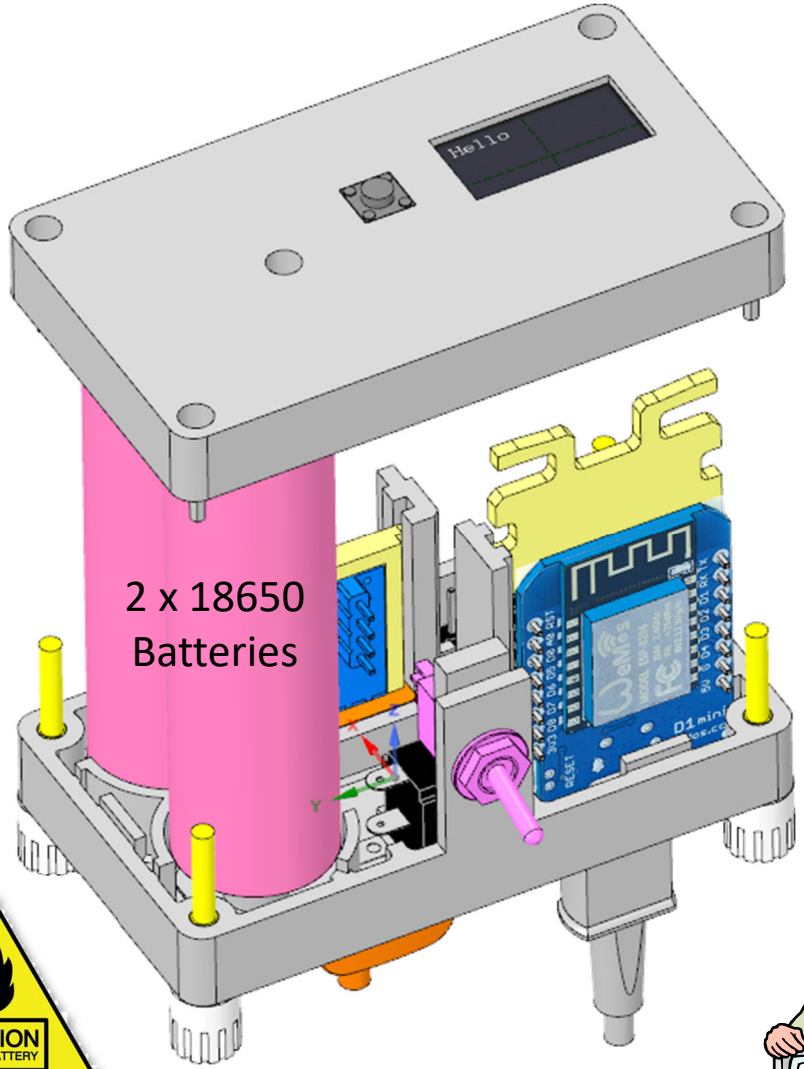
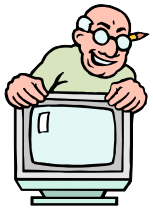
Wii WEMOS D1 Transceiver Mk1

Circuits & Wiring





Read through this document before starting.

+ ESP8266

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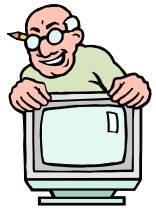
CAUTION



Lithium batteries can be extremely dangerous, if not handled and cared for properly. This design does not include any form of current limiting circuit, like a fuse. So, care must be taken to ensure that the wiring guidelines are followed accurately, that checks are made for short-circuits, and that battery polarities are marked, and they are inserted the correct way round. Failure to do so, could result in an explosive fire.

Charging Practices: Always remove batteries from your project to charge them. Use a charger, designed for the battery used, and from a trusted supplier. Choose a flat, non-flammable surface to charge on, away from flammable materials. Never leave unattended when charging. Don't charge overnight. Monitor charging to ensure charge characteristics are as expected. Only pair batteries with similar characteristics. Do not overcharge, or leave charging for prolonged periods. This increases the risk of damage and fire.

Battery care & maintenance: Stop using a battery if it is swollen, damaged, dented or leaking. Never charge a damaged battery. Never allow a Lithium battery to discharge below 3.2 volts, as cell damage will occur. Avoid extreme temperatures. Do not charge or store batteries in very hot or cold environments. Don't cover batteries whilst charging, as this can trap heat, causing overheating.

In case of fire: Get out and stay out. If a fire starts, leave immediately, and call the fire brigade. For low voltage Lithium batteries, water is a safe extinguisher.

Built-in Monitoring: Most of my project designs include code, and circuitry, to monitor battery voltage, whilst in use. This code then seeks to alert the operator, when the battery has reached a critical low voltage, before shutting down power consuming circuitry; including the micro. Time should therefore be spent on calibrating this feature, as a precaution, for good battery management and maintenance.

Carefully dispose of batteries that damaged, or discharged below their critical voltage.

Hand Tools:

Recommended:

- Fine Nosed Pliers
- Side Cutters
- 1.5 mm Drill
- 2.0 mm Drill
- 4.0 mm Drill
- Needle Files
- Screwdrivers
- Craft Knife

Note: Not all items needed are shown here.

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Tools & Materials:

Temperature controlled iron
Solder flux
Resin cored solder
Hot melt glue gun {optional)
2-part epoxy resin glue
Screw drivers
Tweezers
Wire wrapping tool
Wire wrapping wire 30 AWG
24 AWG stranded wire (red, black & yellow)
Multimeter

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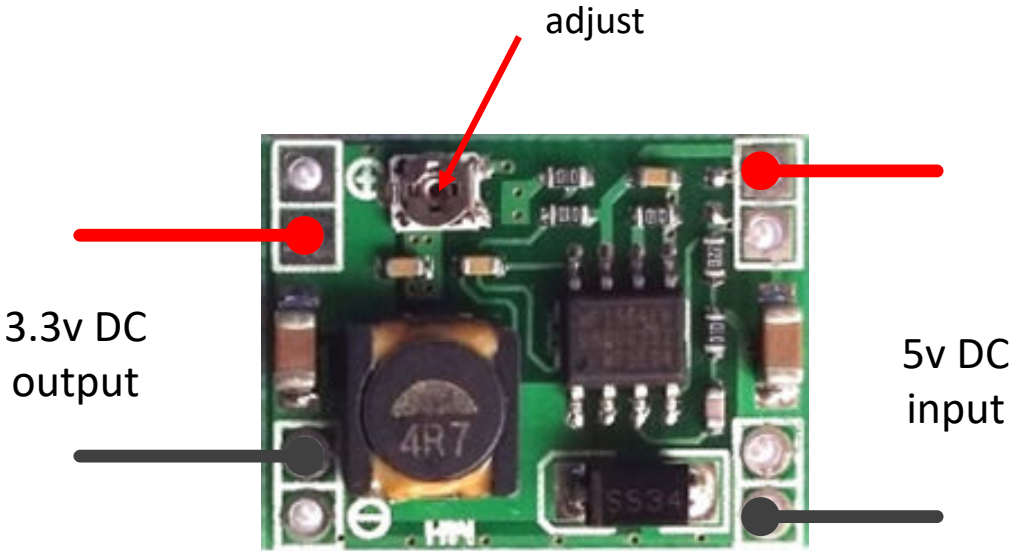
Test Equipment:

You will need a multimeter to:

- set up the 3v3 voltage regulators potentiometer.
- check/calibrate the WEMOS battery voltage measurement.
- check wiring continuity, for unwanted shorts circuits.

It is useful to have one which makes a noise when a short circuit is detected, when checking the integrity of joints, so that you don't need to keep looking at the display.

The voltage regulator should be set up, for a 3.3v output, before inserting it into your project. Use a suitable power DC source of 5 – 8v input.

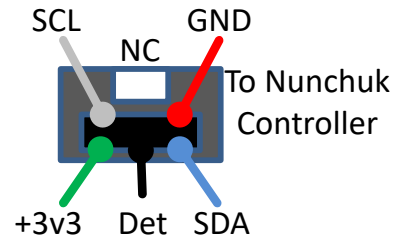


Wii WEMOS D1 Transceiver Wiring

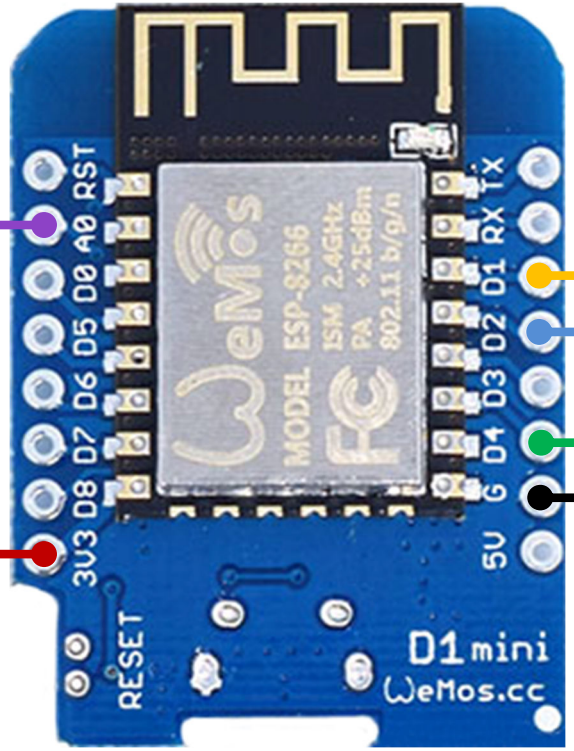
Pin	GPIO
A0	A0
D0	16
D5	14
D6	12
D7	13
D8	15

Pin	GPIO
Tx	1
Rx	3
D1	5
D2	4
D3	0
D4	2

Display connections can vary, ensure power Vcc and GND are of correct polarity!

