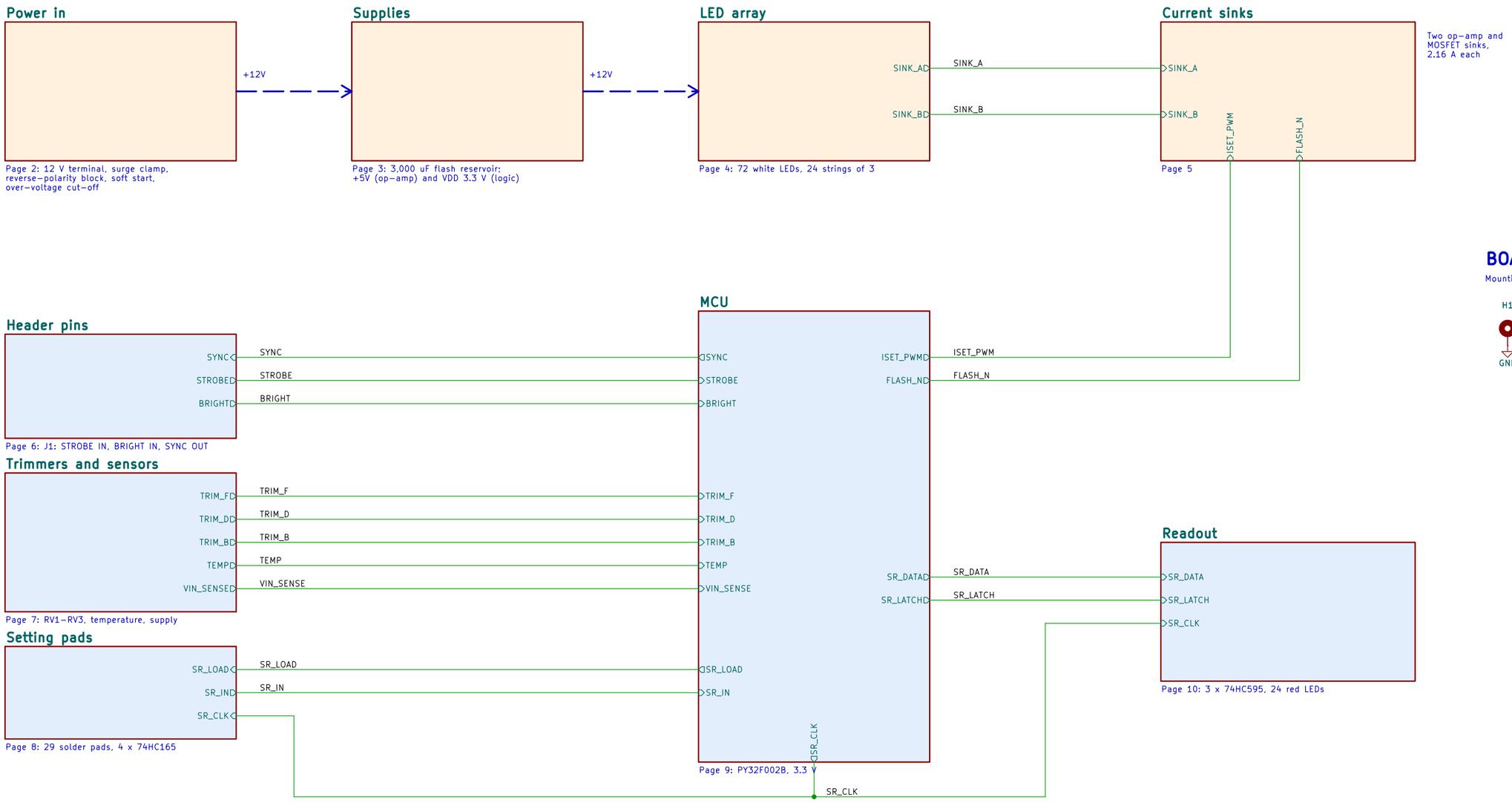
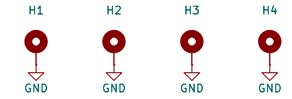
LED STROBE: block diagram

Read left to right. Top row: the power path, from the 12 V input to the LED strings and their current sinks. Bottom row: the control path, from the inputs (header pins, trimmers, setting pads) through the MCU to the sinks and the readout.
Each box is a page: click it to go there. Wires here are the signals between pages; the supply rails (+12V, +5V, VDD, GND, VIN) join by name on every page.



BOARD FRAME

Mounting holes on GND.



