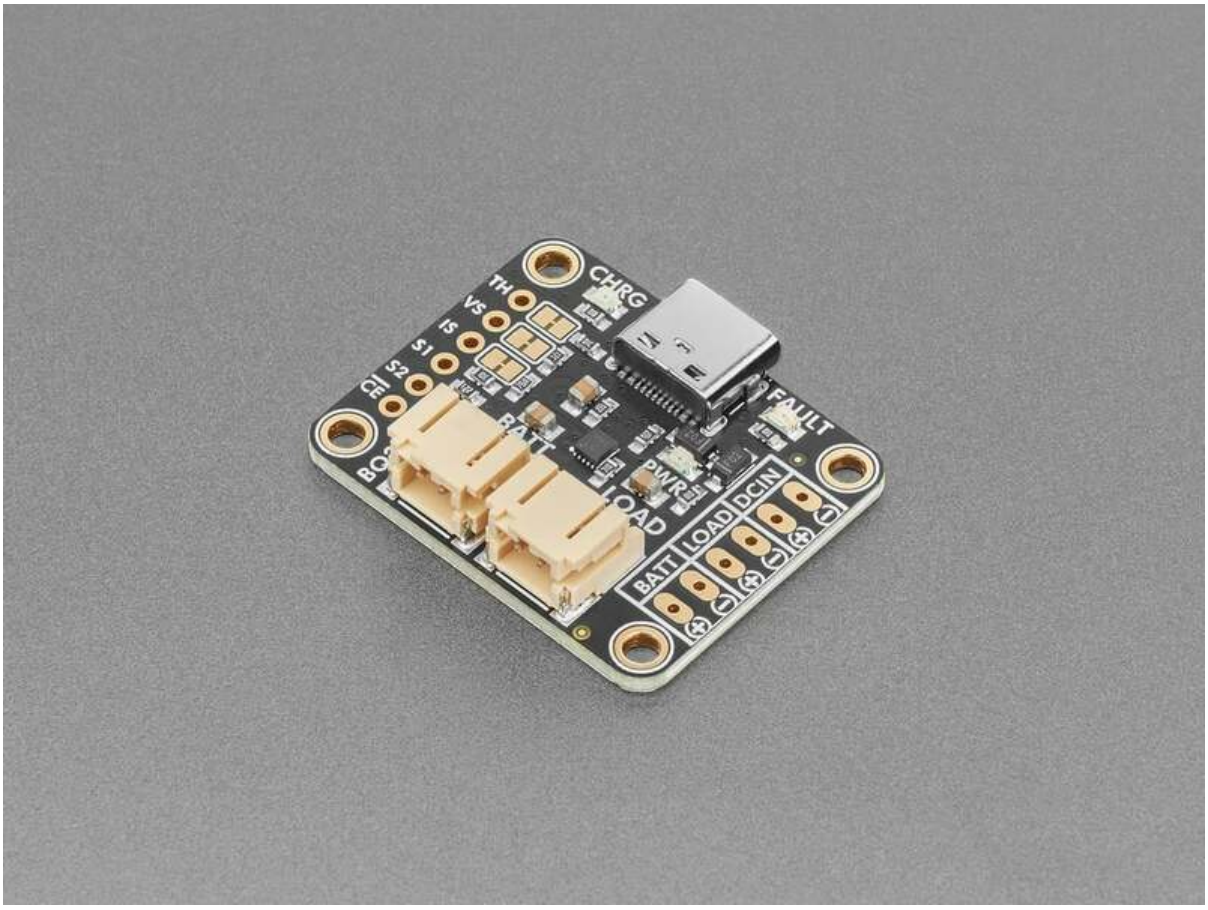
Adafruit bq25185 USB / DC / Solar Lithium Ion/Polymer Charger

Created by Liz Clark



https://learn.adafruit.com/adafruit-bq25185-usb-dc-solar-lithium-ion-polymer-charger