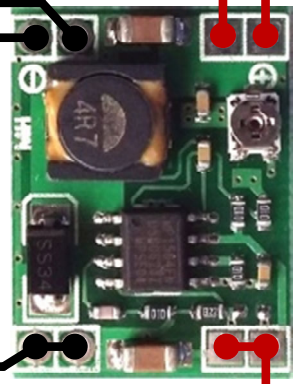


SW1



Buck regulator

Adjust for 3v3



GND

3v3

4k7

*Optional

O/C

680k

1N4006

+7v5

-

Ext/ OFF

ON/OFF Power Switch

+7v5

2 x 18650 Lithium

Pin D1	GPIO5	SCL
Pin D2	GPIO4	SDA
Pin D3	GPIO0	
Pin D4	INPUT_PULLUP	LED_BUILTIN

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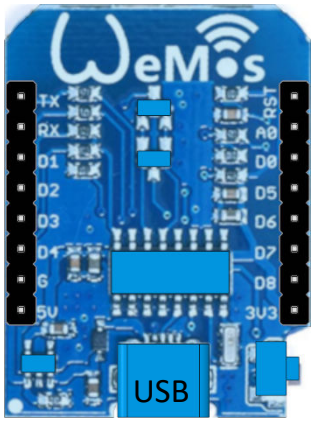
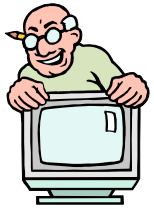
WEMOS Plate Wiring

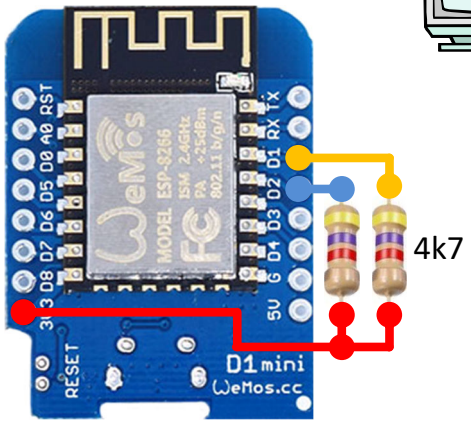
The 3v3 regulator is set up prior to gluing it into the WEMOS plate.

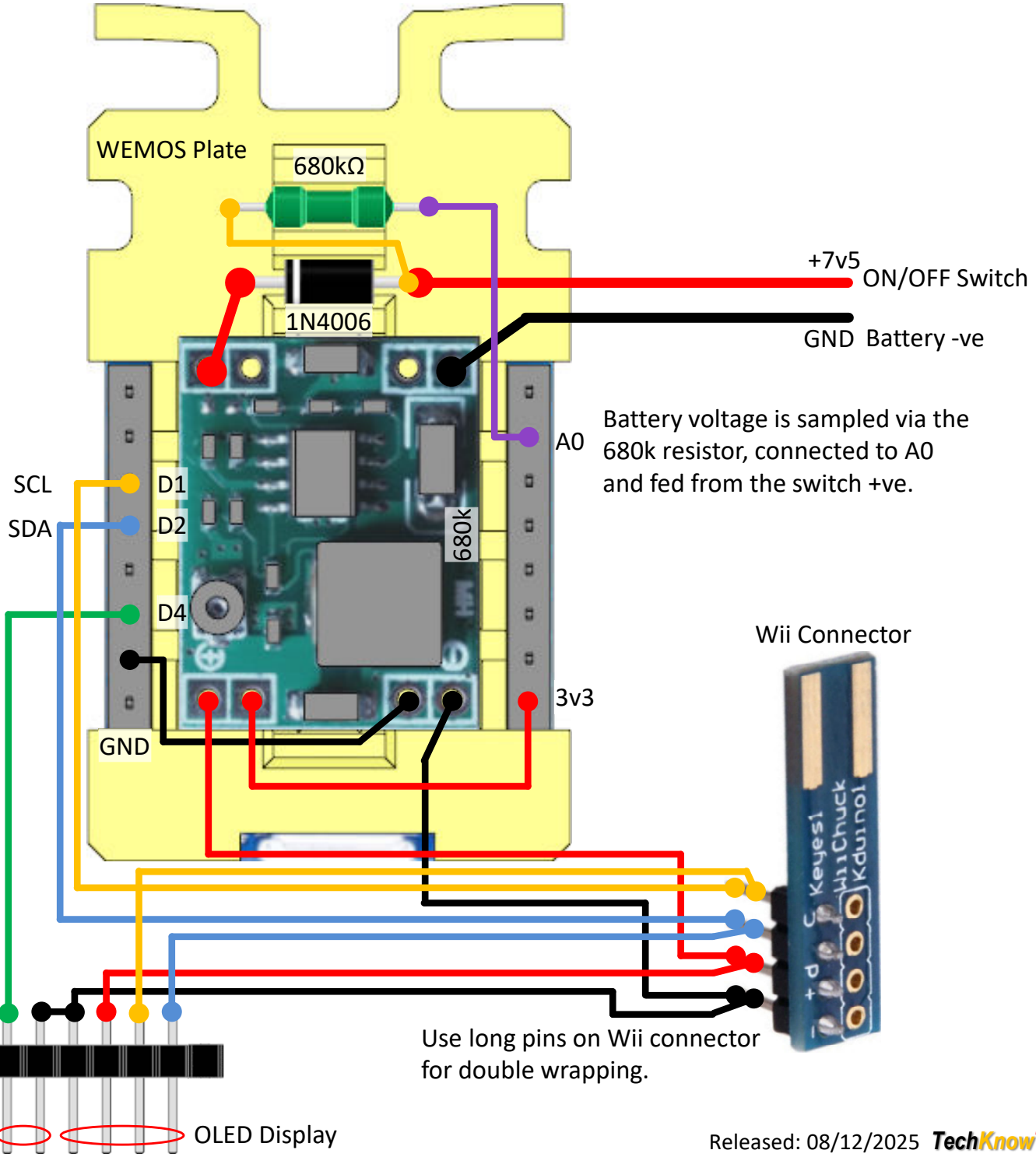
WEMOS D1 mini
viewed from underneath



*Optional I2C pullup resistors may be needed with some Wii controllers. Add if data errors are evident. Value between 2k – 10kΩ







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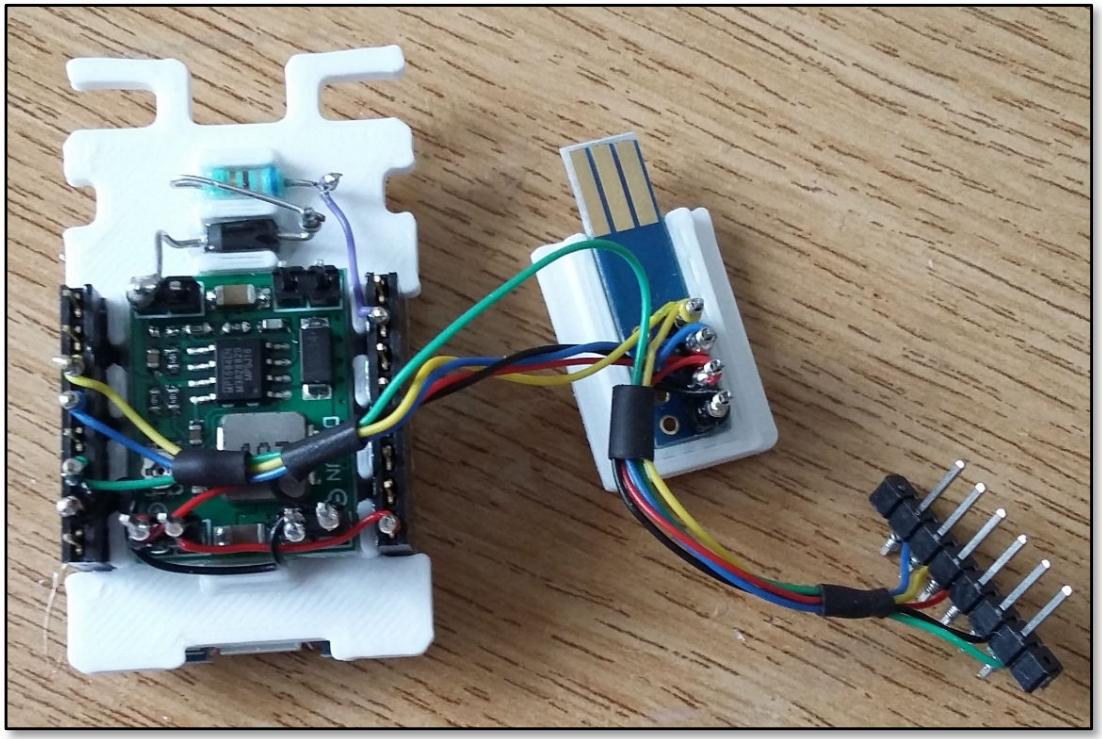
WEMOS Plate Wiring

These components are wired in this way before being glued into the box base.



