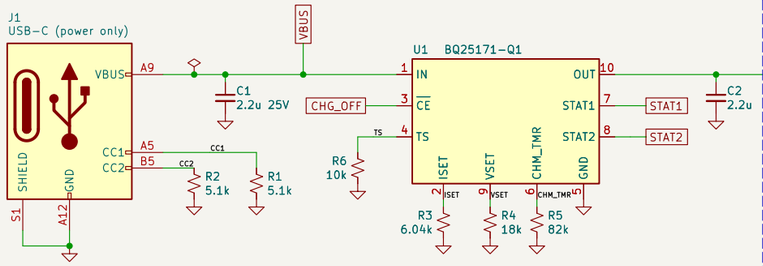
Nixie HV supply for small cells: 1.0 – 5.5 V in, 170 V out

Untested design. The flyback stage keeps the NCH8200HV's control loop; what is new is everything around it.

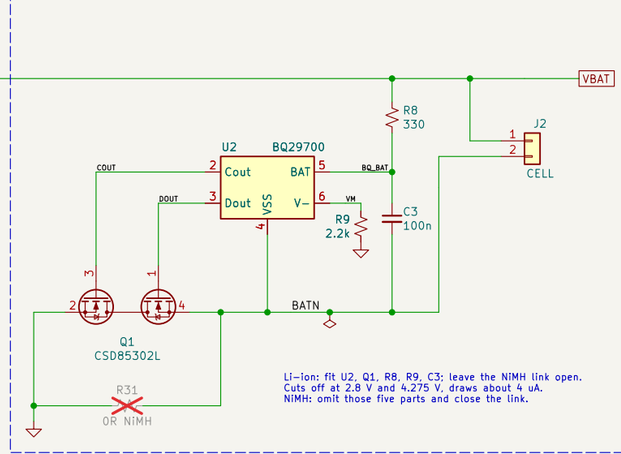
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USB–C IN + CHARGER (Li–ion or NiMH, chosen by R3 / R4 / R5)



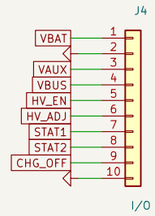
CHARGER SETTINGS (1 % resistors, read once at power–up)
Li–ion, 1 cell (as drawn): R3 6.04k = 50 mA, R4 18k = 4.20 V, R5 82k = Li–ion, 10 h limit
NiMH, 1 cell: R3 15k = 20 mA, R4 62k, R5 15k = NiMH, 12 h
NiMH, 2 or 3 cells: as 1 cell, but R4 = 36k (2 cells) or 24k (3 cells)
Charge current = 300 V / R3, 10 to 800 mA. NiMH charging ends on the timer: choose current x hours near 1.4 x capacity. R6 = 10k means no thermistor; a 10k NTC on the cell in its place stops the charge when the cell warms up. STAT2 low while charging: STAT1 low = fault; CHG_OFF high = stop.
A charge LED pulls STAT2 toward VBUS: leave it off if STAT2 goes to a logic pin running below 3.3 V.

CELL + LI–ION PROTECTION (leave out and bridge for NiMH)



Li–ion: fit U2, Q1, R8, R9, C3; leave the NiMH link open.
Cuts off at 2.8 V and 4.275 V, draws about 4 uA.
NiMH: omit those five parts and close the link.

I/O



OUTPUT VOLTAGE
Vout = 1.25 V x (1 + 20M / Rb)
Rb = R16 = 148k: 170 V, fixed.
Change R16 for another voltage.
A 20k trimmer gives 165 to 189 V, clockwise up.
HV_ADJ (if fitted): open = no shift, 0 V = +25 V,
3.3 V = –41 V. Drive it from a DAC or fast PWM.

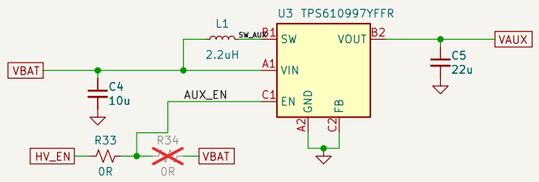
ENABLE
HV_EN high (2.0 V or more) = on. R10 holds it off.
1.8 V logic is too low for U4: level–shift it.
Soft start is 1024 cycles, about 10 ms.
R19 holds Q2 off while U4's gate driver has no supply.

LIGHT LOAD
R12 = 10 mOhm and 100 kHz are the NCH8200HV's values, so below 1.5 A peak U4 stops PWM and sends single large pulses, as that board does.
Q2 CSD17318Q2: 30 V, 20 mOhm at 2.5 V, 6 nC, 2 x 2 mm.