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Overview

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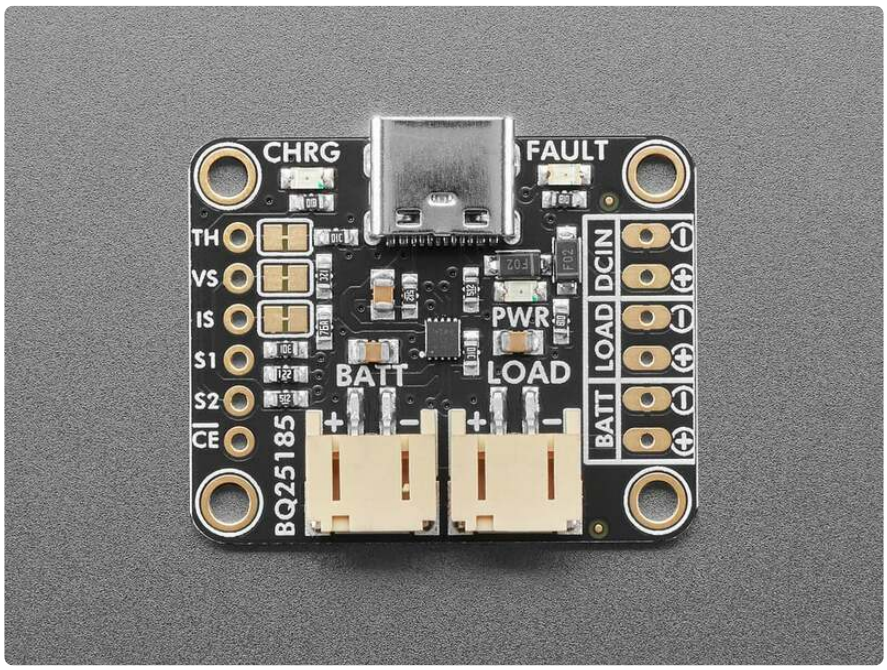
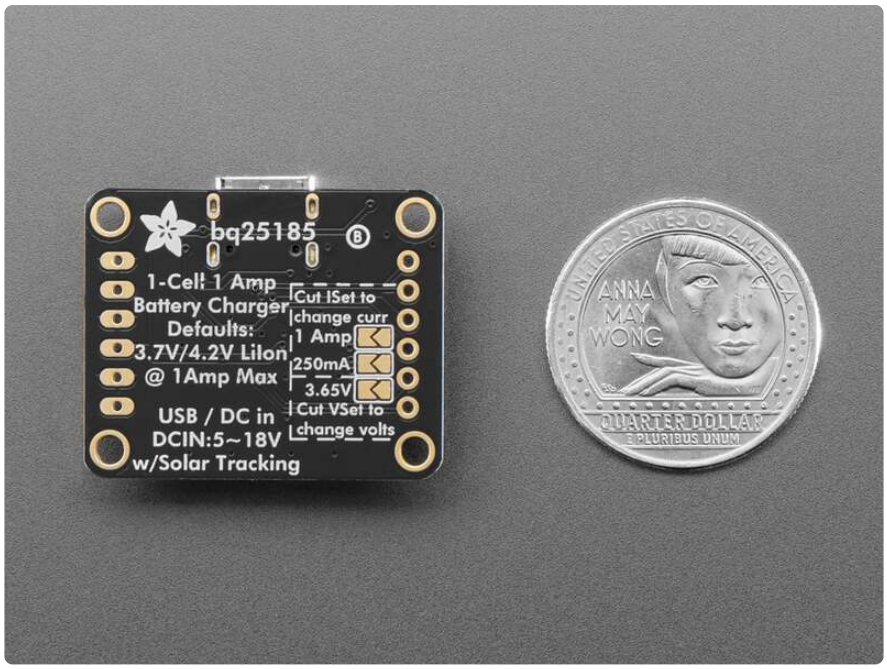


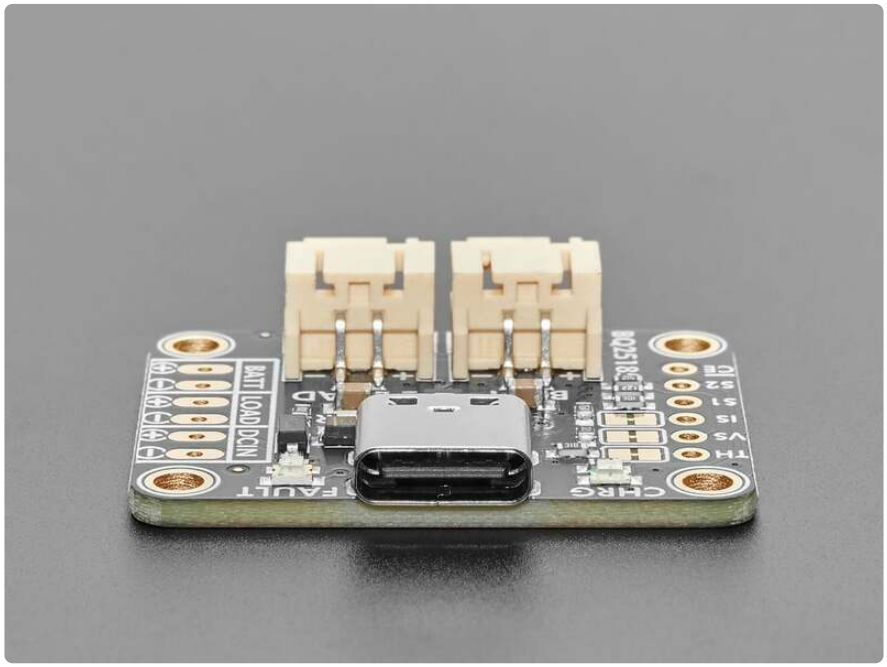
We're always on the look out for better ways to make projects portable: being able to charge your battery in the most convenient manner will let projects run no matter what power is available. The **Adafruit bq25185 USB / DC / Solar Charger Board**, which uses the new bq25185 (https://adafru.it/1aau), is a nifty charger chip with a lot of flexibility for different kinds of batteries (LiPoly, LiIon or LiFePO4), charging rates (250mA, 500mA, or 1A) and power sources (USB, DC or solar). It's also a great value, so it's a good upgrade from MCP73833 (http://adafru.it/259) or MCP73831-based (http://adafru.it/4410) charger boards.



