Power Adapter, Booster

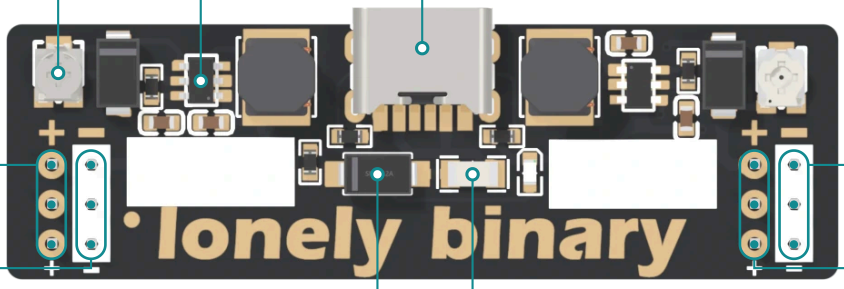
Two breadboard rails from one USB-C socket: about 4.3 to 28 V a side, by trimmer.

Line each + up with a +

Both ends print **+ –** reading left to right, so + is the outer column at the left end and the inner one at the right: the board fits a breadboard one way round. On a breadboard printed mirror-image, one side is backwards whichever way round it goes. Nothing on the adapter shorts, **but every part wired by the printing gets its supply reversed.**

Twelve pins, four groups of three

Drawn from above with the USB-C socket at the top. Each end prints **+ –** left to right: + is the outer column at the left end and the inner column at the right. The three pins in a column are one net.



MT3608 + 22 µH inductor
A 1.2 MHz boost converter per side. Floor: about 4.3 V.

Trimmer, one per side (200 kΩ)
± 25 %: never turn it to the end stop. Set it with a meter.

USB-C socket, power only
5.1 kΩ on CC1 and CC2, so a USB-C charger switches 5 V on.

Left +, 3 pins
4.3 to 28 V, left trimmer

Left –, 3 pins
Ground: all six – are one

Right –, 3 pins
Ground: all six – are one

Right +, 3 pins
4.3 to 28 V, right trimmer

SS24 Schottky diode
Takes about 0.3 V at 100 mA. Stops a second supply feeding back.

Fuse: 0.5 A resettable (PPTC)
Trips by 1 A. One fuse for both sides together.

The top of the knob is different on every board

The 200 kΩ trimmer is ± 25 %, so the top of its travel lands anywhere from about 20 V to past 30 V. The MT3608 is rated 28 V. Set each side with a meter, with nothing on the rail.

More volts, less current

5 V

390 mA, both sides together

Just above the floor, about 4.3 V.

12 V

160 mA, both sides together

A few centimetres of 12 V LED strip; a metre wants far more.

24 V

80 mA, both sides together

Double the volts, half the current.

Power in is capped: the fuse holds 0.5 A at about 4.5 V, about 2.3 W, and the converter loses some of that. **Every volt you add costs current**, and the two sides share it. A load that wants more trips the fuse, and the output falls.

Worked out, not measured: 0.5 A into the converters at 4.54 V (a 5.00 V port less the diode and the fuse at that current), at 85 % efficiency. That is a planning figure: the MT3608's own curves reach higher, and a small converter at a large step does worse. Both sides together; two rails split it.

Watch the rail with an ESP32

Arduino IDE · Board: ESP32 Dev Module · No libraries

```
// Watch a breadboard power rail. Wiring: table on the right.
const int PIN = 34;              // ADC1, input only
const float TOP_OHMS = 100000; // 10000 on a 3.3 or 5 V rail
const float BOTTOM_OHMS = 10000;
const float SCALE = (TOP_OHMS + BOTTOM_OHMS) / BOTTOM_OHMS;

float lo = 99, hi = 0, sum = 0;
int n = 0;
uint32_t last = 0;

void setup() {
  Serial.begin(115200);
  delay(500);
  Serial.println("rail watch: average, lowest, highest");
}

void loop() {
  float v = analogReadMilliVolts(PIN) / 1000.0 * SCALE;
  sum += v;
  n++;
  if (v < lo) lo = v;
  if (v > hi) hi = v;

  if (millis() - last >= 1000) {
    last = millis();
    Serial.printf("%.2f V   low %.2f   high %.2f\n",
                  sum / n, lo, hi);
    lo = 99; hi = 0; sum = 0; n = 0;
  }
  delay(1);
}
```

```
rail watch: average, lowest, highest
```

Then once a second at 115200: the average of about a thousand readings, the lowest and the highest, in volts. Watch it while you turn the trimmer.

Wiring

	FROM	TO
1	Rail +	100 kΩ, first end
2	100 kΩ, second end	the junction
3	The junction	10 kΩ to rail –
4	The junction	GPIO 34
5	ESP32 GND	Rail –

Power the ESP32 from its own USB cable, and plug it in before the adapter. Share ground only: never wire the rail to the ESP32's 5V or 3V3 pin as well. GPIO 34 is on ADC1 and input only, so a slip in the sketch cannot drive the rail. The 100 kΩ top resistor divides by eleven, so 28 V arrives as about 2.5 V. Fit it before turning the booster up: two 10 kΩ would read a flat 6.2 V.

Power in is capped

Everything comes in through the 0.5 A fuse at about 4.5 V: about 2.3 W, less what the converter loses. That is about 160 mA at 12 V, both sides together. The back's MAX 2A@5V is the MT3608's own rating, not this board's. Both converters run whenever the cable is in, with no switch, so set the voltage before wiring anything, and unplug to change the wiring.

When it does not work

I plugged it in the wrong way round

The adapter is almost certainly fine: nothing shorts, and + and – swap names. Parts wired to those rails may not be. Turn it round and check each part.

I turned it to the end and it read 31 V

Turn it down at once. The MT3608 is rated 28 V, 30 V absolute maximum on its switch pin. Set it with a meter and nothing wired to the rail.

The fuse trips at 12 V with only 300 mA

300 mA at 12 V is 3.6 W out and about 4.2 W in: nearly an amp from USB. The fuse holds half that.

It will not go below about 4.3 V

The floor of any boost converter: turned down, the MT3608 stops switching and the input passes through its diode. For less, use the step-down board.

The voltage collapses under load

The load wants more than 0.5 A at the input can give at that voltage: about 160 mA at 12 V. The fuse trips and the output falls.

It whines faintly

Normal with little connected: at light load the MT3608 switches in bursts that can land in the audible range.

Specifications

Input	USB-C, power only; 5.1 kΩ on CC1, CC2	**Current**	0.5 A in total, both sides; trips by 1 A
Diode	SS24 Schottky, about 0.3 V at 100 mA	**Outputs**	About 4.3 V to 28 V per side, by trimmer
Boost	2 × MT3608, 1.2 MHz, 22 µH, always on	**Trimmer**	200 kΩ ± 25 % per side; set with a meter
Pins	2 × (3 +, 3 –), 2.54 mm pitch, one way round	**Board**	53.34 × 16.36 mm, pins 7.9 mm below