Wiring before attaching the power leads

Use long pins on Wii connector for double wrapping. Wrap 1st set, solder then wrap the 2nd.

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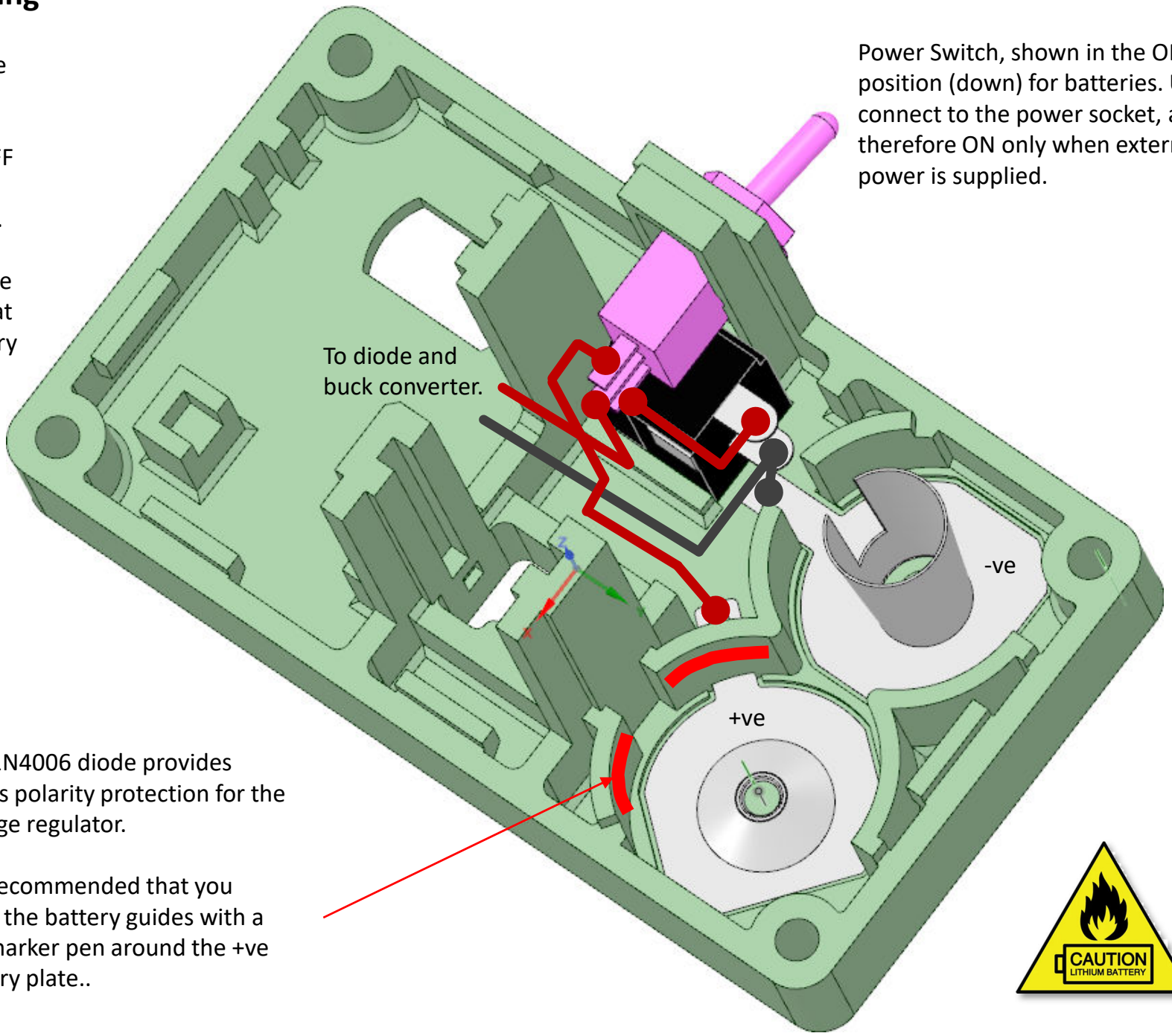
18650 Battery Clip Wiring

Battery –ve goes directly to the buck regulator.

Battery +ve goes to the ON/OFF switch, then to the 1N4006 diode, then the buck regulator.

DC power socket is wired to the other side of the switch, so that power is either from the battery or the socket.



Power Switch, shown in the ON position (down) for batteries. Up will connect to the power socket, and therefore ON only when external power is supplied.

The 1N4006 diode provides revers polarity protection for the voltage regulator.

It is recommended that you mark the battery guides with a red marker pen around the +ve battery plate..

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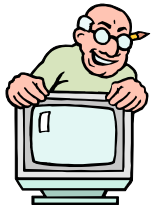
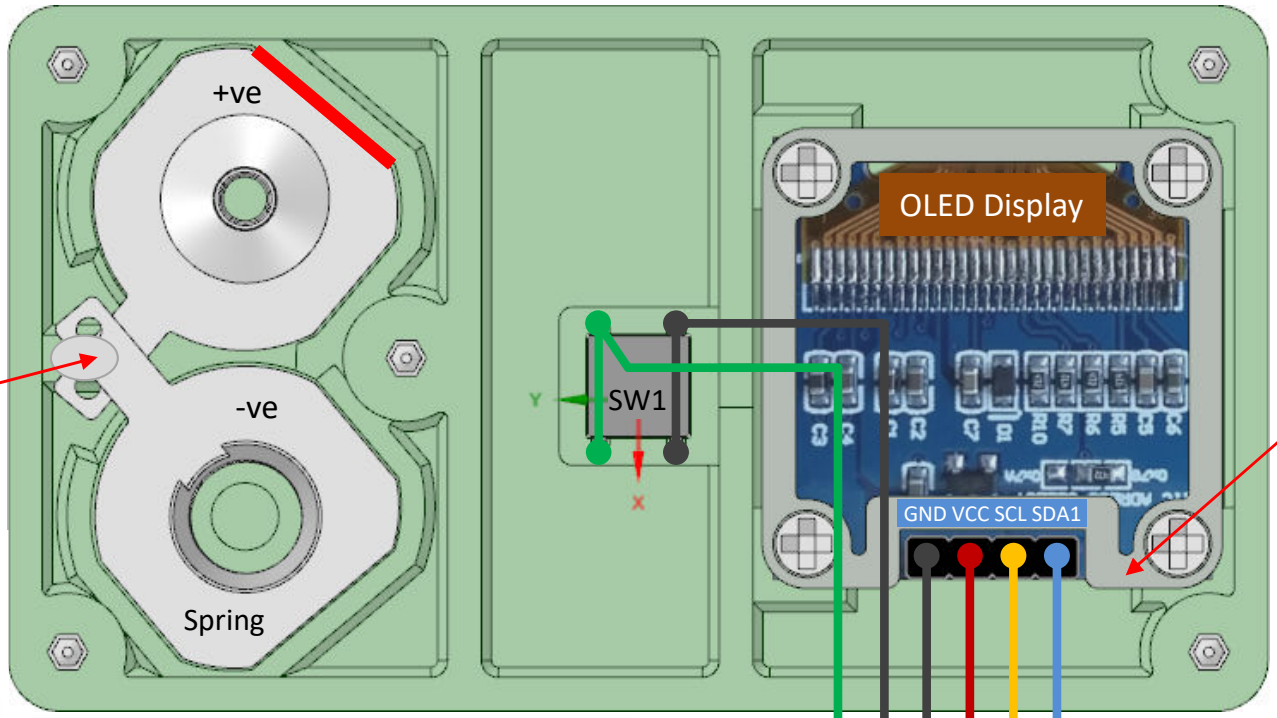
Box Lid Wiring