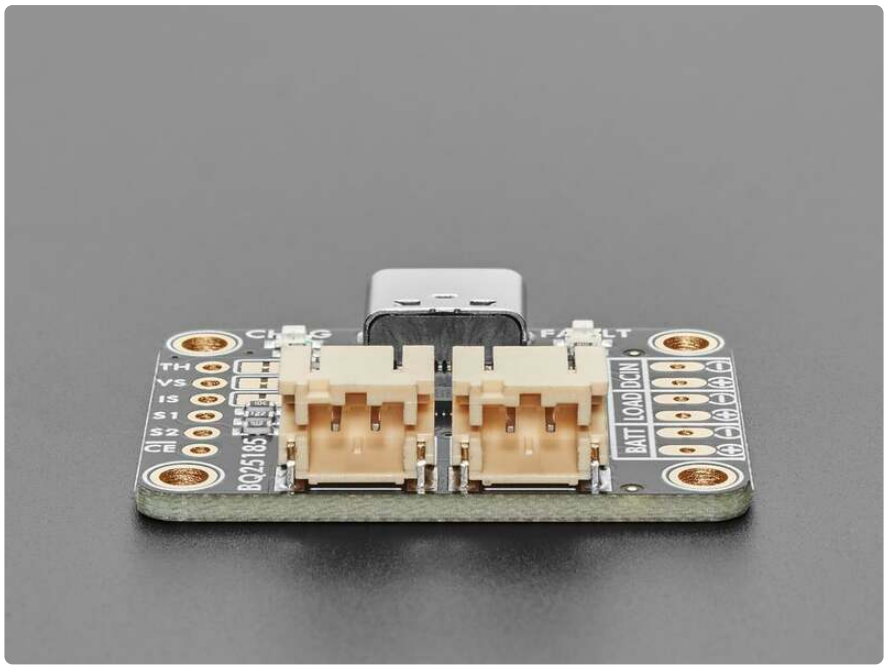
To let folks really explore what this chip can do, we made a basic breakout board with all the things we find most useful: two ways to power/charge including a solar-friendly DC input, adjustable current and voltage, power path management, and status and control I/O.

- **USB Type C** connector with 5.1k CC resistors so it will work with any computer or power supply to get 5V and up to 1A
- **Separate DC or Solar Input** - Two pads on the side can be used to connect a 5 ~ 18V power supply, which can be used instead of USB. If the input is a solar panel, the charging chip will adjust the current draw so that the voltage does not dip below the battery, thus optimizing the solar power input. No large capacitor needed to stabilize it, and you get near-MPPT capability without the cost and complexity of MPPT.
- **Default charge rate of 500 mA**, but you can cut the **IS** jumper on the front and solder either jumper on the back to set the rate to 1A or 250mA
- **Default 3.7V nominal / 4.2V max** battery chemistry/voltage for all modern 1-cell LiPoly or Lilon batteries. You can set this to 3.2V / 3.65V for **LiFePO4** batteries by cutting the **VS** jumper on the front and soldering a jumper on the back
- **Power Path to Load** - If the load connector is drawing current while the USB / DC/Solar power is attached, it will default to drawing current from the charger and any left over current will go to the battery. That keeps your battery from constantly charging/discharging which will reduce the battery life. The max draw from USB / DC / Solar is still 1A, if you need more current it will come from the battery and the chip can provide up to 3A current spikes from the battery to the load output!

- **Regulated 4.5V-max Load Output** - no matter what voltage you have on the USB or DC / solar inputs, the Load output port will never go above 4.5V due to an internal voltage regulator. Keep this in mind, though, when dealing with high currents and high DC voltages as the LDO will make the board start to overheat and throttle the current.
- **Three Status LEDs** - Orange Charging LED, red Fault LED, and Green Power Good LED. The charge/fault pins are also available on the left side breakout pads.
- **Thermistor -** cut the TH trace and you can connect a 10K thermistor to the TH pad which will adjust the charge rate to keep the battery from overheating.
- **Chip Enable** to disable the charger.
- Mounting holes!



