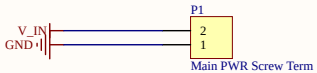
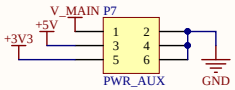
Main Power

Main Power In
12-30V

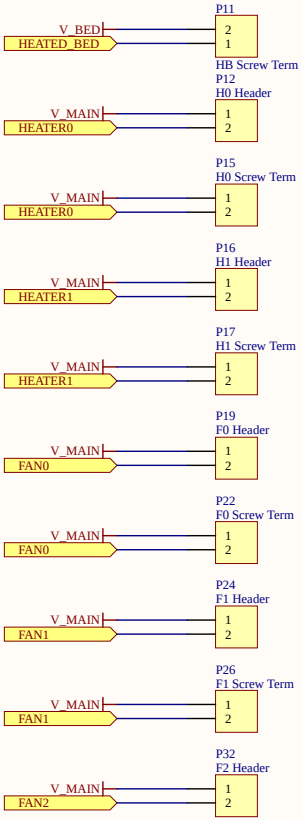


HB Power In
12-30V

Auxiliary Power



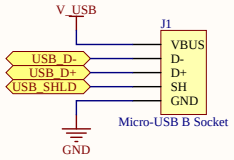
MOSFETs

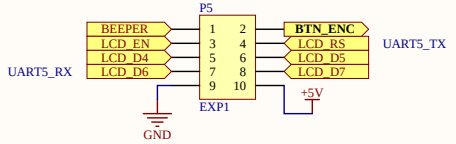


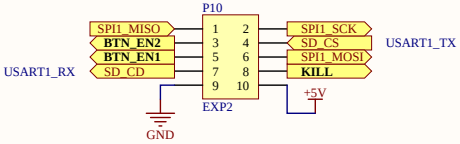
Expansion

EXP1 and EXP2 suit displays / control panels
- -buttons on interrupts
- -buzzer on timer's PWM output (TIM8 CH4)
- -SPI for SD access
- -match existing RAMPS/RUMBA style character+graphic LCDs

EXP1 and EXP2 both have U(S)ARTs (1 & 5) on matching pins
- -either could be used individually for a serial-based external display
- -note EXP2 USART1 peripheral is shared with EXP4 USART1







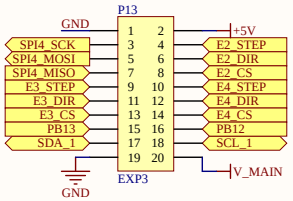
EXP2 P10 is 'KILL' signal on some board and control panel schematics. 'KILL' is supposed to cause the printer to freeze or reset. However:
- -P10 is not connected on common control panels (as per RRD Character or Graphic Control Panel Schematics, 'RESET' / P8 is used instead)
- -EXP2 has no power pin, limiting its standalone functionality

Therefore, 'KILL' signal has been moved to P8, replacing 'RESET', and P10 is now a 5V power pin.

If an existing control panel does connect P10, it will either:
- -be a button shorting it to GND, which will trip the 5V regulator's short-circuit protection and reset the board.
- -be a button shorting it to 5V, which will do nothing.

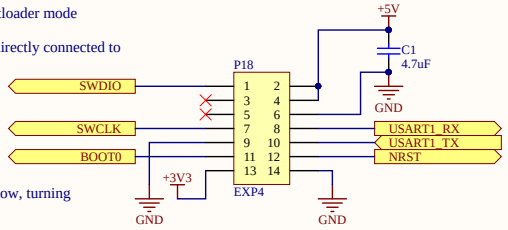
EXP3 can be used for an expansion board:
- -Three sets of STEP/DIR/EN pins for stepper drivers
- -SPI4 for stepper driver control
- -PB12/13 as GPIO or CAN
- -SDA/SCL for I2C

This allows three additional TMC2130 stepper drivers, plus either two MOSFETs directly (PB12/13) or a more extensive expansion via I2C or CAN.



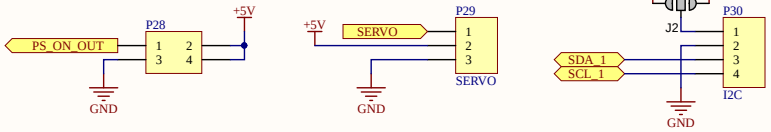
EXP4 is a combination programming and Raspberry Pi / host header:
- -UART for control by host board
- -NRST and BOOT0 allow programming via UART
- -SWDIO, SWCLK and NRST allow programming via SWD
- -SWDIO as pull-down input can detect Pi's 3.3V supply
- -SWCLK can be used as GPIO if needed
- -BOOT0 and adj. 3.3V can be jumpered for HW bootloader mode

Pinout matches Raspberry Pi GPIO header, and can be directly connected to a Pi Zero or similar board.