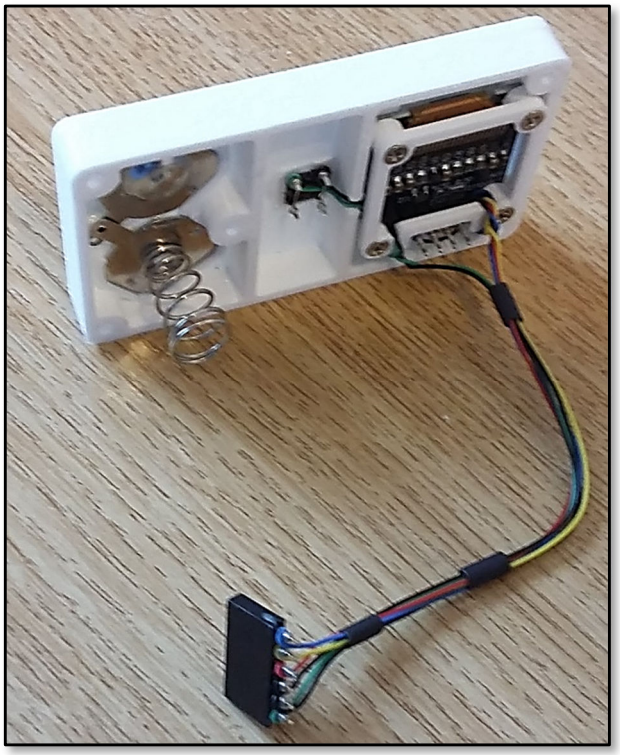
Pre-solder the tabs on the two battery clips separately, then apply a smear of flux to the freshly soldered connections, before gluing the clips into the box lid.

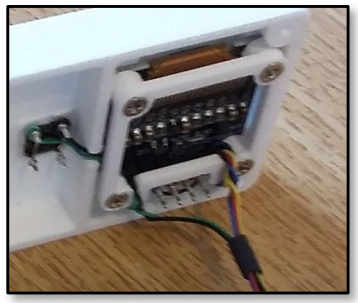
Once the glue has set, load some solder onto the end of a hot iron and use it to fuse the two tabs together.



The I2C harness must be at least the depth of the case. Excess length, can easily be stored in the void of the case.







Loop wires around display strap to relieve strain.

Ensure sufficient length

Plugs into 6-pin strip in base

Plug can be removed from base to allow separation from body when charging batteries if needed.

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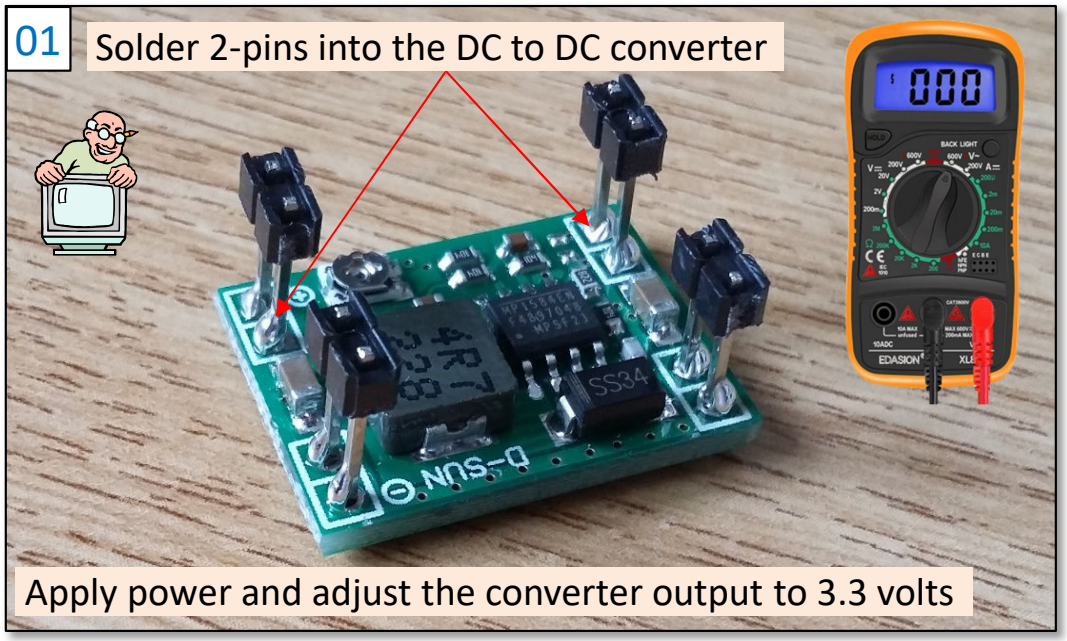
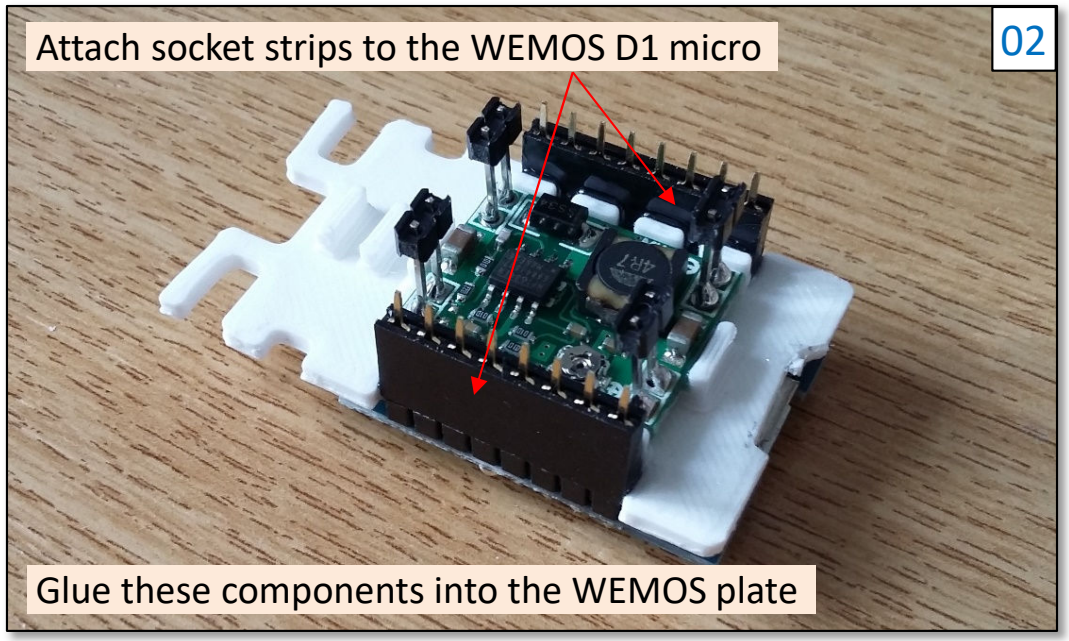
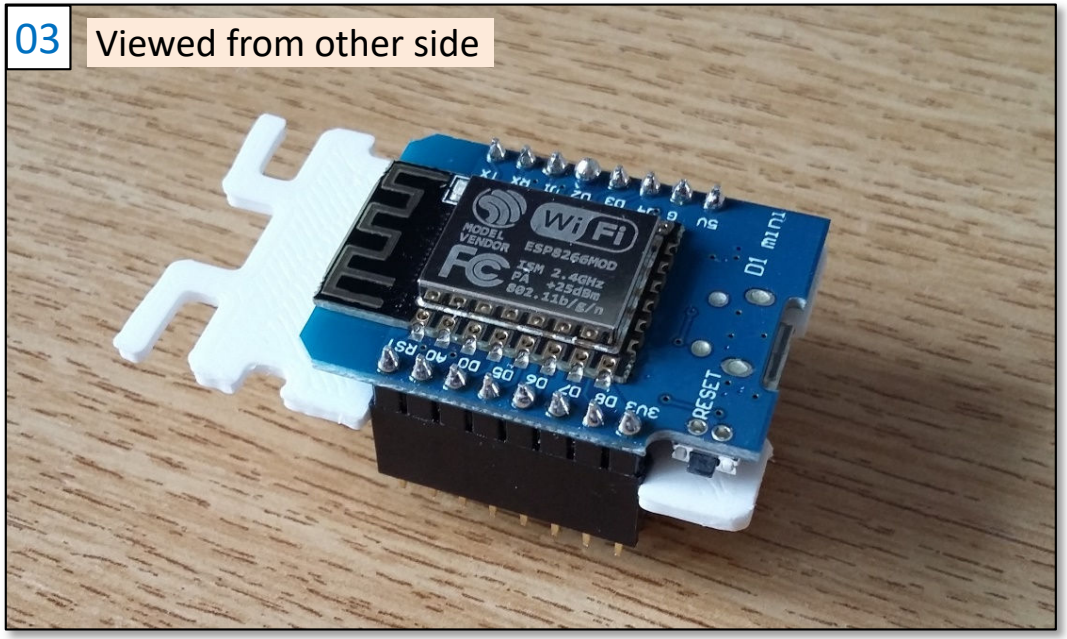
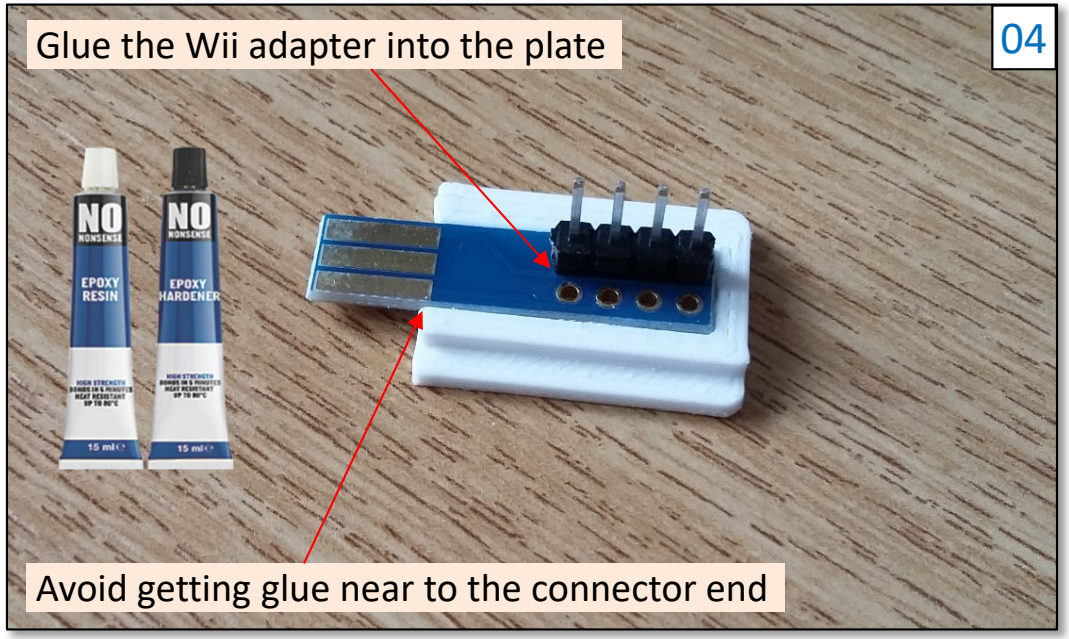
Wiring Sequence Photos