This board is pretty much plug-and-play. Change any jumpers you like and then connect your battery to the BATT port, and the LOAD goes to your circuit. Don't forget the LOAD will never go above 4.5V, but it can go as low as 3.0V if the battery is nearly empty. You can monitor the voltage on the battery and load via the secondary pads on the right side, if necessary.



To use with solar, pick up a 5~7V solar panel (https://adafru.it/1aav), and either cut the connector off to wire it directly, or use a 2.1mm adapter cable (http://adafru.it/2788) plus a 2.1mm terminal block (http://adafru.it/368) to get two wires for the DC Input port.

If you need a board with higher charge current or a DC plug already on-board, check out the bq24074 which has up to 1.5A charge rate and a on-board 2.1mm DC jack (http://adafru.it/4755).

Pinouts

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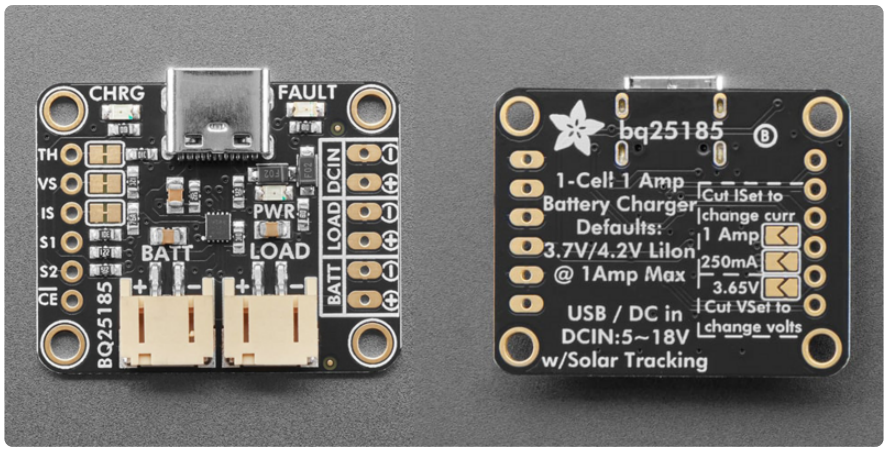
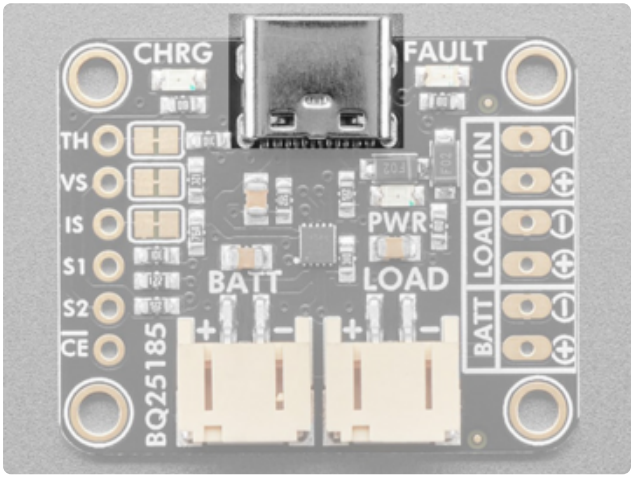
Revision History:

- **As of February 5, 2025** - The back silkscreen now has the correct jumper details.



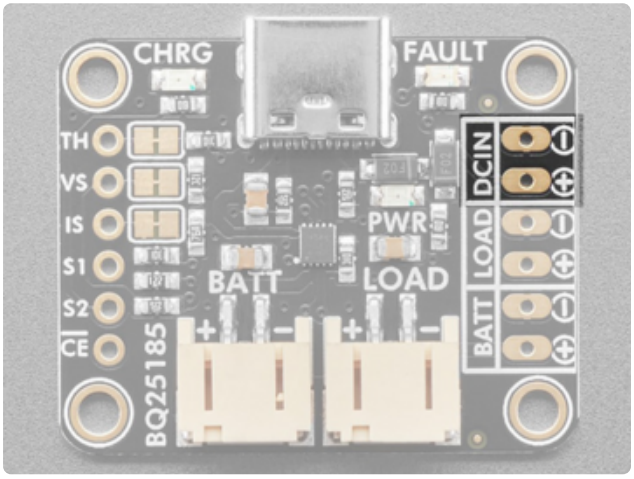
JST connectors on this breakout are JST-PH (2 mm pitch). These are the e connectors on the LiPoly batteries in the Adafruit shop.

