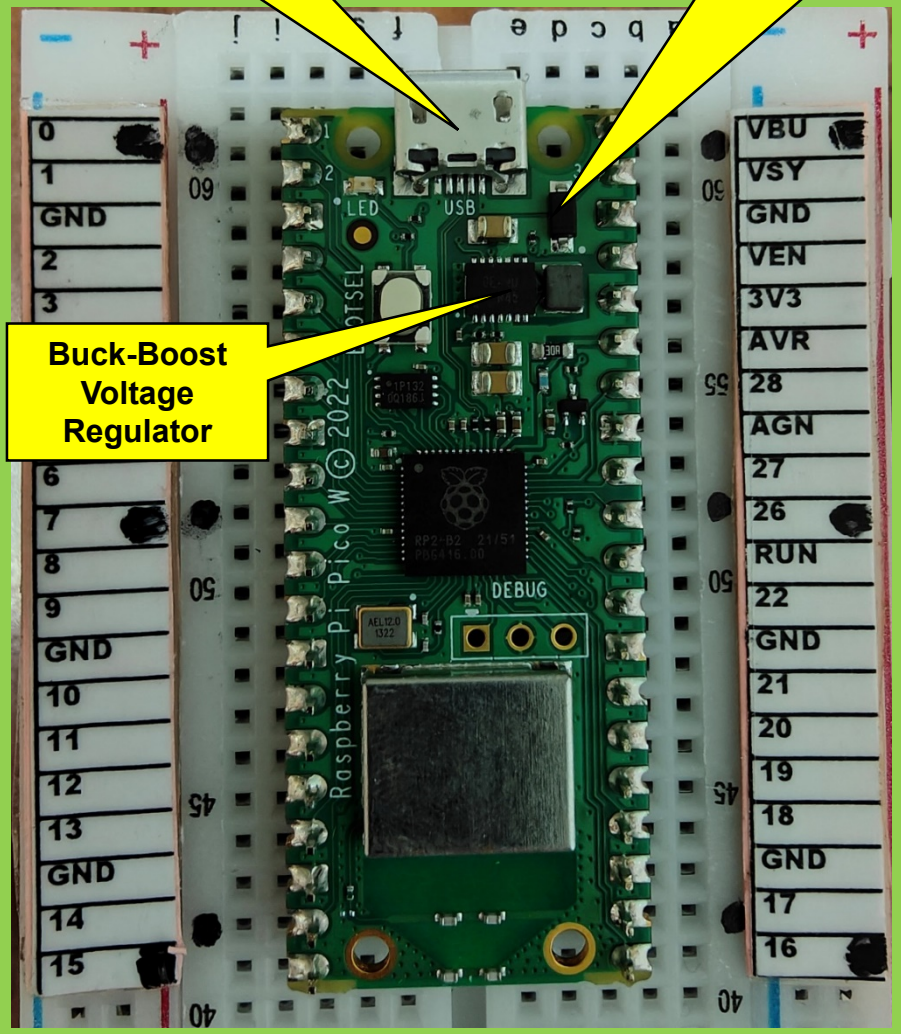
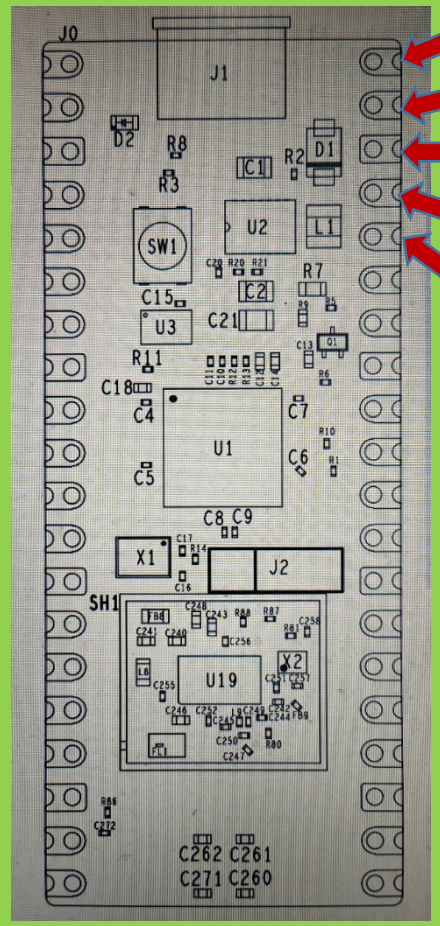
Pi Club Sharing Session