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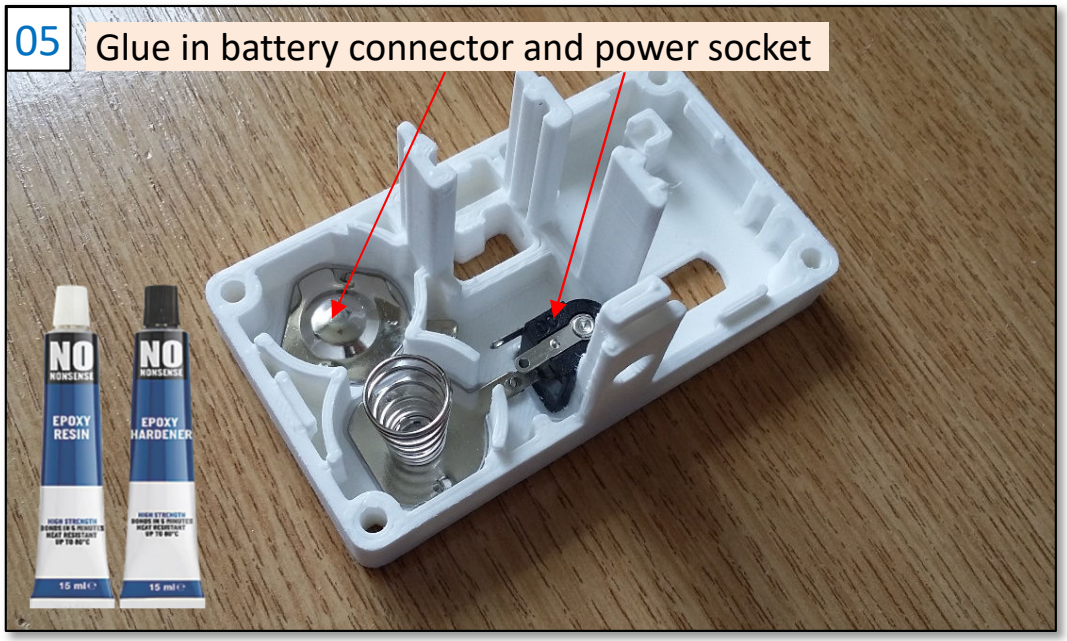
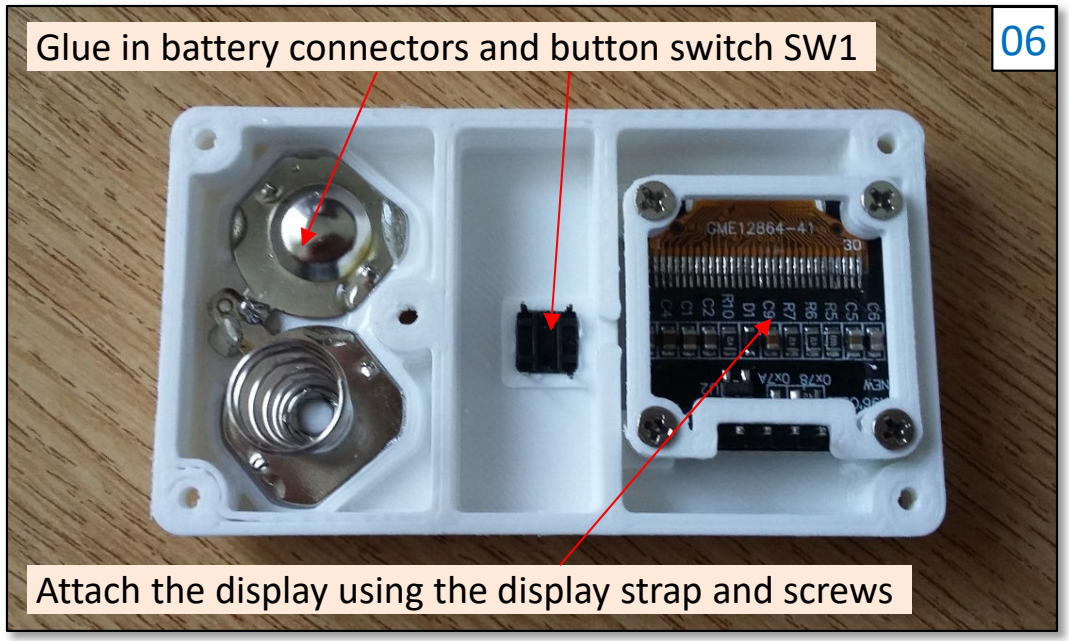
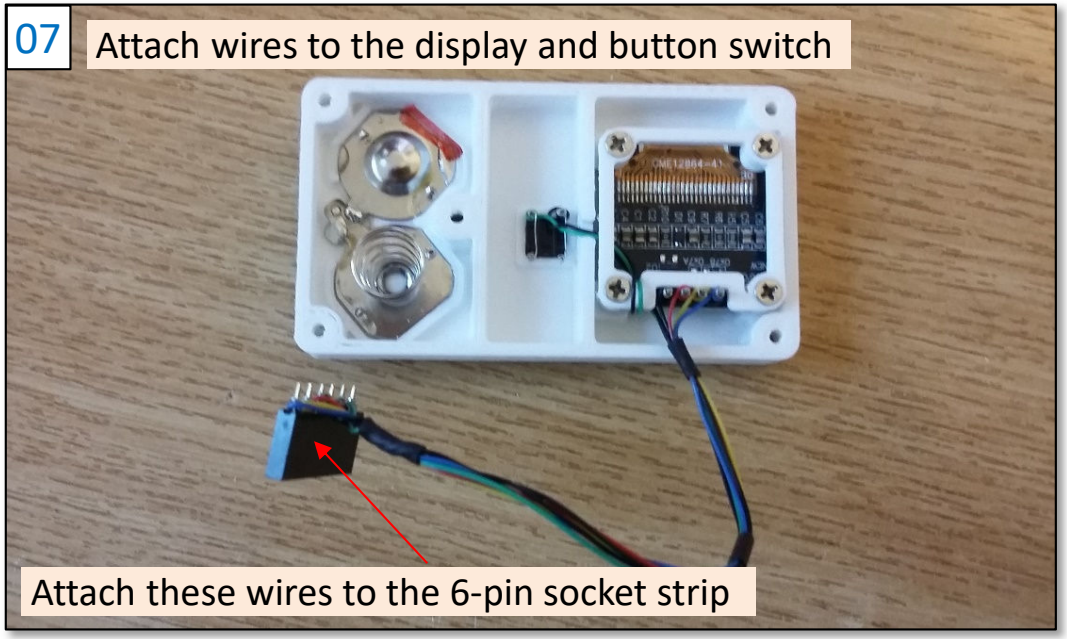
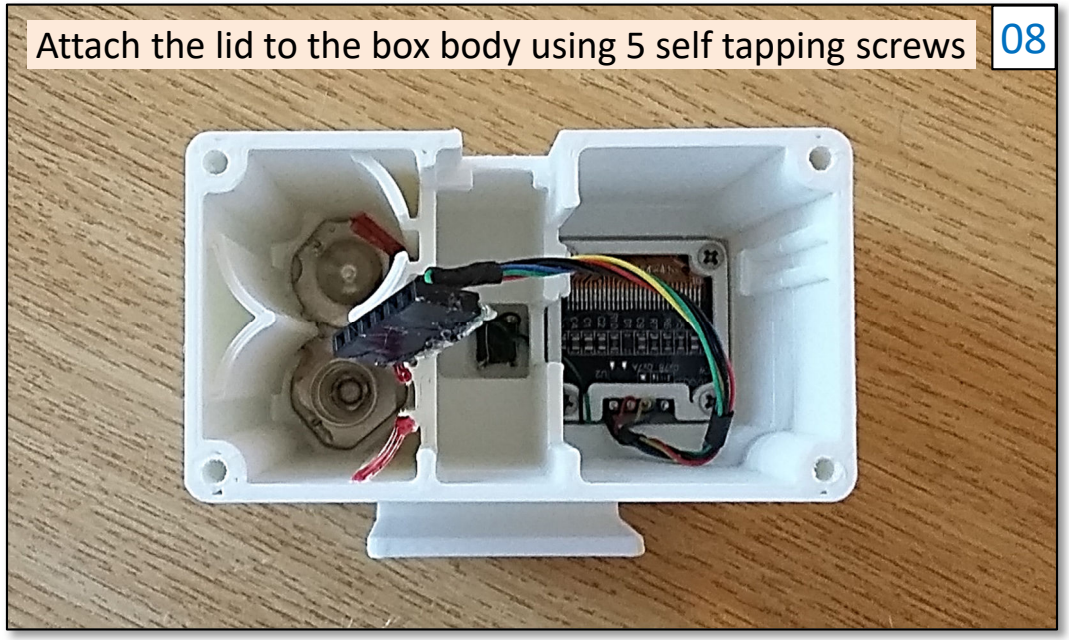
Wiring Sequence