USB Connector



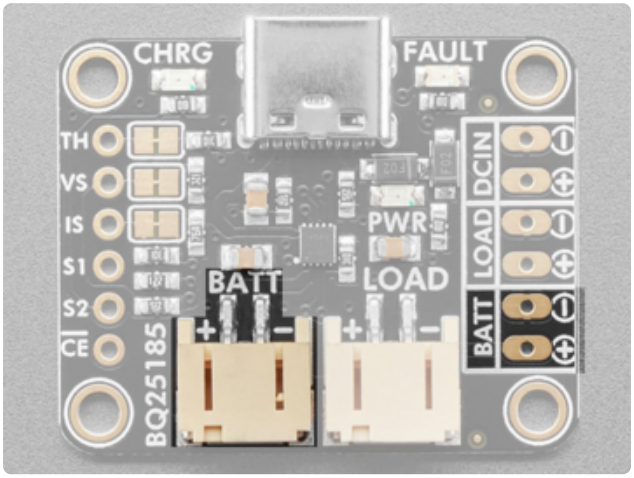
At the top edge of the board is the **USB Type C** connector. It has 5.1k CC resistors so it will work with any computer or power supply to get 5V and up to 1A.

DC/Solar Input



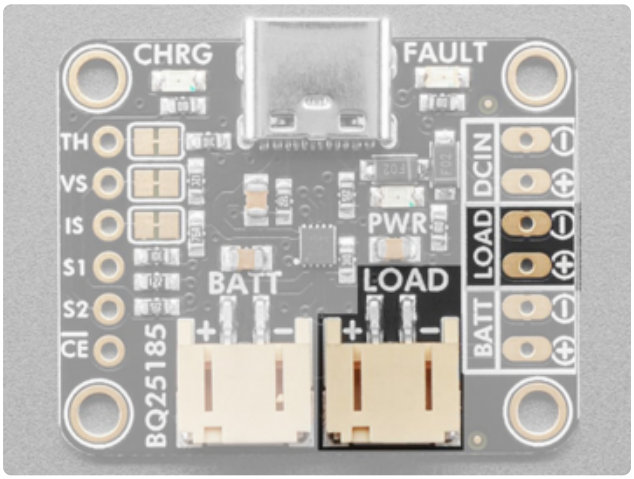
DCIN - On the right side of are the board are the DC or solar input pads. They can be used to connect a 5 ~ 18V power supply, which can be used instead of USB. If the input is a solar panel, the charging chip will adjust the current draw so that the voltage does not dip below the battery.

Battery Output



BATT - At the bottom of the board is the JST-PH battery connector, labeled BATT on the board silk. By default, the output is 3.7V nominal / 4.2V max battery chemistry/ voltage for all modern 1-cell LiPoly or LiIon batteries with a default charge rate of 500 mA.
This output is available on the right side of the board as well. You can use this secondary output to monitor the voltage on the battery with a multimeter.

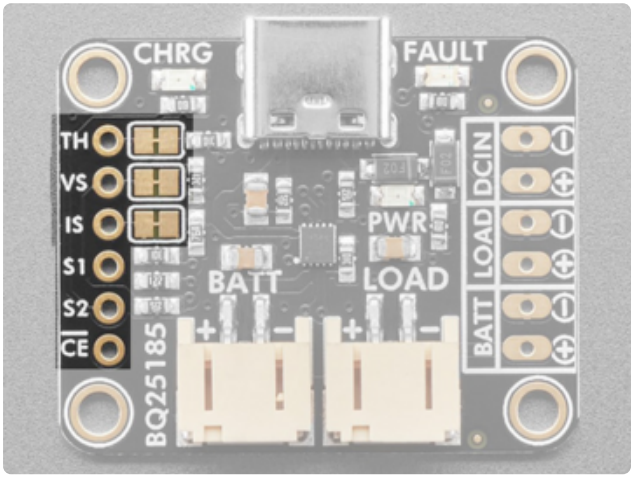
Load Output



LOAD - At the bottom of the board is the JST-PH load output connector, labeled LOAD on the board silk. It provides a regulated 4.5V-max load output. No matter what voltage you have on the USB or DC / solar inputs, the load output port will never go above 4.5V due to an internal voltage regulator. Keep this in mind, though, when dealing with high currents and high DC voltages as the LDO will make the board start to overheat and throttle the current. You can monitor the voltage on the load via the secondary pads on the right side, if necessary, with a multimeter.

If the load connector is drawing current while the USB / DC/Solar power is attached, it will default to drawing current from the charger and any left over current will go to the battery. That keeps your battery from constantly charging/ discharging which will reduce the battery life. The max draw from USB / DC / Solar is still 1A, if you need more current it will come from the battery and the chip can provide up to 3A current spikes from the battery to the load output!

Status and Control I/O



TH and **jumper** - This is the thermistor pad. You cut the TH jumper and you connect a 10K thermistor to the TH pad which will adjust the charge rate to keep the battery from overheating.