LAYOUT NOTES

1. Star ground at J2 pin 2. Flash loop: C1–C5 > LEDs > Q1/Q2 > R25–R28 > back to C1–C5, short and wide. J1 GND joins only at J2.
2. Sense Kelvin: R40/R45 tap SENSE at the resistor pads. 3. Q8 (temperature) touches Q1's drain copper.
4. Back of board: a flat zone behind the LEDs for a customer heatsink (no parts; thermal vias, solder mask).
5. Value pads and source jumpers on the back. 6. Trimmers at the ends of their readout rows. 7. U2 (5 V LDO) on a copper pad: up to 0.3 W.

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app

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LED-STROBE-XXL

NE

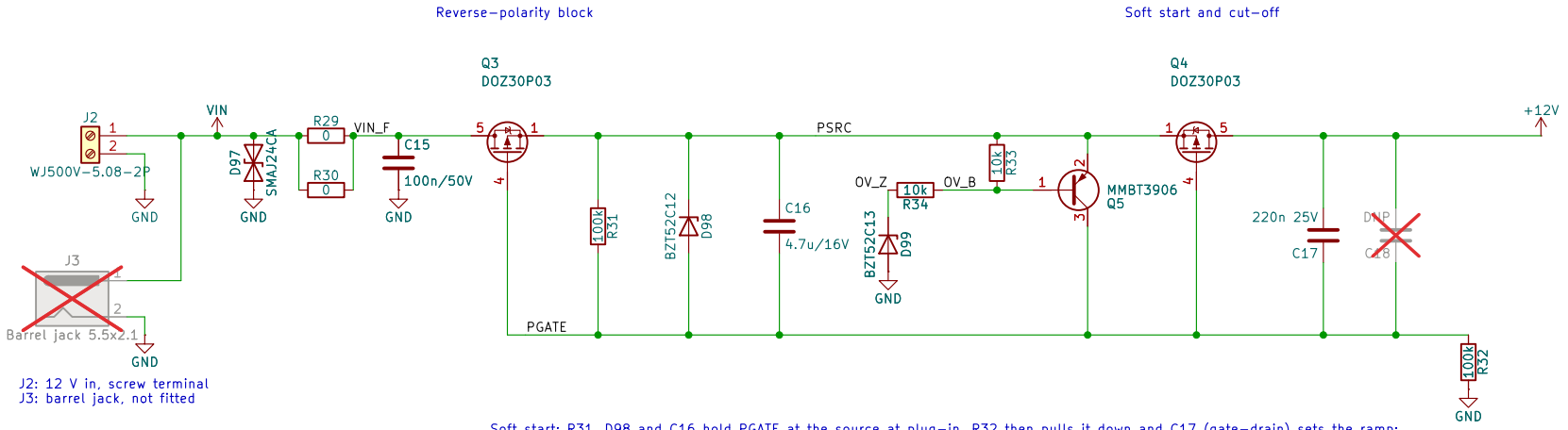
Sheet: /
File: LED-STROBE-XXL.kicad_sch

Title: LED STROBE board, format XXL

Size: A3	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 1/10

2 POWER IN: 12 V in, surge clamp, reverse-polarity block, soft start, over-voltage cut-off

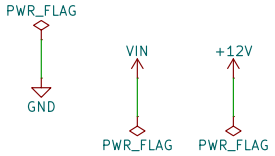
12 V comes in on J2 (left) and leaves as +12V (right) for the flash reservoir, the LED strings and the regulators. D97 clamps surges; R29 and R30 are 0 ohm links (ferrite-bead option).
Q3 and Q4 are back-to-back P-MOSFETs that share one gate, PGATE. Q3 blocks a reversed adapter; Q4 ramps the output up at plug-in (soft start).
Star ground at J2 pin 2: the flash loop (C1-C5, LEDs, sinks, sense resistors) returns to it alone.



J2: 12 V in, screw terminal
J3: barrel jack, not fitted

Soft start: R31, D98 and C16 hold PGATE at the source at plug-in. R32 then pulls it down and C17 (gate-drain) sets the ramp: about 0.3 V/ms, so the 3,000 uF reservoir draws about 1 A.
Over-voltage: above about 14 V the zener D99 conducts, Q5 turns on and shorts gate to source, and the board turns off (a 24 V adapter by mistake).