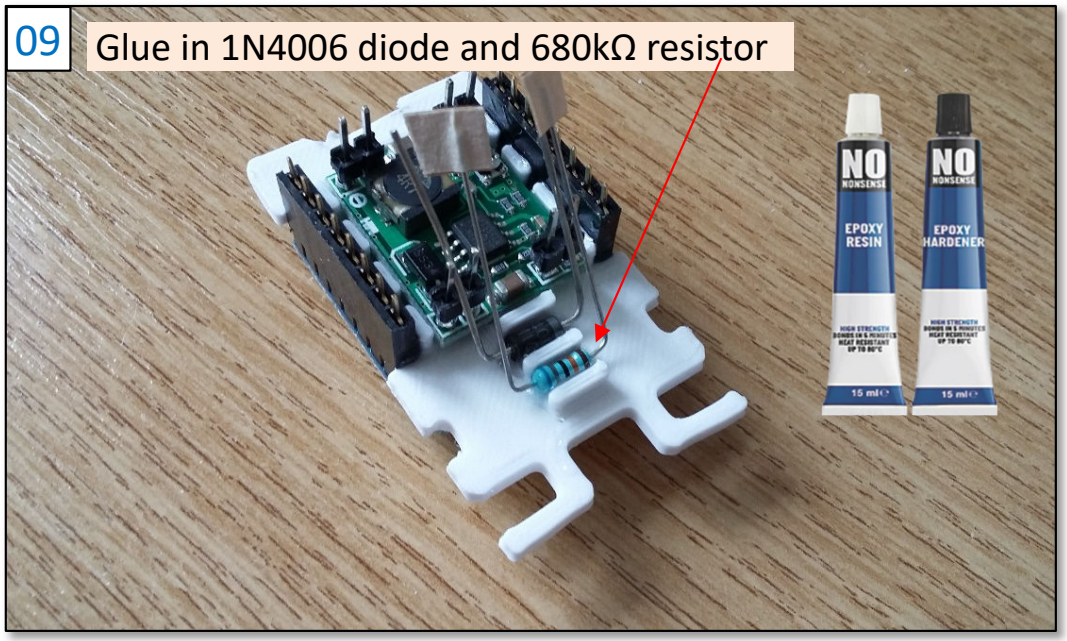




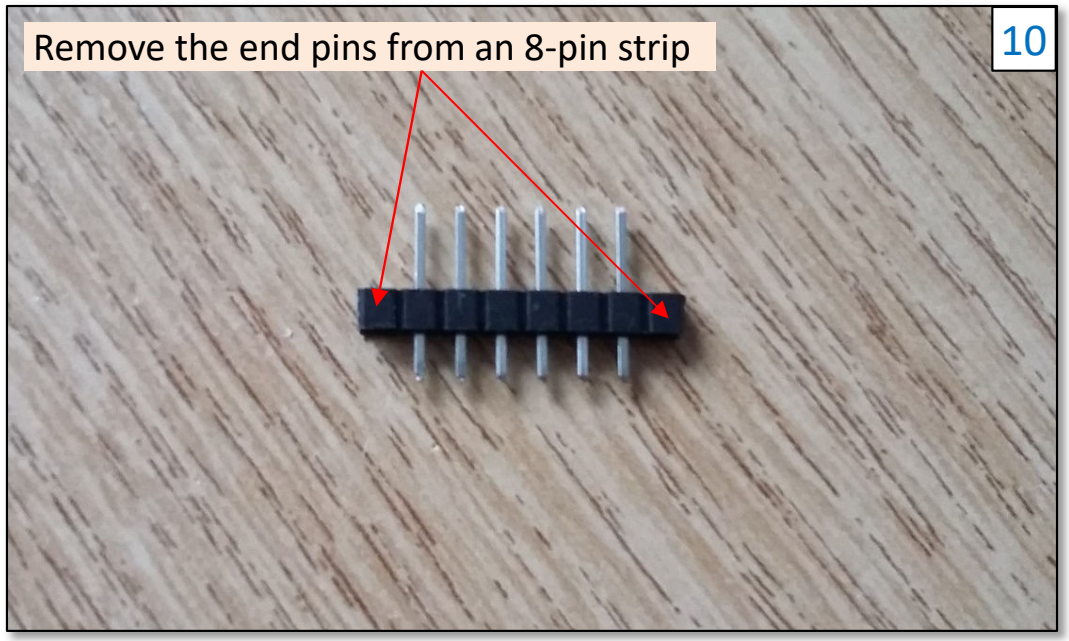


Wiring Sequence

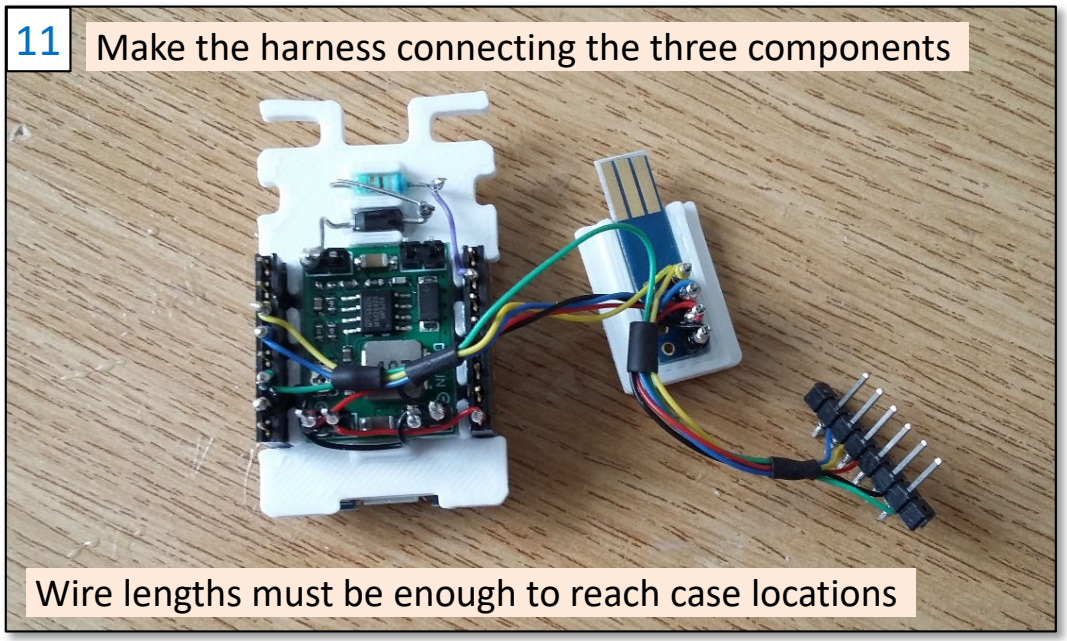
09 Glue in 1N4006 diode and 680kΩ resistor



