# lamaPLC: MPPT solar charging Controller Modules

An **MPPT** (*Maximum Power Point Tracking*) Solar Charge Controller is an intelligent DC-to-DC converter that optimizes the energy harvested from solar panels. Unlike basic controllers, it decouples the solar panel's voltage from the battery's, ensuring the panel always operates at peak efficiency.

### Core Function & Working Principle

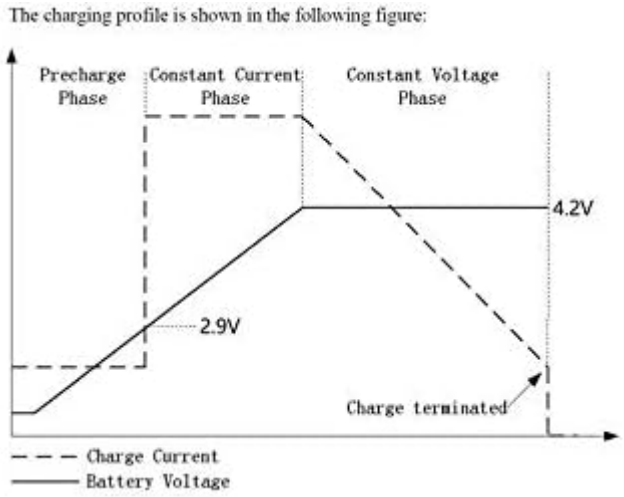
- **Maximum Power Point Tracking:** Solar panels have a fluctuating *"sweet spot"* (*Maximum Power Point* or **MPP**) where the combination of voltage (V) and current (I) produces the most watts. The MPPT module uses a perturb-and-observe algorithm to *"sweep"* the panel's input, finding the optimal point in real time as sunlight and temperature change.
- **Voltage Down-Conversion:** If a panel produces 18V but the battery only needs 12V, an MPPT controller converts that *"excess"* 6V into additional amperage rather than wasting it as heat.
- **Efficiency:** Modern MPPT modules typically offer 98% to 99% tracking efficiency, harvesting up to 30% more energy than standard PWM Controllers.

## SD05CRMA

The **SD05CRMA** is a compact *Solar Charge Controller module* based on the CN3163 integrated circuit. It is designed specifically to charge single-cell **3.7V** *Lithium-Ion* (Li-Ion) or *Lithium-Polymer* (LiPo) batteries using solar energy.

### Core Specifications

- **Input Voltage:** DC 4.4V to 6.5V (optimized for 5V solar panels).
- **Output Voltage:** DC 4.2V (standard charging voltage for Li-Ion/LiPo).
- **Maximum Charge Current:** 1.0A by default.
- **Operating Temperature:** -40°C to +85°C.
- **Dimensions:** Approximately 18mm x 10.16mm x 2.7mm



**Key Features**

- **Adaptive Charging:** The module features an *"on-chip adaptive cell"* that automatically adjusts the charging current based on the solar panel's output capability, preventing the input voltage from collapsing.
- **MPPT-like Performance:** Although linear, its adaptive nature makes it ideal for solar systems with fluctuating power availability.
- **Adjustable Current:** You can adjust the charging current by replacing R1 with a resistor (e.g., 1.18kω for 1A, 1.47kω for 0.8A).
- **Status Indicators:** It typically includes two LEDs: "**CR**" (Charging) and "**OK**" (Fully Charged or Constant Voltage mode).
- **Protection:** Includes overcharge protection, thermal regulation to prevent overheating, and automatic sleep mode when the input source is removed.

**Note:** If your solar panel outputs more than 6.5V (e.g., 12V or 18V), you must use a DC-DC step-down module.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