VS and **jumper** - This is the voltage setting pad. If you are using **LiFePO4** batteries instead of 1-cell LiPoly or LiIon batteries, you can cut the VS jumper and solder the 3.65V jumper on the back closed.

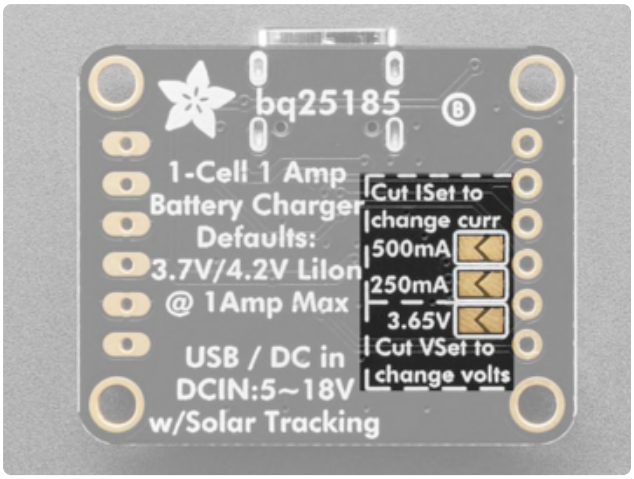
IS and **jumper** - This is the current setting pad. You can cut the jumper to change the charge rate with the current jumpers on the back of the board.

S1 - This is the Status 1 pad. It is connected to the red FAULT LED.

S2 - This is the Status 2 pad. It is connected to the orange charge (CHRG) LED.

/CE - This is the chip enable pad. You can pull this pad high to disable the chip.

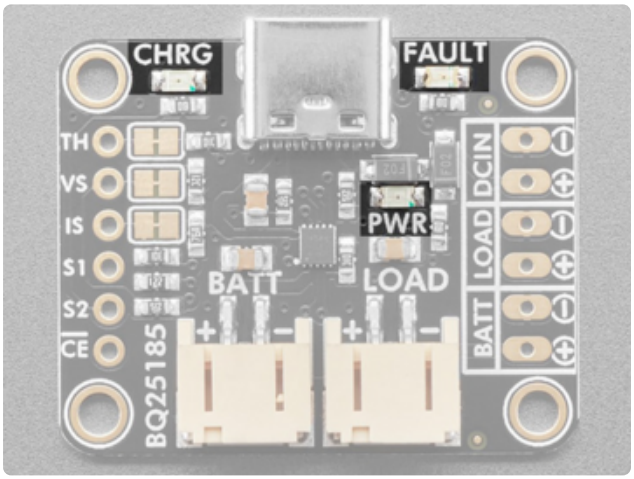
Current and Voltage Back Jumpers



Change current jumpers - on the back of the board are two jumpers to change the charge current rate. If you cut the IS jumper, you can solder one of these jumpers closed to set the charge current to 1A or 250mA instead of the default 500mA.

Change voltage jumper - on the back of the board is a single jumper to change the voltage range to 3.2V nominal / 3.65V max instead of the default 3.7V nominal / 4.2V max. This voltage range is used for LiFePO4 batteries. You will need to cut the VS jumper first before soldering this jumper closed.

Status LEDs



CHRG - This is the charge status LED. It is an orange LED. It is connected to the **S2** (Status 2) pin on the left side of the board. It will be lit while a battery is charging.
FAULT - This is the fault status LED. It is a red LED. It is connected to the S1 (Status 1) pin on the left side of the board. It will be lit if the board experiences a fault condition. The bq25185 has integrated fault protection for a few conditions:

Input overvoltage protection
Battery undervoltage protection
Battery short protection
Battery overcurrent protection
Input current limit protection
Thermal regulation and thermal shutdown
Battery thermal fault protection
Safety timer fault
ISET and ILIM/VSET pin short/open protection.

PWR - This is the power good LED. It is a green LED. If the the board is powered properly, this LED will be lit.

Downloads

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Files

- bq25185 Datasheet (https://adafru.it/1aaw)