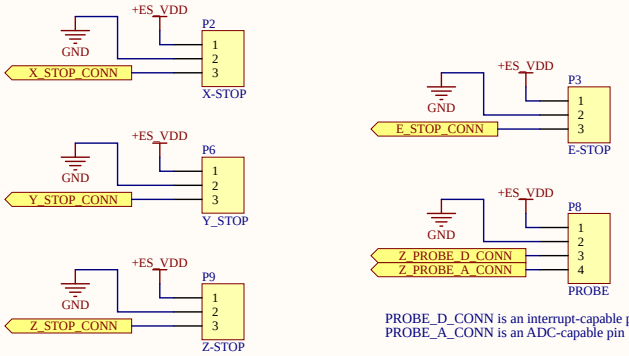


PS_ON can be used to pull external PSU enable signal now, turning on PSU
OR
PS_ON can be used as a low-side MOSFET to control a 5V fan, with adjacent 5V pin for easy connection.

5V power can be supplied via either of the 5V pins, bypassing the board's internal regulator and USB supply.

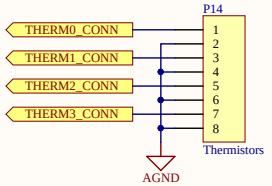


Endstops / Z-Probe



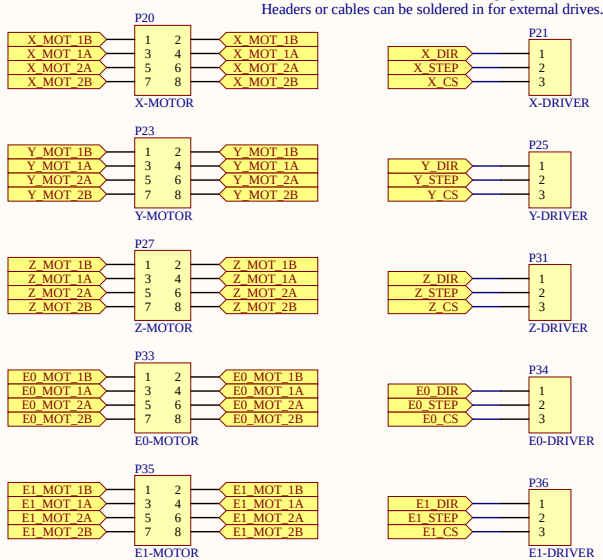
PROBE_D_CONN is an interrupt-capable pin
PROBE_A_CONN is an ADC-capable pin

Thermistors



Stepper Motors

Driver STEP/DIR/EN headers are not populated.
Headers or cables can be soldered in for external drives.



Aus3D

GPLv3
github.com/Aus3D/PicoPrint
www.aus3d.com/picoprint

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Date: 2/05/2018
Drawn: Chris Barr
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External Connectors

Power

Notes

V_IN recommended range is 12-30V, limited by:
-Electrolytic capacitors (max. 35V)
-5V Regulator (max. 40V)

V_IN is protected against reverse-polarity by P-FET Q7, which is off with body-diode reverse-biased when input polarity is reversed. Zener D17 protects Q7 from gate voltage exceeding ratings when V_IN is high.

V_MAIN is measureable by STM32 via voltage divider, with lowpass RC filter.

V_MOT is separated from V_MAIN by FB1, to reduce magnitude of chopper switching noise returning to V_MAIN.

V_REG is separated from V_MAIN by FB2 for similar reasons.

D15 prevents capacitance on logic rail from feeding switched MOSFET outputs on V_MAIN, and also protects components on 5V/3V rails from reverse-polarity should Q7 be incorrectly bypassed via V_MAIN.

Notes

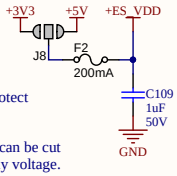
5V regulator's output is set to ~5.4V so that it is more likely to take precedence over USB 5V power in the ORing diode setup. This also means the voltage after the diodes should still be ~ 5V, and not below.

V_USB is fused to protect any host computer or power supply from short-circuits on the 5V rail, and to limit current draw to within USB specifications.

V_USB only directly sees 4.7uF of capacitance in order to comply with the maximum 10uF loading in the USB specification. Additional capacitance (~100uF) is present on the output of the 3V regulator; however the regulator's current-limiting behaviour and non-zero startup time limits the inrush current via V_USB.

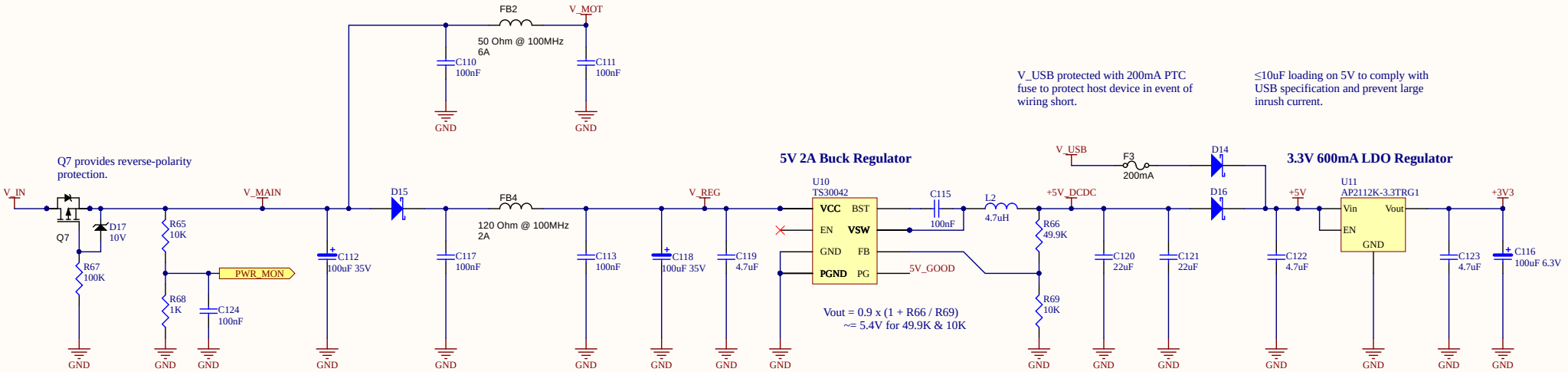
Endstop power is fused to protect both board and external sensor / switch against incorrect wiring. 5V or 3.3V regulators' short-circuit protection should protect board sufficiently, but 200mA maximum on endstop power is safer for external components and allows board to continue operating through a shorted sensor.