"Powering of RPi Pico W"

Sunday, 5 Mar 2023 @ TRL

RPi Pico W Component Layout





Pin 40 - VBUS (USB power) 5 VDC

Pin 39 - VSYS 1.8 to 5.5 VDC

The 8 GROUND pins are all electrically connected

Pin 37 – 3V3_EN (Pull low to power off the Pico)

Pin 36 – 3V3 (OUT) – max 300 mA

RPi Pico W Power Supply Circuitry

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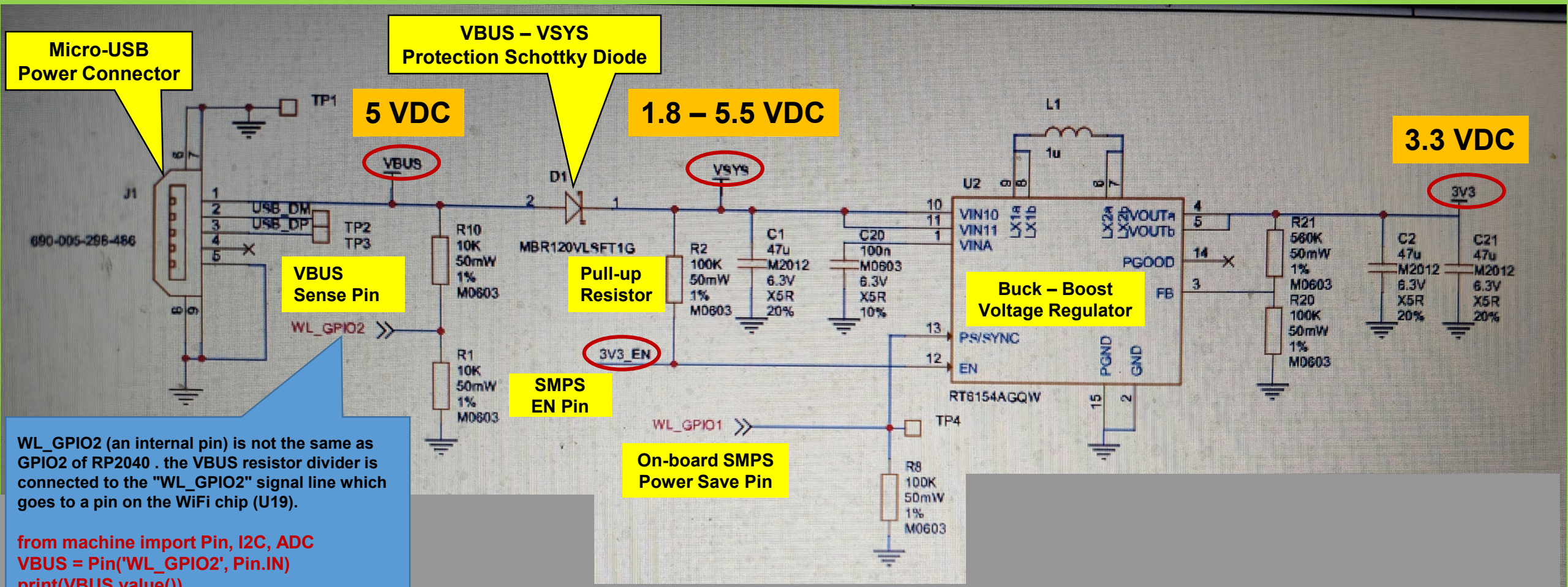


WL_GPIO2 (an internal pin) is not the same as GPIO2 of RP2040 . the VBUS resistor divider is connected to the "WL_GPIO2" signal line which goes to a pin on the WiFi chip (U19).

```
from machine import Pin, I2C, ADC
VBUS = Pin('WL_GPIO2', Pin.IN)
print(VBUS.value())
```

Functional Description of RPi Pico W Power Supply Circuitry

VBUS is the 5V input from the micro-USB port, which is fed through a Schottky diode to generate VSYS.

