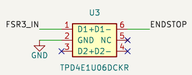
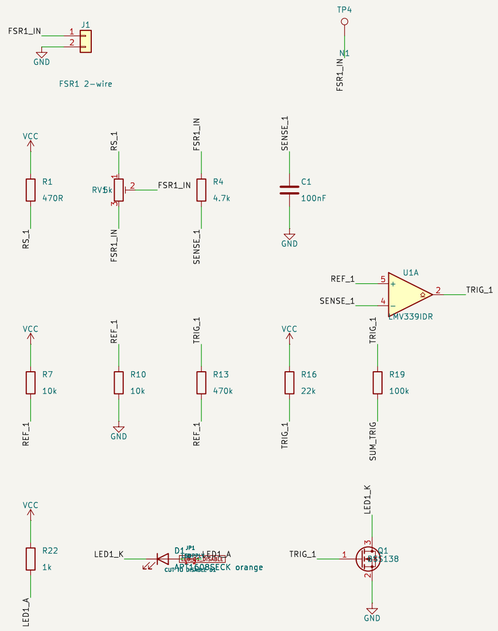
FSR ENDSTOP BREAKOUT — three FSRs OR-combined into one normally-closed style S/G/5V endstop output

01 / ESD ARRAYS U2 (FSR1, FSR2) AND U3 (FSR3, ENDSTOP); CONNECTORS J1–J3 IN THE CHANNEL BLOCKS, J4 AT THE RIGHT

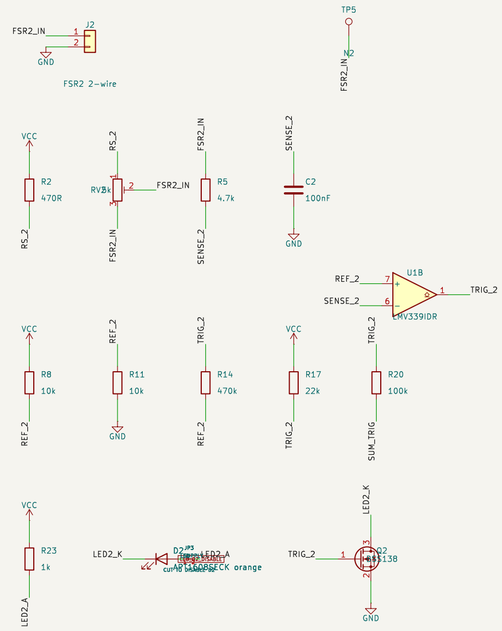




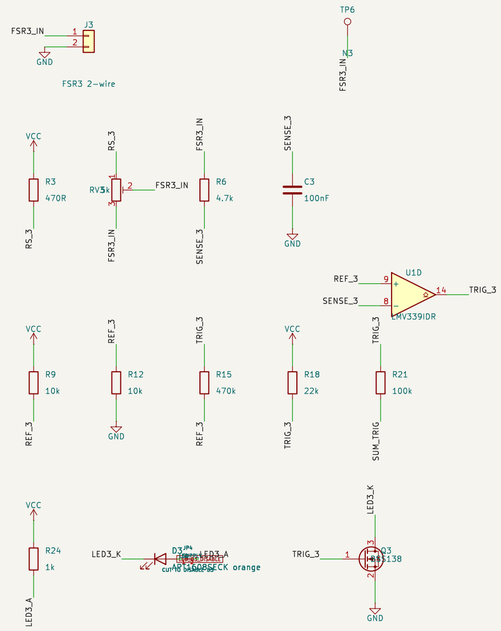
02 / CHANNEL 1: FSR1 DIVIDER, COMPARATOR, LED T1



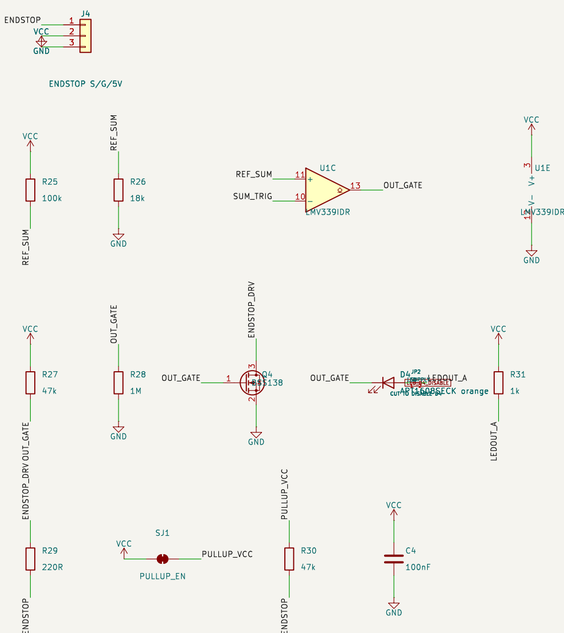
03 / CHANNEL 2: FSR2 DIVIDER, COMPARATOR, LED T2