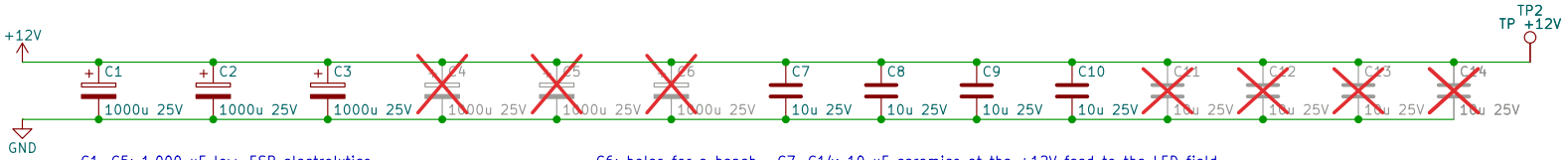
ERC power flags



Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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LED-STROBE-XXL
NE
Sheet: /Power in/
File: power_in.kicad_sch
Title: LED STROBE: Power in
Size: A4 | Date: 2026-11-10 | **Rev: P1**
KiCad E.D.A. 10.0.5 | Id: 2/10

3 FLASH RESERVOIR AND LOGIC SUPPLIES

The reservoir capacitors on +12V deliver each flash; the input only has to refill them between flashes.
U2 makes +5V for the op-amp, U3 makes VDD (3.3 V) for the MCU and the shift registers.

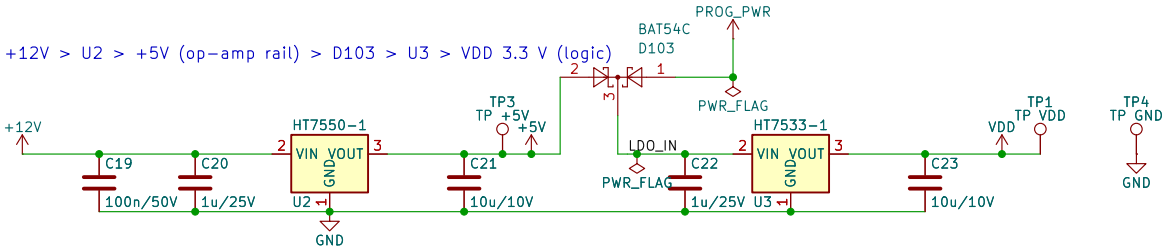


C1–C5: 1,000 uF low-ESR electrolytics,
C1–C3 fitted (C4, C5 spare footprints)

C6: holes for a bench capacitor (P1 testing)

C7–C14: 10 uF ceramics at the +12V feed to the LED field (C7–C10 fitted)

+12V > U2 > +5V (op-amp rail) > D103 > U3 > VDD 3.3 V (logic)



Give U2 a copper pad: it drops 7 V at up to 40 mA (0.3 W).
J1 pin 7 (VDD) can supply about 50 mA.

D103: programming with no 12 V. J4 pin 5 from the programmer (5 V or 3.3 V) runs U3; or 3.3 V into J4 pin 1 runs VDD directly. Either way only the logic is powered (about 25 mA). U3 sees +5V less about 0.35 V in normal use.

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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LED-STROBE-XXL
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Sheet: /Supplies/
File: supplies.kicad_sch

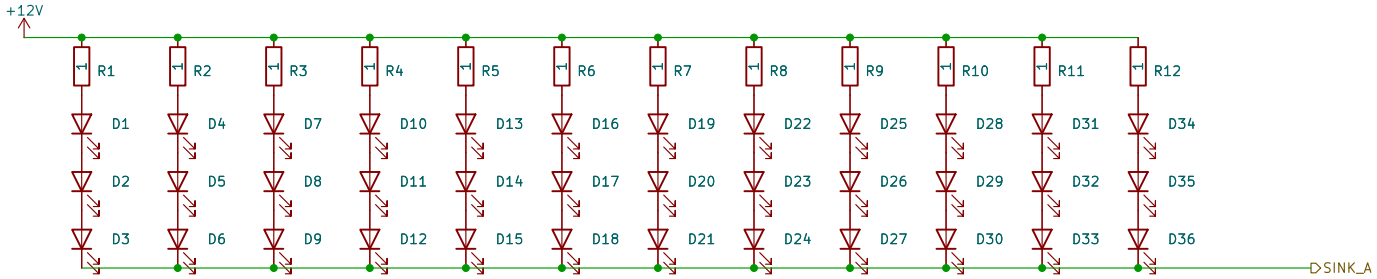
Title: LED STROBE: Flash reservoir and logic supplies

Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 3/10

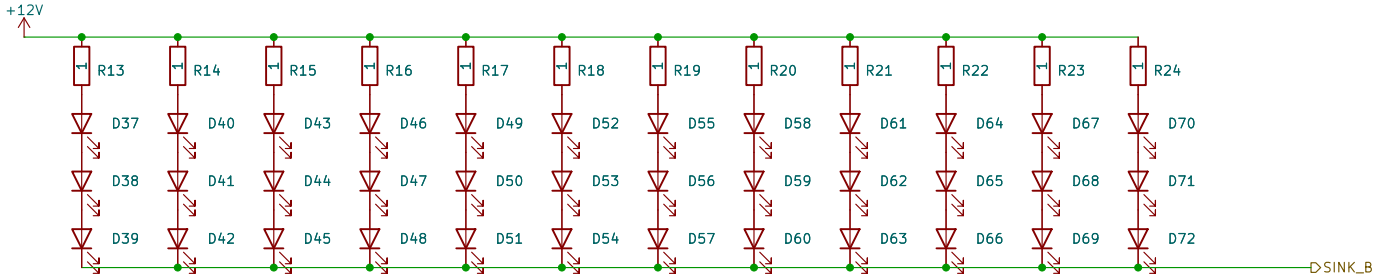
4 LED ARRAY: 72 white 2835 LEDs, 24 strings of 3, 180 mA each at full brightness

Each string runs from +12V through a 1 ohm ballast and three LEDs to its current sink.
Strings 1–12 return on SINK_A (to Q1), strings 13–24 on SINK_B (to Q2). All LEDs: Everlight 67-21S white 2835, LCSC C385305.

Strings 1–12 > SINK_A (page 5)



Strings 13–24 > SINK_B (page 5)



Ballasts R1–R24: 1 ohm 1 %, one per string.

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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LED-STROBE-XXL
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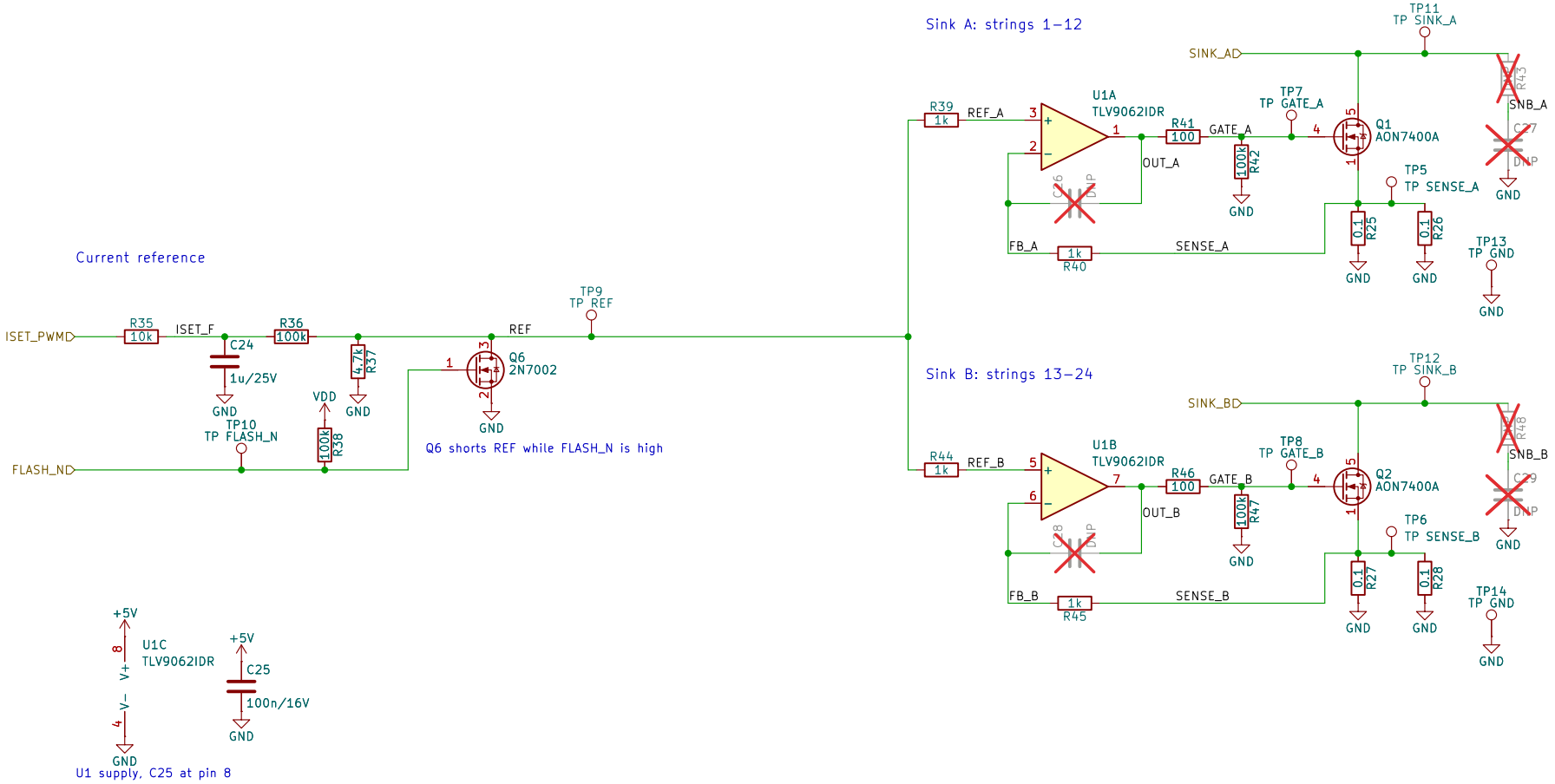
Sheet: /LED array/
File: led_array.kicad_sch