The VBUS to VSYS protection schottky diode (D1) adds flexibility by allowing power of different supplies into VSYS.

VSYS is the main system 'input voltage' and feeds the RT6154 buck-boost SMPS, which generates a fixed 3.3V output for the RP2040 device and its I/O (and can be used to power external circuitry).

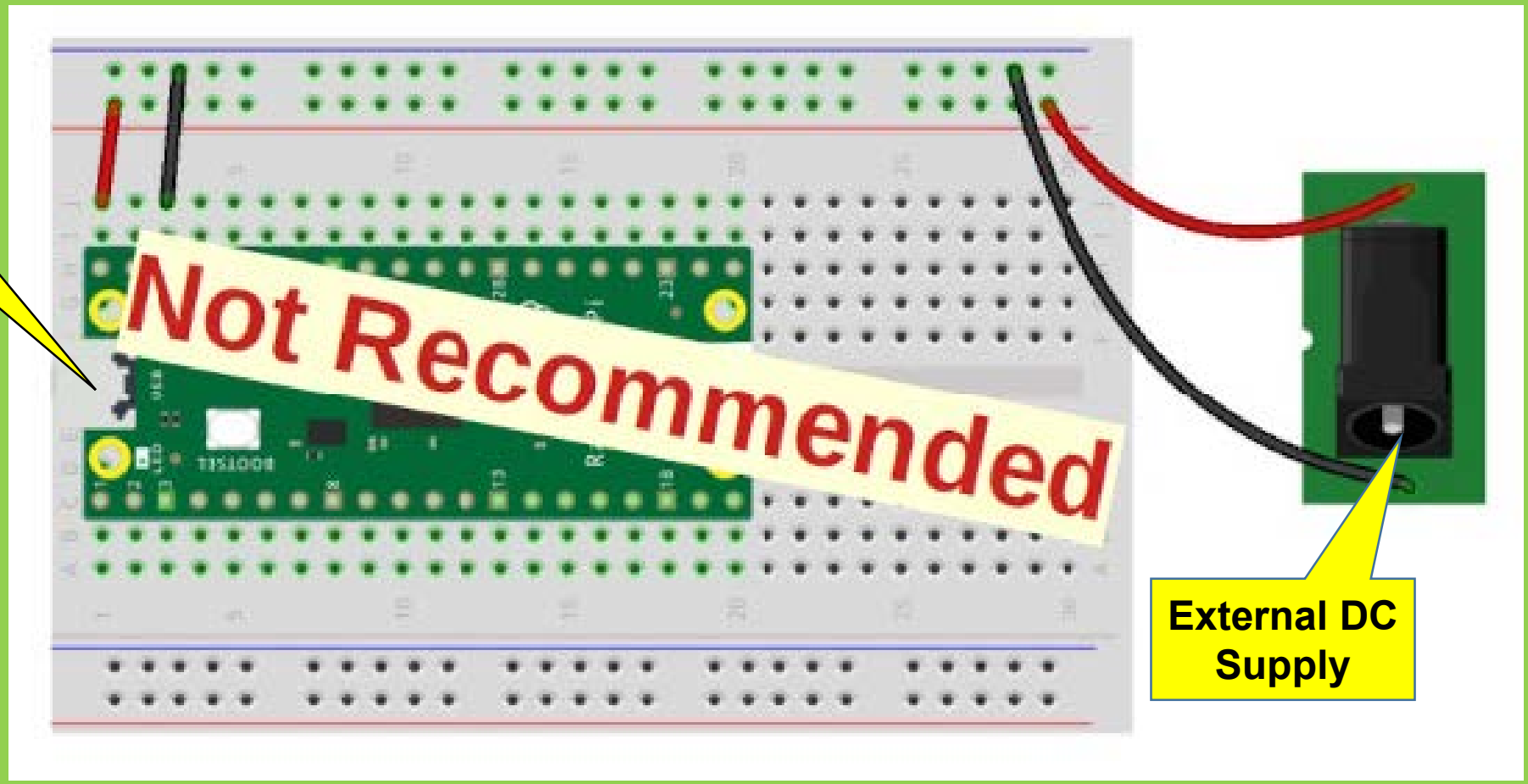
The Buck-Boost SMPS can switch from buck to boost mode, and therefore can maintain an output voltage of 3.3V from a wide range of input voltages, ~1.8V to 5.5V, which allows a lot of flexibility in the choice of power source.