10 Remove the end pins from an 8-pin strip

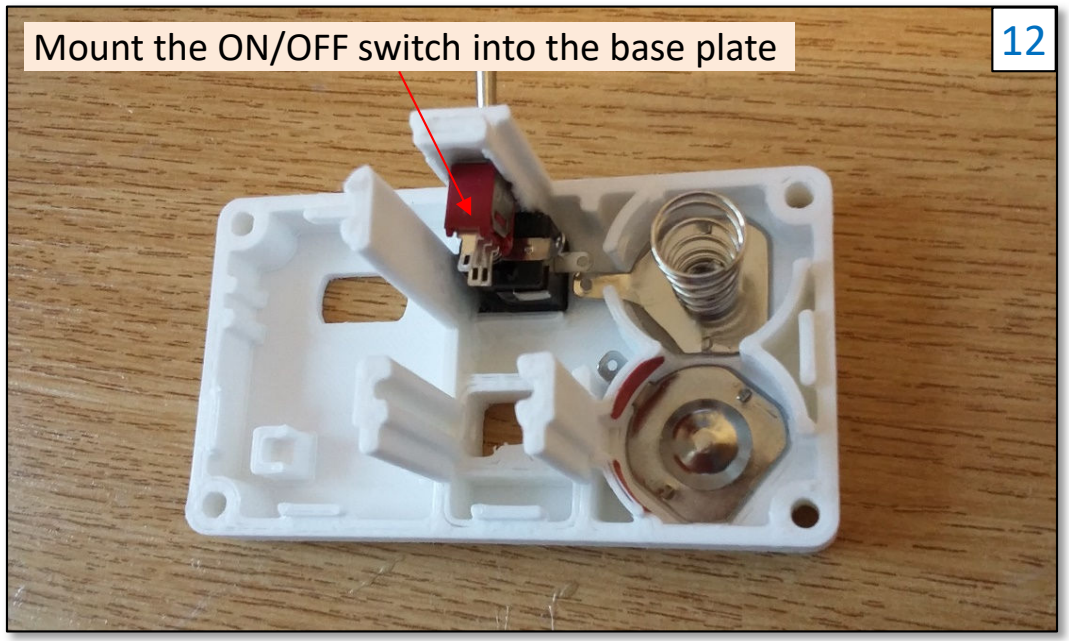


11 Make the harness connecting the three components



Wire lengths must be enough to reach case locations

12 Mount the ON/OFF switch into the base plate



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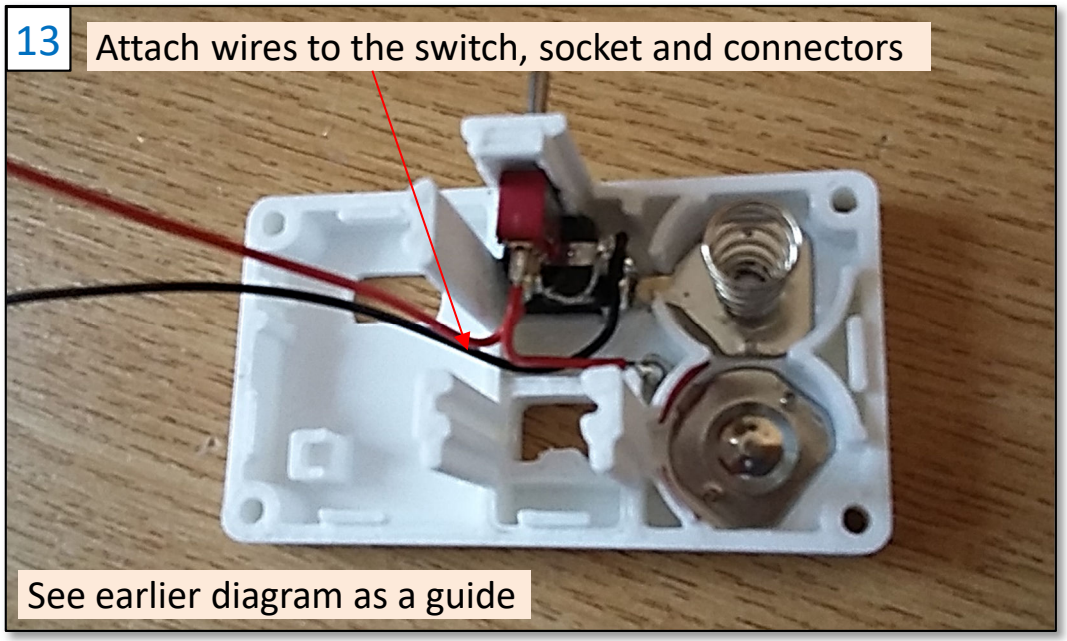
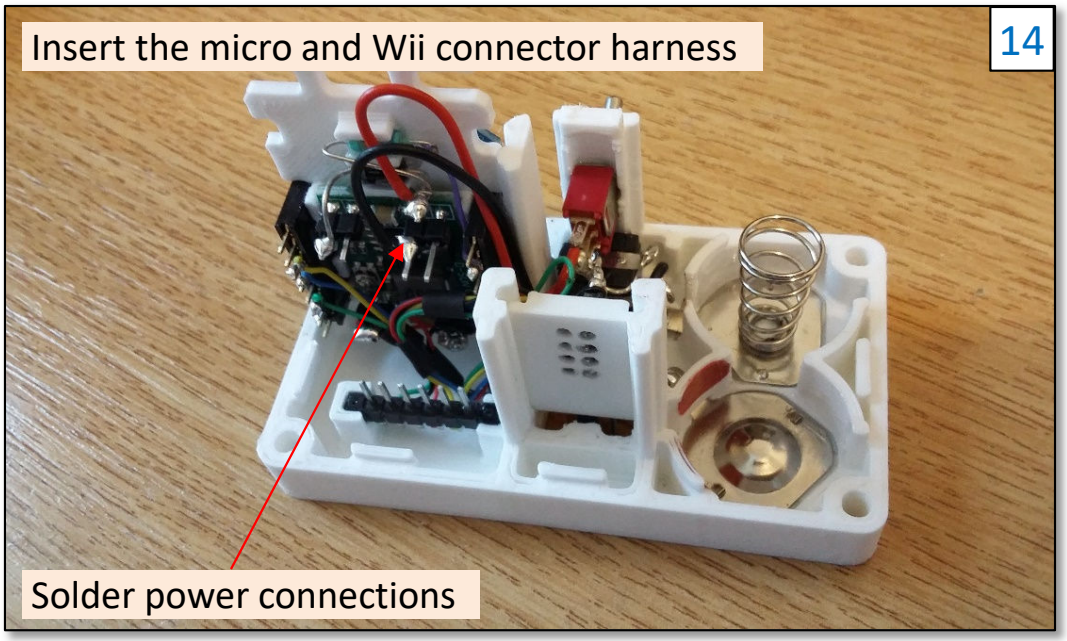
Wiring Sequence