Title: LED STROBE: LED array

Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 4/10

5 CURRENT SINKS: the MCU sets the current (ISET_PWM) and gates the flash (FLASH_N)

ISET_PWM is filtered to a DC reference, REF. Each op-amp drives its MOSFET until the voltage on the sense resistors equals REF, so I per sink = REF / 50 mohm.
Full scale 148 mV (2.96 A); the firmware caps it at 108 mV = 2.16 A (12 x 180 mA). FLASH_N high (and at reset, through R38) turns Q6 on and pulls REF to 0: LEDs off.
DNP parts: op-amp compensation and drain snubbers for P1 tuning. Keep the sense returns Kelvin to the resistor pads.



Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app

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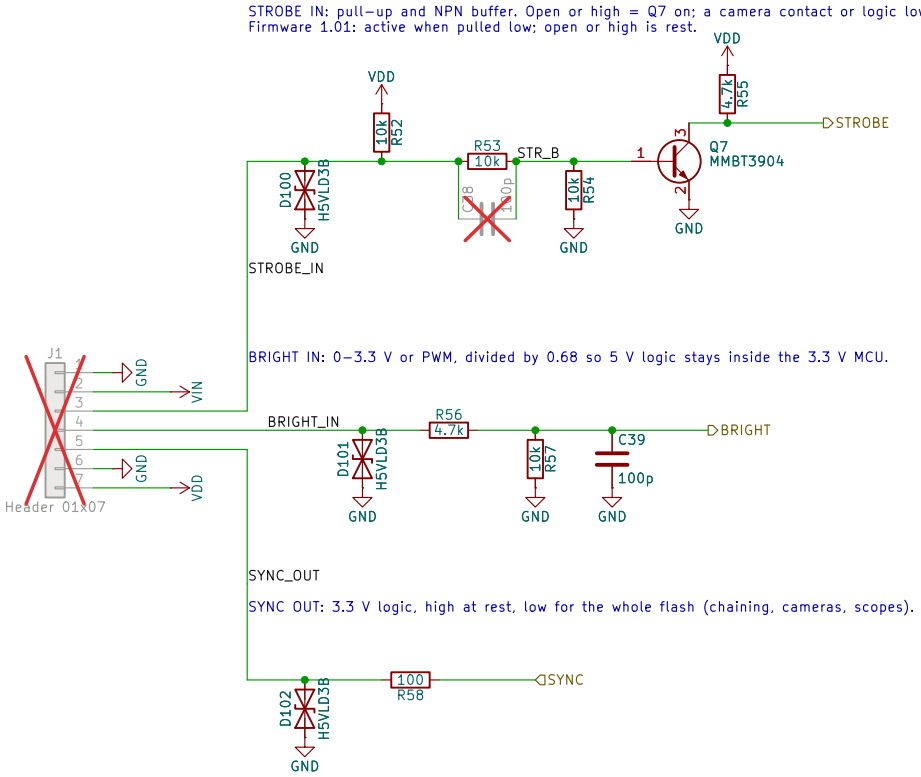
Sheet: /Current sinks/
File: current_sinks.kicad_sch

Title: LED STROBE: Current sinks

Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 5/10

6 HEADER PINS: STROBE IN, BRIGHT IN, SYNC OUT (1.8 / 3.3 / 5 V logic)

J1 ships loose (DNP) with only the 7 pins in use. Every signal pin has an ESD diode.



Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app

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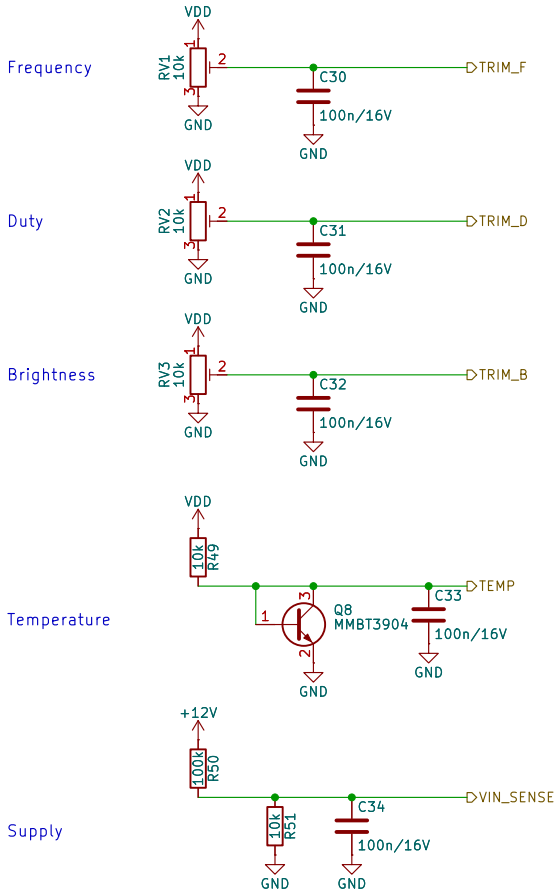
Sheet: /Header pins/
File: header_pins.kicad_sch

Title: LED STROBE: Header pins: STROBE IN, BRIGHT IN, SYNC OUT

Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 6/10

7 TRIMMERS, TEMPERATURE AND SUPPLY SENSE: analog inputs to the MCU

Each trimmer sets one value while its source jumper (page 8) is open, the default and the factory-test setting.
Q8 measures the sink temperature; VIN_SENSE watches the supply.



Trimmers: 10 kohm across VDD, the wiper to an ADC input (ADC_IN1–3). 100 nF on each wiper.

Q8: diode-connected NPN against Q1's drain copper. About −2 mV/K; calibrated at the factory test.

VIN_SENSE = +12V / 11: reads up to 36 V.

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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Sheet: /Trimmers and sensors/
File: trimmers_sensors.kicad_sch

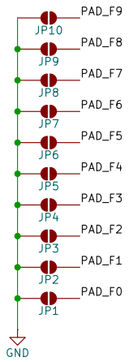
Title: LED STROBE: Trimmers, temperature and supply sense

Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 7/10

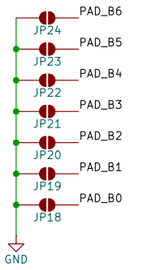
8 SETTING PADS: 24 value pads, 3 source jumpers and 2 option pads (back of board), read by 4 x 74HC165

Value pads: close a pad = 1. Frequency F0–F9 (1 Hz steps), duty D0–D6 (0.1 % steps), brightness B0–B6 (1 % steps). Each input has a 10 kohm pull-up (RN1–RN8).
Source jumpers JP25–JP27: the centre pad is GND. Open = trimmer (default, factory test); bridge to PADS or to PIN.
Chain: U5 > U6 > U7 > U8 > MCU (SR_IN). All load on SR_LOAD low and shift on SR_CLK.

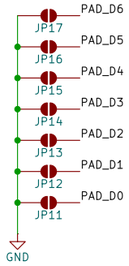
FREQUENCY (F0 = 1 Hz)



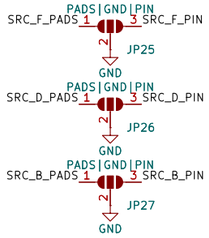
BRIGHTNESS (B0 = 1 %)



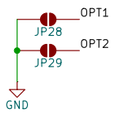
DUTY (D0 = 0.1 %)