WL_GPIO2 monitors the existence of VBUS, while R10 and R1 act to pull VBUS down to make sure it is 0V if VBUS is not present.

WL_GPIO1 controls the RT6154 PS (power save) pin. When PS is low (the default on Pico W) the regulator is in pulse frequency modulation (PFM) mode, which, at light loads, saves considerable power by only turning on the switching MOSFETs occasionally to keep the output capacitor topped up. Setting PS high forces the regulator into pulse width modulation (PWM) mode. PWM mode forces the SMPS to switch continuously, which reduces the output ripple considerably at light loads (which can be good for some use cases) but at the expense of much worse efficiency. Note that under heavy load the SMPS will be in PWM mode irrespective of the PS pin state.

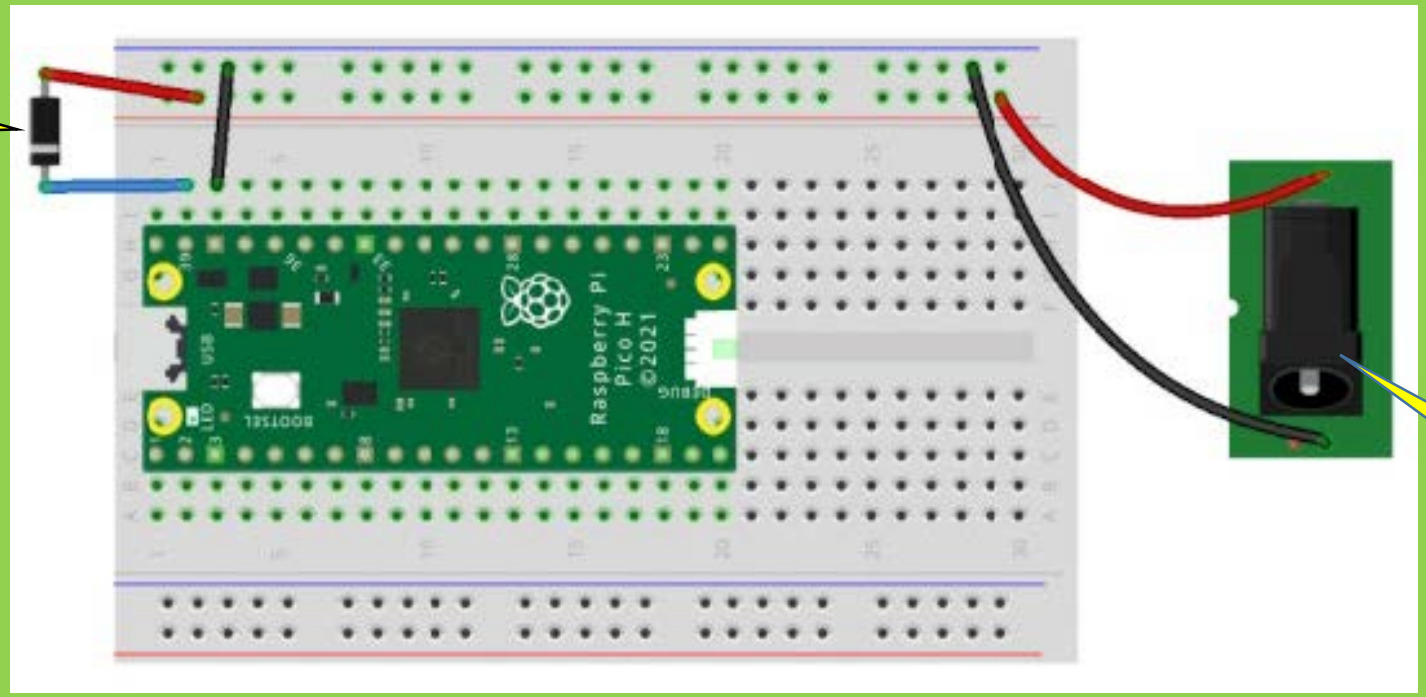
The **SMPS EN** pin is pulled up to VSYS by a 100kΩ resistor and made available on Pico W pin 37. Shorting the GPIO37 to ground will disable the SMPS and put it into a low power state.