RATINGS THAT MATTER
C11, C12: 250 V. R14, R15: 0805, for 85 V across each.
D2 sees Vout + 18 x Vin, about 270 V: use 600 V, fast.
Q2 sees Vin + Vout / 18, about 15 V, plus the leakage spike.
R12: metal strip, Kelvin–sensed to U4 pins 6 and 7.

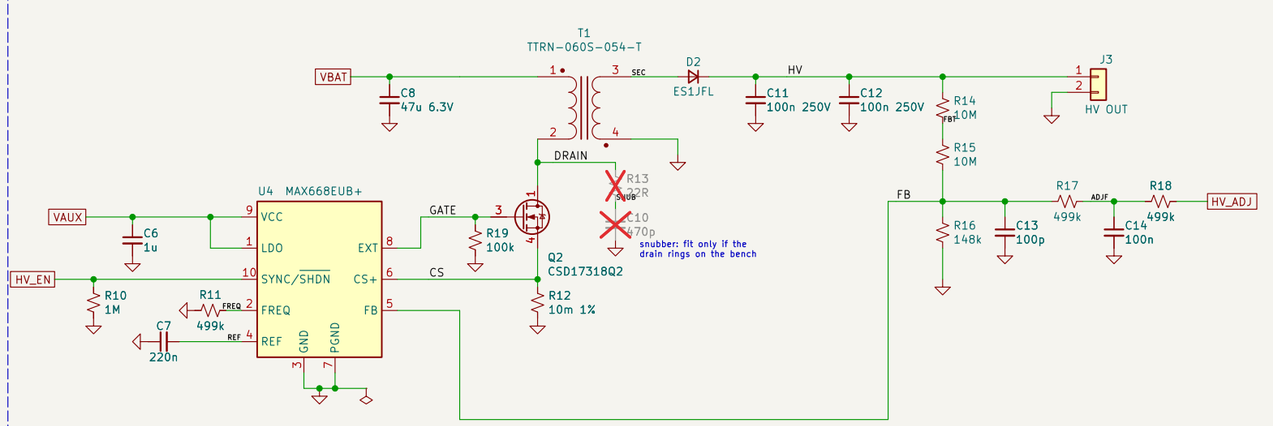
NOT YET PROVEN – CHECK ON THE BENCH
T1: the –054's inductance, ratio and pin use (data here is the –055's), and which end of the footprint is pin 1; C13: whether the snubber is needed: efficiency at 1.2 V; charger start on a flat NiMH cell.
170 V is on J3, D2, C11, C12, R14 and T1's secondary.

AUX BOOST: 0.7 V start –> 5 V for U4 and gate drive



As shipped the boost runs only while HV_EN is high, so with HV off this block draws about 1 uA or less (TLV61220: U4 stays powered, about 4 uA).
Move the link to VBAT to keep VAUX up all the time as a logic rail.

170 V FLYBACK – same controller, timing and sense values as the NCH8200HV



T1 – Tokyo Coil Engineering TTRN–060S–054–T, the transformer on the NCH8200HV
Camera–flash flyback transformer, 6.8 x 9.6 x 4.8 mm, 2 + 3 gull–wing pins (one unused).
Tokyo Coil publishes figures for the –055 only: 10.8 uH primary, 1:18, 235 mOhm / 44.5 Ohm max, 2.7 A maximum primary switching current. The –054's own values are not published: measure one.
Pins per the TTRN–060S sheet: primary 1 (start) – 2, secondary 4 (start) – 3.
Not a distributor part: Tokyo Coil direct, or Taobao / AliExpress at about 3 USD each.

HOW MUCH CURRENT, FROM WHAT
With the –055's figures the flyback tops out at 0.375 W per V^2 of input (90 % duty, 100 kHz, 10.8 uH):
    1.2 V in: 0.5 W –> roughly 2 mA at 170 V (the 235 mOhm primary costs most here)
    2.4 V in: 2.2 W –> roughly 8 to 10 mA
    3.3 V and up: T1's 2.7 A peak, about 3.9 W –> 20 mA class, as the NCH8200HV is rated
A cell with high internal resistance (flat alkaline, 1/3 AAA NiMH) gives less than this:
the cell is the limit, not the converter. VBAT is a cell: 5.5 V at most.

Flyback core copies the NCH8200HV: MAX668, 100 kHz, 10 mOhm.
Generated from the decision page. Not built or simulated.
The option string is printed under the sheet title.

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File: nixie_hv.kicad_sch

Title: Nixie HV supply for small cells, 170 V out

Size: A3	Date: 2026–11–13	**Rev: B**
KiCad E.D.A. 10.0.6		Id: 1/1