SOURCE JUMPERS



OPTIONS

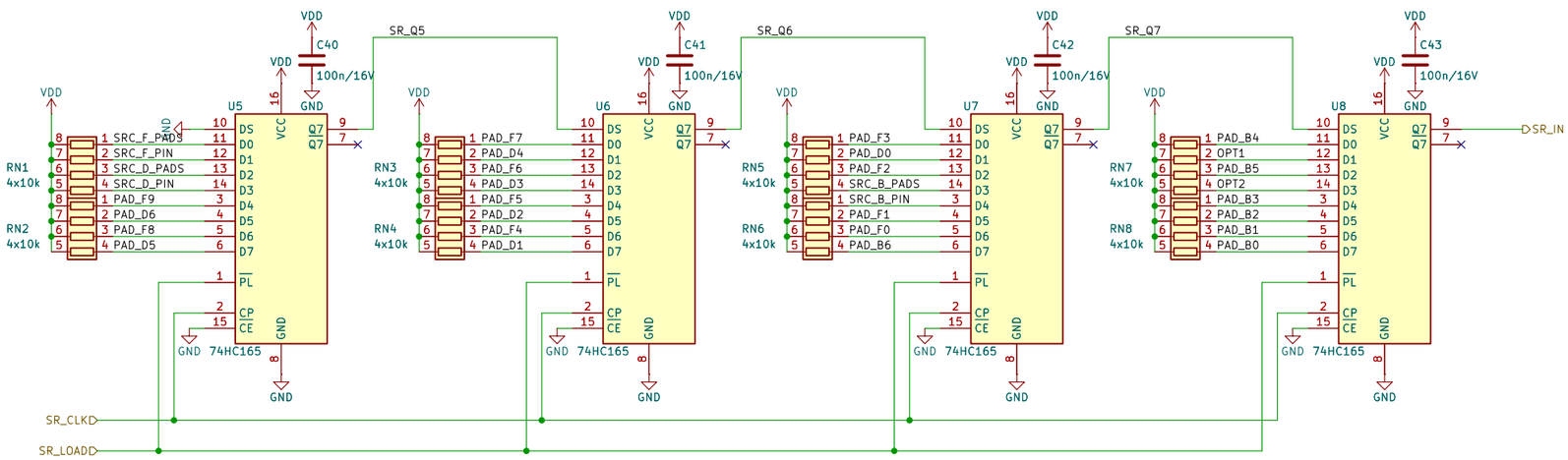


U5 reads D0–D7:
SRC_F_PADS, SRC_F_PIN, SRC_D_PADS,
SRC_D_PIN, F9, D6, F8, D5

U6 reads D0–D7:
F7, D4, F6, D3, F5, D2, F4, D1

U7 reads D0–D7:
F3, D0, F2, SRC_B_PADS,
SRC_B_PIN, F1, F0, B6

U8 reads D0–D7:
B4, OPT1, B5, OPT2, B3, B2, B1, B0



Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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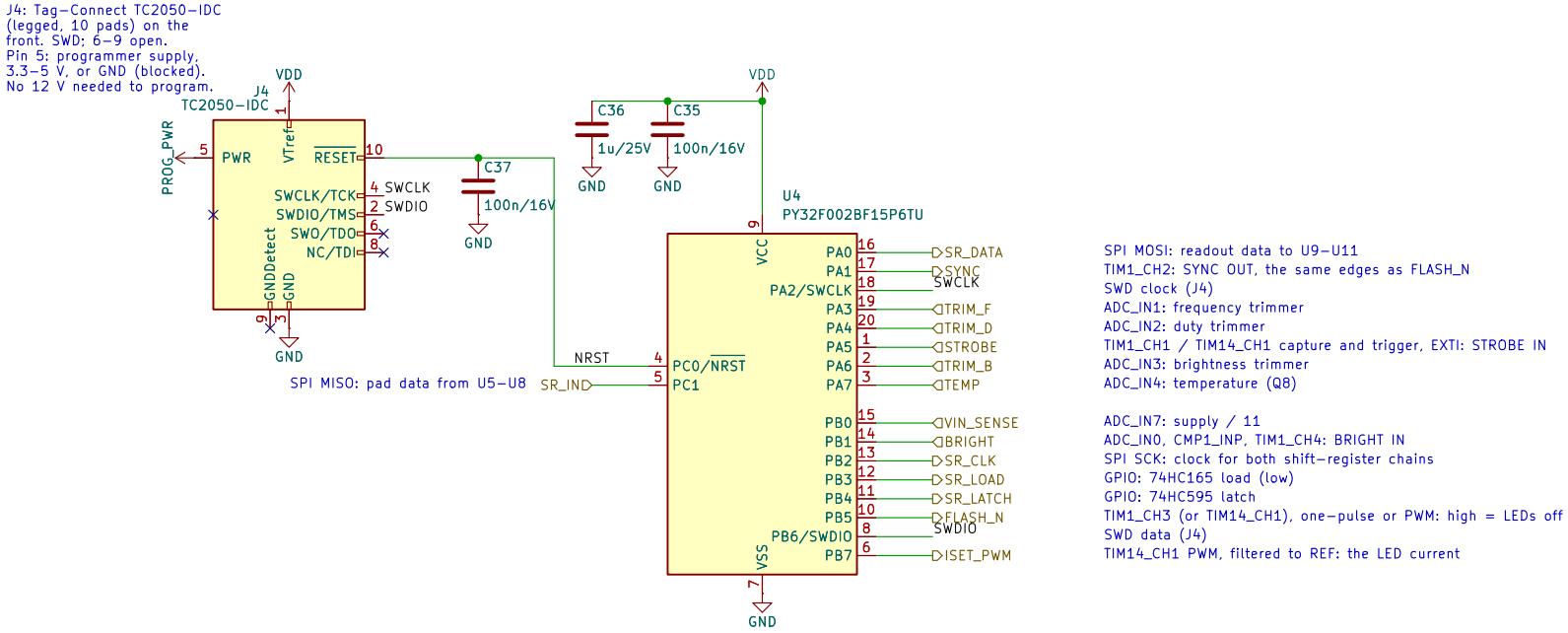
Sheet: /Setting pads/
File: setting_pads.kicad_sch

Title: LED STROBE: Setting pads and their shift registers

Size: A3	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 8/10

9 MCU: PY32F002B (TSSOP-20) at 3.3 V

Reads the inputs (pages 6–8), runs the flash timing and drives the current sinks (page 5) and the readout (page 10).
Programmed through J4, a Tag-Connect spot on the front.