Powering the RPi Pico W Through VBUS (5 VDC)



This is NOT recommended as it could result in two DC power supplies (USB and external) being connected in parallel).

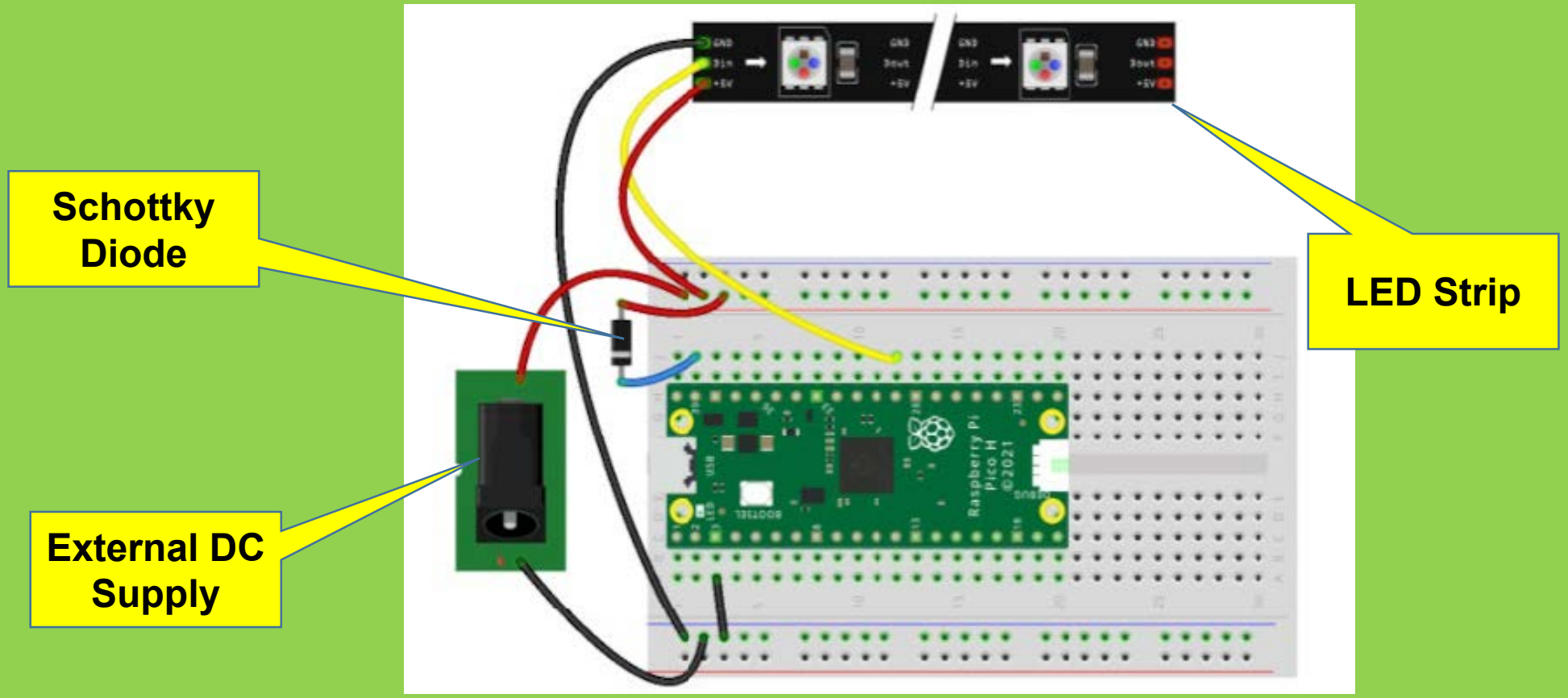
Powering the RPi Pico Through VSYS (1.8 – 5.5 VDC)