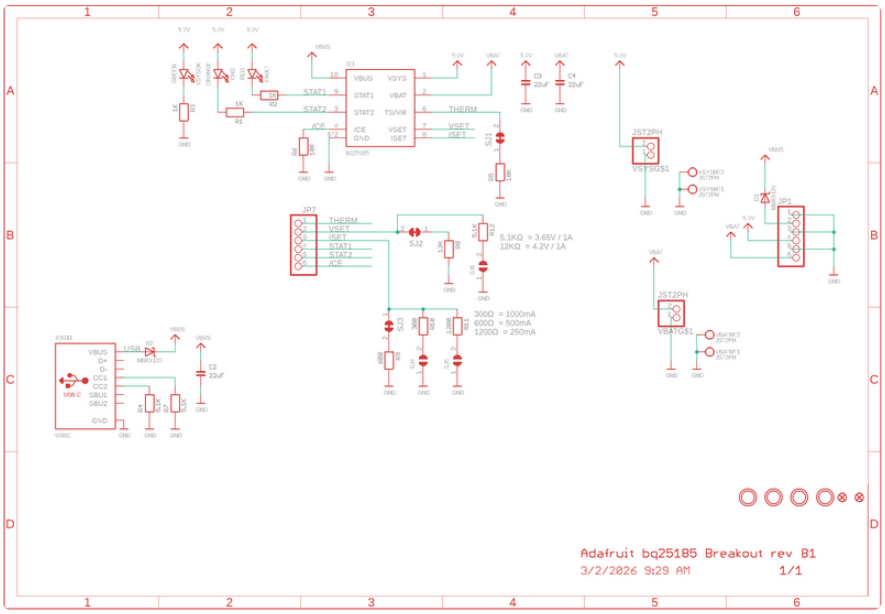
- EagleCAD PCB Files on GitHub (https://adafru.it/1aax)
- 3D models on GitHub (https://adafru.it/1an8)
- Fritzing object in the Adafruit Fritzing Library (https://adafru.it/1aay)

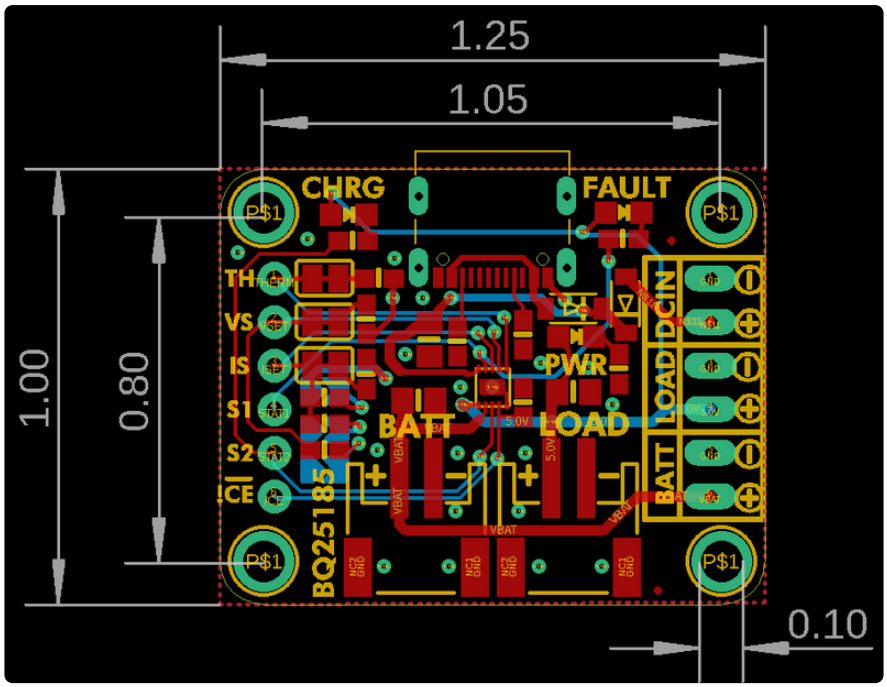
Schematic and Fab Print

Rev B1

Revision History:

- **As of February 5, 2025** - The back silkscreen now has the correct jumper details.

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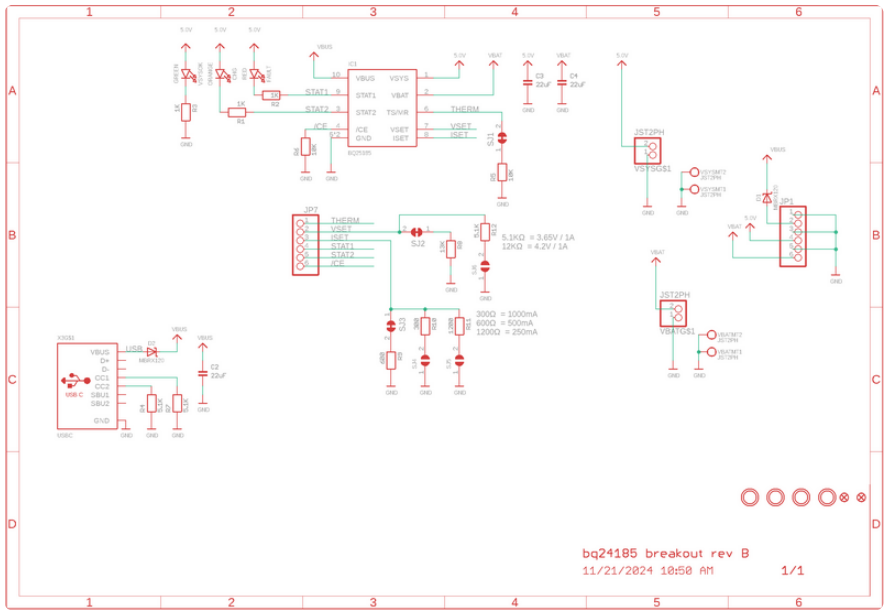
S2
/CE
BQ25185
PWR
BATT
LOAD
DCIN
LOAD
BATT