SPI MOSI: readout data to U9–U11
TIM1_CH2: SYNC OUT, the same edges as FLASH_N
SWD clock (J4)
ADC_IN1: frequency trimmer
ADC_IN2: duty trimmer
TIM1_CH1 / TIM14_CH1 capture and trigger, EXTI: STROBE IN
ADC_IN3: brightness trimmer
ADC_IN4: temperature (Q8)

ADC_IN7: supply / 11
ADC_IN0, CMP1_INP, TIM1_CH4: BRIGHT IN
SPI SCK: clock for both shift-register chains
GPIO: 74HC165 load (low)
GPIO: 74HC595 latch
TIM1_CH3 (or TIM14_CH1), one-pulse or PWM: high = LEDs off
SWD data (J4)
TIM14_CH1 PWM, filtered to REF: the LED current

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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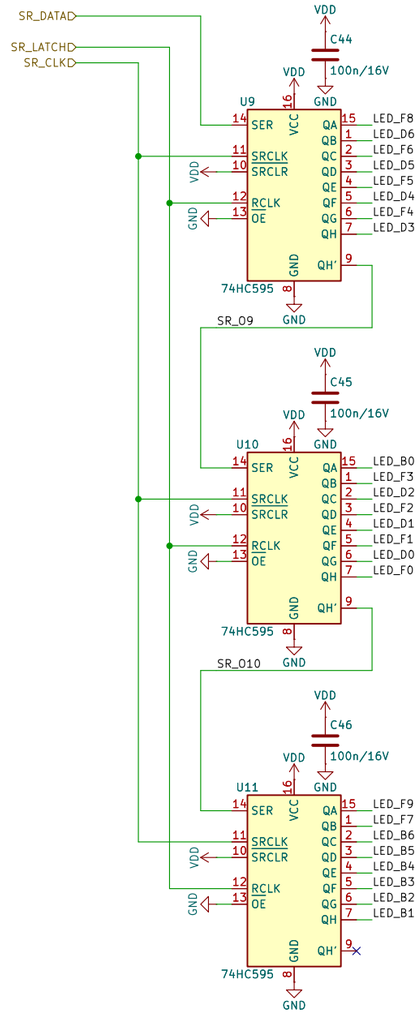
Sheet: /MCU/
File: mcu.kicad_sch

Title: LED STROBE: MCU

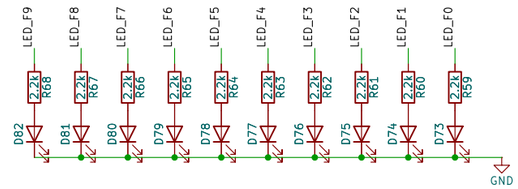
Size: A4	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 9/10

10 READOUT: 3 x 74HC595 drive 24 red LEDs in three rows (frequency, duty, brightness)

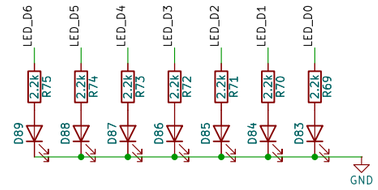
Chain: MCU SR_DATA > U9 > U10 > U11, latched on SR_LATCH. Each row shows the value in use, in binary, most significant bit on the left as on the board.



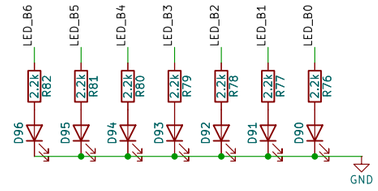
FREQUENCY (Hz)



DUTY (0.1 %)



BRIGHTNESS (%)



Outputs QA–QH (the firmware's bit table):
U9: F8 D6 F6 D5 F5 D4 F4 D3
U10: B0 F3 D2 F2 D1 F1 D0 F0
U11: F9 F7 B6 B5 B4 B3 B2 B1

Gen 1 (rev P1) board schematic, as built. Datasheet and schematic: led-strobe.vercel.app
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Sheet: /Readout/
File: readout.kicad_sch

Title: LED STROBE: Readout: three rows of binary LEDs

Size: A3	Date: 2026-11-10	**Rev: P1**
KiCad E.D.A. 10.0.5		Id: 10/10