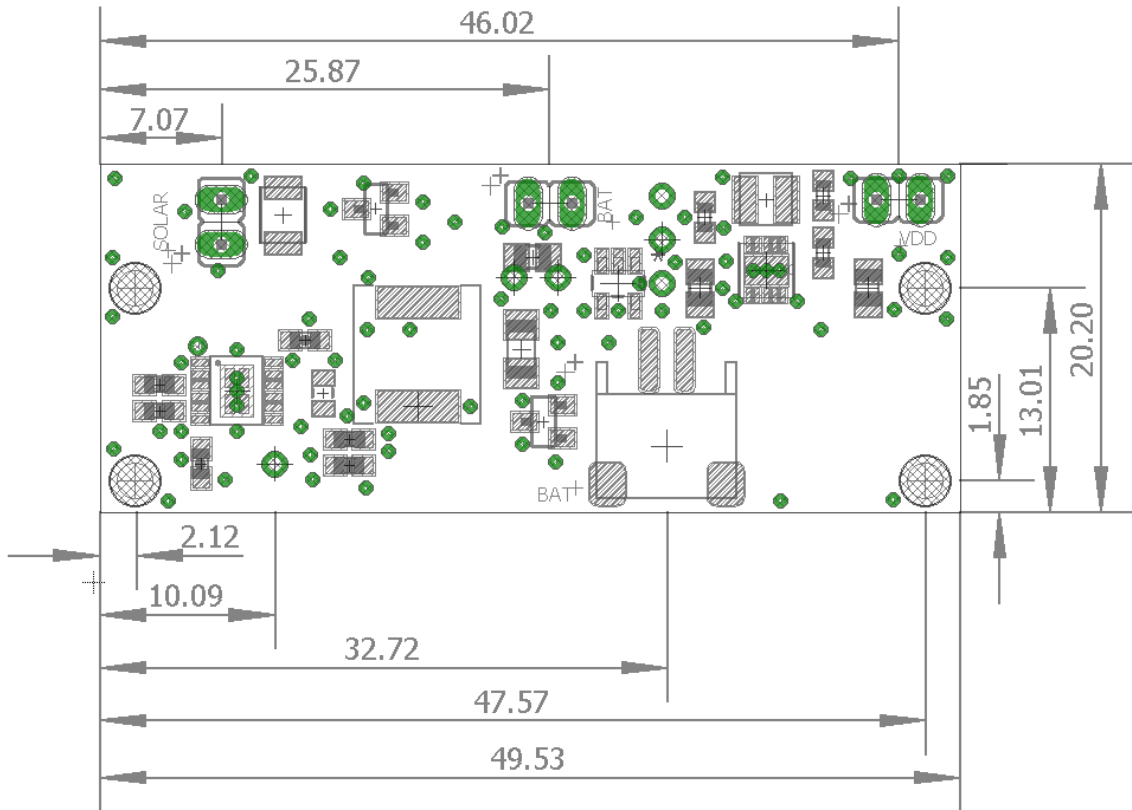
## 6 Usage Scenarios

Due to its flexible structure the MPPT Leaf can be used in many different configurations to cover many different usage scenarios and applications. Following a short overview is given about what is possible here:

Power input at (1)	Element at (2) or (3)	Usage scenario
Solar cell with nominal voltage >5V	Battery	Battery-buffered, self-contained application which is fully powered by solar energy and can bridge absence of illumination for some time
Solar cell with nominal voltage >5V	Capacitor >100 $\mu$ F	Self-contained application which is fully powered by solar energy but depends on availability of sunlight
Solar cell with nominal voltage >5V	nothing	Illegal – do not use!
Variable or stable power source in range 4.95..32 V	Battery	Battery-buffered application which can bridge power-failures for some time and can handle a floating or variable power supply
Variable or stable power source in range 4.95..32 V	Capacitor >100 $\mu$ F	Directly powered application which can handle a floating or variable power supply
Variable or stable power source in range 4.95..32 V	nothing	Illegal – do not use!
No power input	Battery	Will work until battery is empty (but does not deep-discharge it)
No power input	Capacitor >100 $\mu$ F	No operation
No power input	nothing	No operation

# APPENDIX A – Board dimensions

Board dimension drawings, all values are given in unit mm.



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