Rev B


bq24185 breakout rev B
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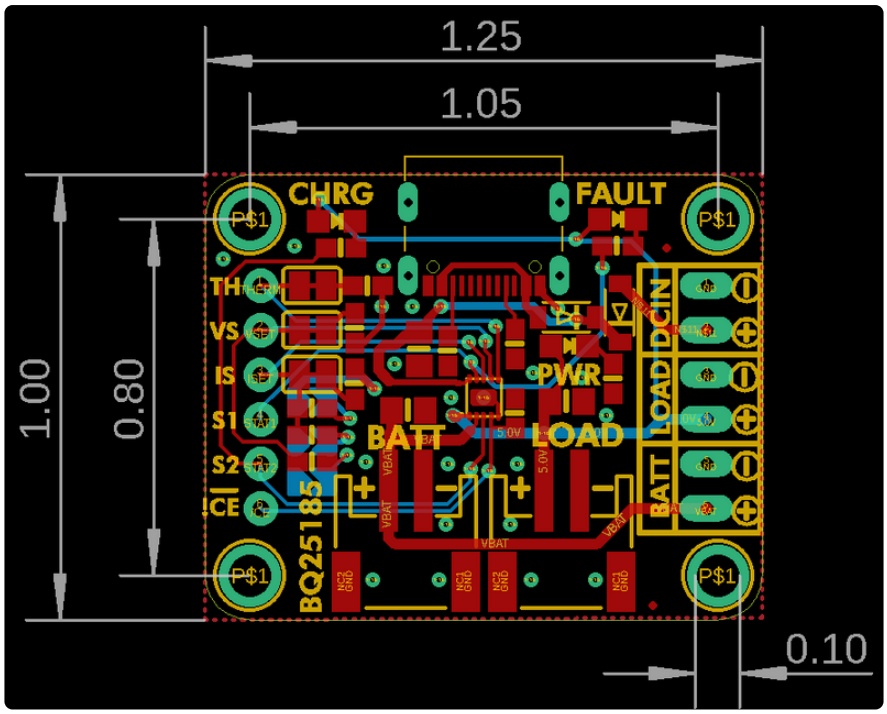
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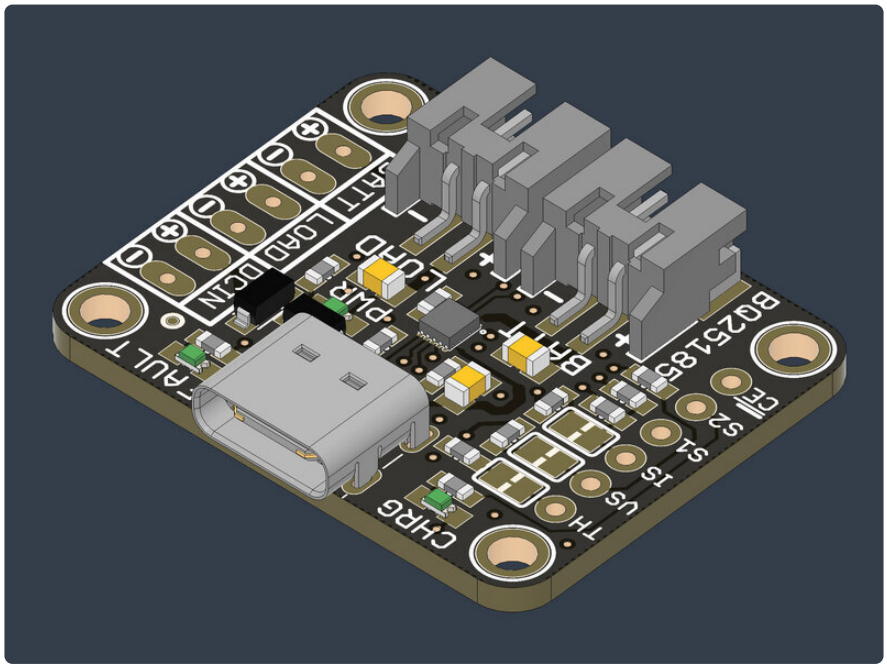
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