Choosing a charger for a small solar node

A small panel, one 18650 or LiPo cell and an ESP32 that wakes, sends and sleeps. The charger in the middle is the part most builds get wrong, and on a USB-style charger a panel can waste much of a winter day's sun.

Solar panel → Charger → 18650 / LiPo → ESP32 + radio

Why a USB charger isn't a solar charger

A USB charger expects a stiff 5 V supply that can deliver whatever current it asks for. A solar panel can't. Ask it for more than the sun is giving and its voltage collapses, so the charger drops out, restarts, and harvests only a fraction of what's available. A solar-aware charger reduces its current to hold the panel near its sweet spot, the **maximum power point** (roughly 80% of the panel's open-circuit voltage).

Four rules that save most builds

- **Match the panel voltage.** For one Li-ion cell use a 5–6 V panel. Linear chargers turn everything above ~4.2 V into heat, and 12 V panels need a switching (MPPT) charger.
- **Never charge below 0 °C.** Li-ion and LiFePO4 both plate lithium in the cold. Frosty sites need a charger with a 10 k NTC thermistor input.
- **DW01 cut-off (~2.4 V) is a last resort.** Put the ESP32 into long deep sleep below ~3.3 V instead.
- **One charger per cell.** Only one charger should be feeding the battery at a time.

The main charger types

TYPE	EXAMPLE CHIP	WITH A SOLAR PANEL	GOOD FOR	WATCH OUT FOR
Basic linear	TP4056 4–8 V in · up to 1 A	No input regulation, so it drags the panel voltage down on weak days	USB charging, or a panel much bigger than the load	Set the PROG resistor to what the panel can supply. The TEMP pin is usually disabled on cheap modules
Solar-aware linear	CN3065 up to 1 A	Cuts charge current automatically when the panel can't keep up	1–3 W, 5–6 V panels on small sensor nodes	Still linear: excess voltage becomes heat
Power path	BQ24074 Adafruit board: 6–10 V · 0.5/1/1.5 A	Holds the input at ≥4.5 V and runs the load from the panel first, charging with what's left	Nodes that must run while charging, outdoors (NTC option)	Linear efficiency. Load output is capped at 4.4 V
True MPPT	CN3791 4.5–28 V in · up to 4 A	Switching charger that holds the panel at a set maximum-power voltage (resistor divider)	5–20 W panels, 6 V or 12 V, repeaters and bigger nodes	Buy the version that matches your panel voltage. No NTC input
Energy harvester	BQ25504 µW–mW · <330 nA idle	Boost converter with MPPT, cold-starts from about 600 mV	Postage-stamp cells, indoor light, supercaps	Only for very low-power nodes
LiFePO4	TP5000 4.5–9 V in · ~1 A (2 A max)	Switching charger, selectable 4.2 V or 3.6 V	LiFePO4 cells for long life and heat tolerance	Set it to 3.6 V. A 4.2 V Li-ion charger will overcharge LiFePO4

Quick pick by panel

≤ 1 W / indoor	BQ25504 harvester
1–3 W · 5–6 V	CN3065, or BQ24074 if the node runs while charging
3–10 W · 6 V	CN3791 (6 V version) or BQ24074 at 1.5 A
10 W+ · 12 V	CN3791 (12 V version)
LiFePO4 cell	TP5000 set to 3.6 V

Size it for winter, not summer

A charger can only pass on what the panel harvests. In an Adelaide June a panel at winter tilt gets about 3.6 peak sun hours, and a flat panel in Hobart about 1.5. Check your panel and battery against the worst month before you choose the charger:

apdesignlabs.com.au/solar-sizer.html

Coming soon: **The Small Solar Charger Handbook**, with more boards, wiring diagrams, MPPT resistor maths and bench-tested winter results.

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Figures from manufacturer datasheets and module documentation. Modules vary, so check yours. © 2026