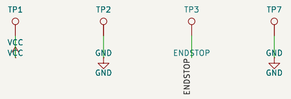


04 / CHANNEL 3: FSR3 DIVIDER, COMPARATOR, LED T3



05 / OR COMBINER, OUTPUT STAGE Q4, J4





FUNCTION: each FSR sits in a divider VCC – RFIX 470R – trimmer 0..5k – node – FSR – GND. When the FSR resistance falls below its per-channel trimmer setpoint (force above threshold) its comparator releases TRIG_n (high-Z, pulled up).

U1 = LMV339 quad open-collector comparator: KiCad unit A = channel 1, unit B = channel 2, unit D = channel 3, unit C (pins 10/11/13) = OR combiner, unit E = power (V+ pin 3, V- pin 12). IN- = SENSE_n, IN+ = REF_n.

OR: TRIG_1..3 -> 100k each -> SUM_TRIG (U1 pin 10, IN-) vs REF_SUM = 0.1525 VCC. OUT_GATE (pin 13) low = any FSR above threshold = Q4 off = ENDSTOP released.

OUTPUT (NORMALLY-CLOSED EMULATION): ENDSTOP is pulled LOW (220R + Q4 to GND) when all sensors are below threshold; it is RELEASED (host pull-up = HIGH) when any sensor triggers, when the board is unpowered, or when the cable breaks.

FIRMWARE: treat ENDSTOP HIGH as TRIGGERED (normally-closed polarity), LOW = idle/ready. This is an electrical state, not a safety statement; not a safety interlock.

UNPLUGGED OR OPEN FSR = NO TRIGGER: an open FSR looks like an unloaded FSR (> 10 MOhm); that channel never triggers. A shorted FSR triggers (safe).

J4 (ENDSTOP, view from top of board, pin 1 square pad): 1 = ENDSTOP (signal), 2 = GND, 3 = VCC (3.0–5.5 V from host, +5 V nominal). J1–J3 pin 1 = FSR node, pin 2 = GND (FSR is not polarised).

CABLE: a native Smoothieboard v2 endstop header runs 1 power / 2 GND / 3 signal, so the cable to it must CROSS pins 1 and 3 (S <-> 5V). A straight cable swaps signal and +5 V (about 23 mA, no damage expected, no function). Do not use on the 4-pin probe/VMOT header. No hot-plug.

SJ1 (PULLUP_EN, bridged by default): connects the local 47k ENDSTOP pull-up (R30) to VCC; cut it if the host provides the only pull-up. SJ1 is the only population option.

ESD: U2/U3 TPD4E1U06DBVR (SOT-23-6) use channel pins 1 and 6 (identical protected channels, TI SLVSBQ9D p.3); pins 3, 4, 5 are no-connect. Place U2/U3 at the connector entries with via-free protected traces.

Hysteresis is private per channel: RH (R13–R15) only between TRIG_n and REF_n (positive feedback into IN+). RV wiper (pin 2) and pin 3 are tied to FSRn_IN so a lifted wiper raises Rs (more sensitive = safe direction).

CERN-OHL-S-2.0 | KiCad only | V02 STUDY: CAD-verified design intent only, no measured accuracy or repeatability claimed; first-article bench qualification required.



v10 study: three FSR channels, OR combiner, normally-closed-style open-drain ENDSTOP output
Generated from design_contract.json by tools/create_schematic.py
Smoothieware / CERN-OHL-S-2.0
Sheet: /
File: fsr-breakout.kicad_sch

Title: Smoothie FSR breakout (3x FSR to one NC-style endstop)

Size: A2	Date: 2026-10-01	**Rev: v10**
KiCad E.D.A. 9.0.8		Id: 1/1