A preferred way to connect an external DC supply to the Raspberry Pi Pico W is via the VSYS pin.

It is recommended that an external Schottky diode (such as 1N5817) be used with the on-board protection Schottky diode (D1) so as to prevent backfeeding.

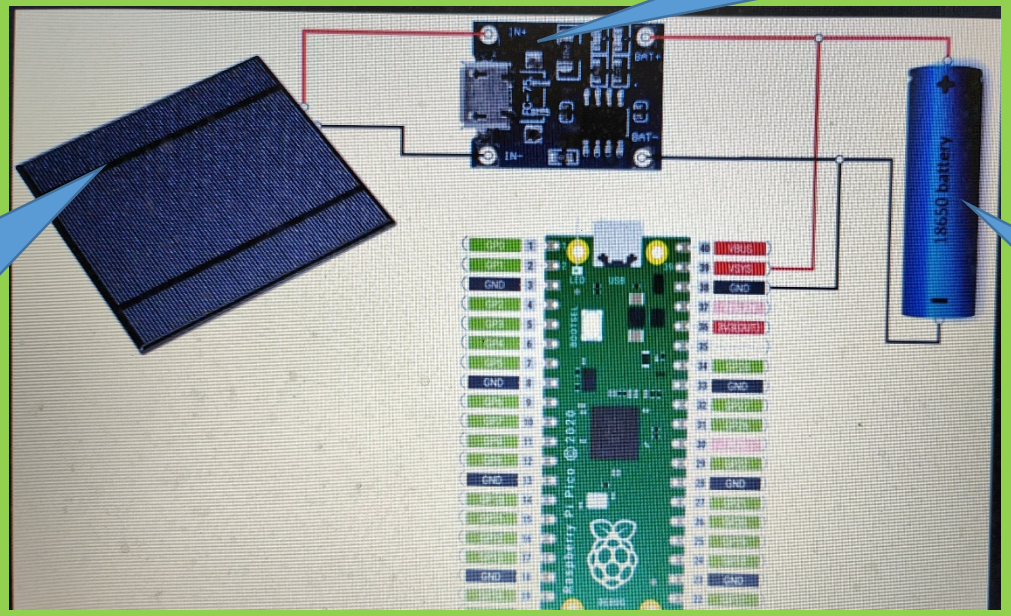
Powering the RPi Pico Through VSYS (1.8 – 5.5 VDC) with External Circuit



An external supply is connected through the Schottky diode with the external supply also being used to power a LED strip.

Powering the RPi Pico Remotely

Battery Charger
Tech Spec (Example)
TP4056 modules
Input Voltage: -0.3 VDC to 8VDC
Output Voltage: 4.2 V
Charging Current: 1200 mA max.



Solar Cell
Tech Spec (Example)
Output Voltage: 5VDC
Output Current: 500mA
Output Power: 2.5W

Rechargeable Battery
Tech Spec (Example)
Lithium-ion Battery (18650)
Voltage : 3.7V
Capacity : 3400mAh

RPi Pico has low power consumption, therefore it is ideal for remote monitoring applications where mains electricity supply may not be available.

Whilst powering through VSYS will allow for a wide range of dc supply voltage, if the power is intermittent or is prone to energy spikes then it is recommended to employ some kind of battery backed solution. Effectively using the renewable energy source to charge a battery which is then used to supply the Pico.

End of Sharing Session