13 Attach wires to the switch, socket and connectors



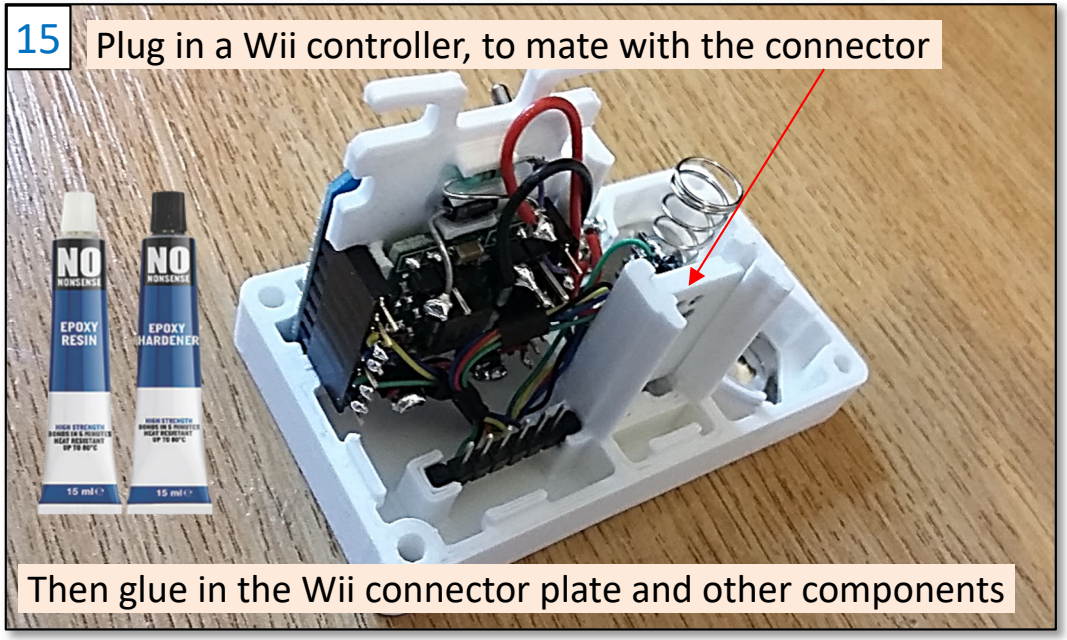
See earlier diagram as a guide

14 Insert the micro and Wii connector harness



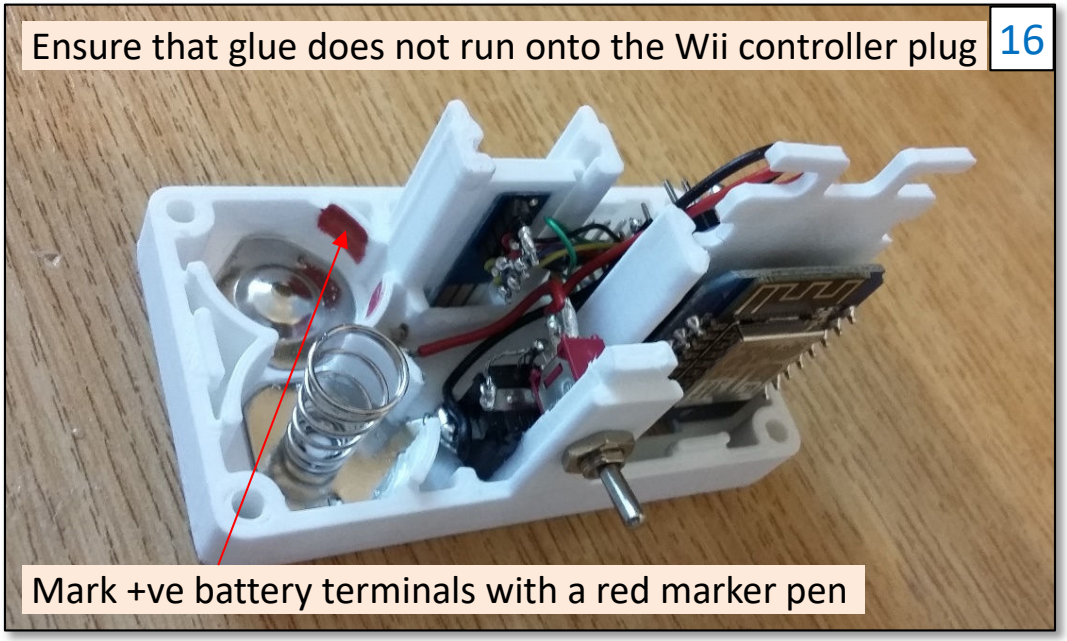
Solder power connections

15 Plug in a Wii controller, to mate with the connector



Then glue in the Wii connector plate and other components

16 Ensure that glue does not run onto the Wii controller plug



Mark +ve battery terminals with a red marker pen

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2.4GHz

ESP NOW

All done, and ready for final testing.
Note that the benefit of using wire wrap is that you can test during the build process.

Note. Your D1 Mini WEMOS device will have an exclusive MAC address, which is displayed when you turn it on. Code in other projects will need to search for this device, using that address, in order to pair with it.

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Battery Voltage Health Monitoring

See 18650 discharge curve obtained from the internet. In this analysis both batteries are identical and connected in series,
Assume fully charged batteries max voltage is V_{BM} >= 8.2v max
I measured fully recharged 18650 at 8.4v when connected and ON.
Set battery warning point at V_B = 7.00v
Set battery critical point at V_{BC} = 6.60v

WEMOS D1 is powered from DC-DC buck converter at 3.3v
It has internal resistor network of 220k + 100k, so 3.2v at A0 pin gives 1.0v at VADC == 1023 on 10-bit converter (1023 max).
If we use a 680k resistor feeding A0 we get 10.0v == 1023
Using a Multimeter I determined the conversion factor to be 1030

MAX: V_M = 8.2v, gives A0 = 839 on ADC (V_M* 102.3)

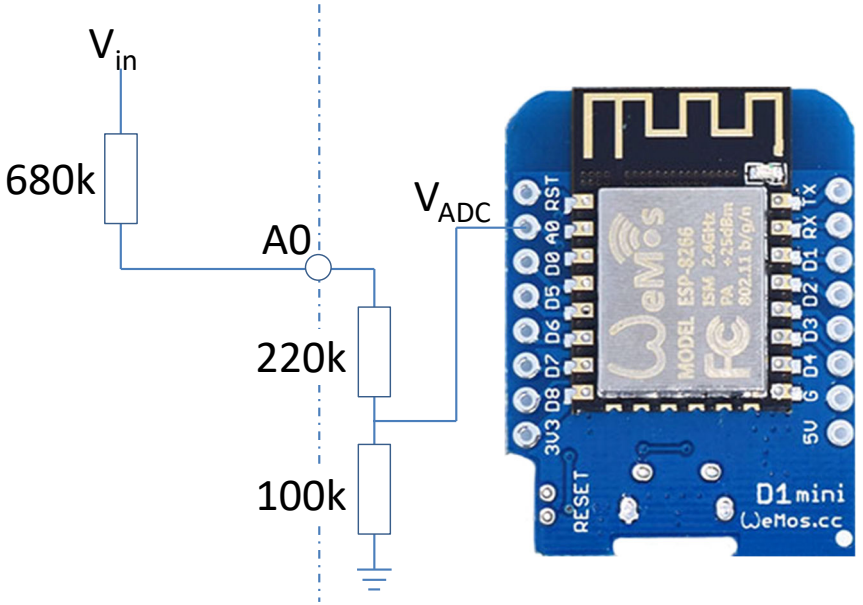
WARNING: V_B = 7.0v, gives A0 = 716on ADC (V_B* 102.3)

CRITICAL: V_{BC} = 6.6v, gives A0 = 675 on ADC (V_{BC}* 102.3)

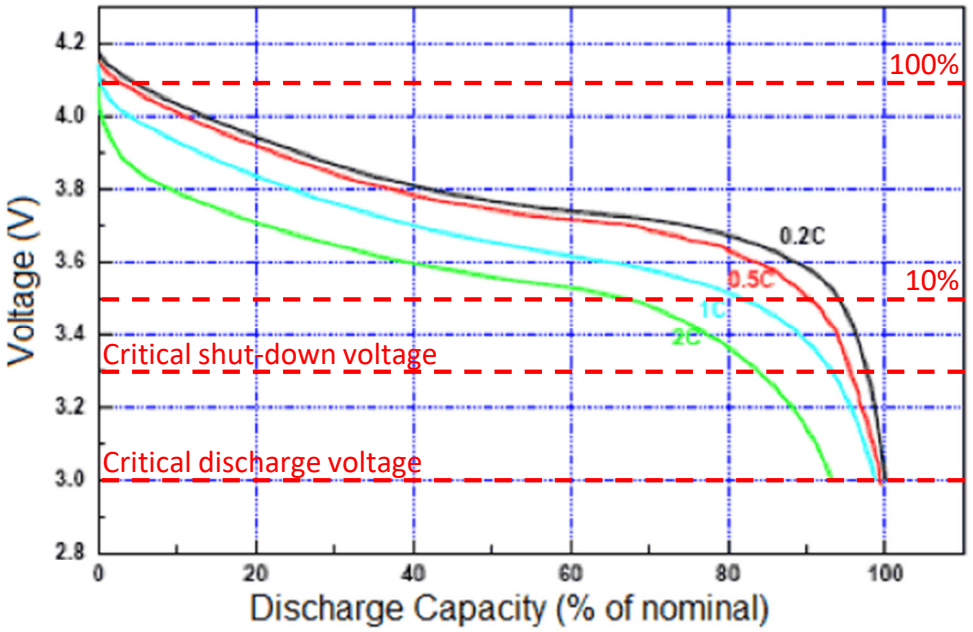
The code will sample the battery voltage on power-up to ensure it is sufficient, then at every regular intervals, calculating an average to remove noise.

Given the relatively light current drawn I have assumed a linear discharge curve ranging from 8.2v (100%) to 6.6v (0%) capacity. The rate of discharge is monitored and used to actively predict the life of the battery in use.

Note: If connected to USB port with internal battery switched OFF the ADC will read a value much less than 5 volts. So, if the micro starts with such a low reading it assumes that it is on USB power.



18650 Lithium Battery
Discharge Profile



Discharge: 3.0V cutoff at room temperature.