Endstop Voltage Select



Endstop power is fused to protect against wiring mistakes.

SMD jumper defaults to 5V, can be cut and soldered to change supply voltage.



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github.com/Aus3D/PicoPrint
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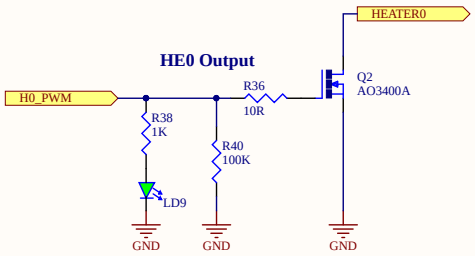
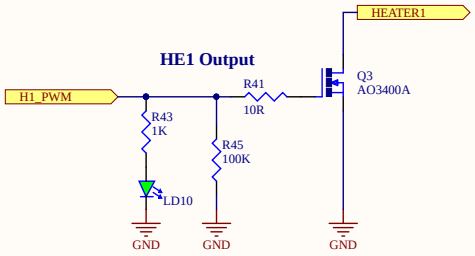
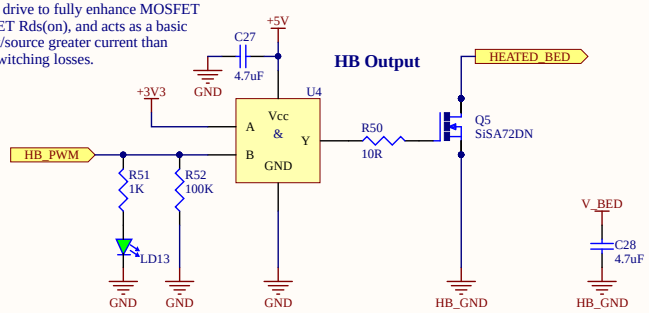
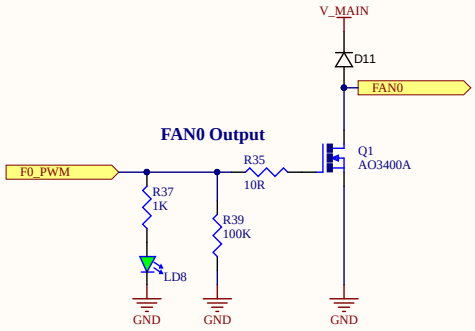
MOSFET Outputs

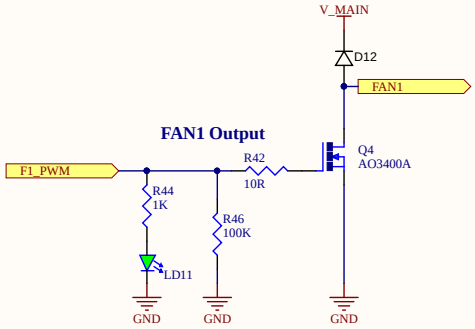


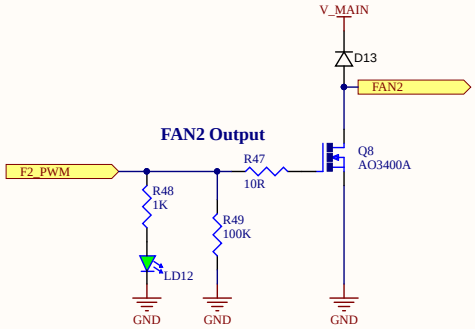


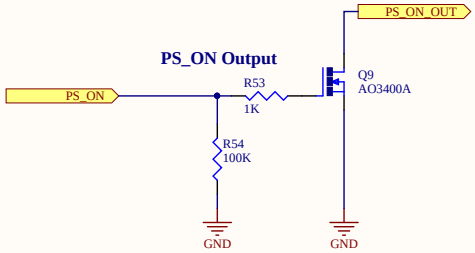
Logic gate provides 5V drive to fully enhance MOSFET gate and reduce MOSFET Rds(on), and acts as a basic MOSFET driver to sink/source greater current than STM32 pin, reducing switching losses.











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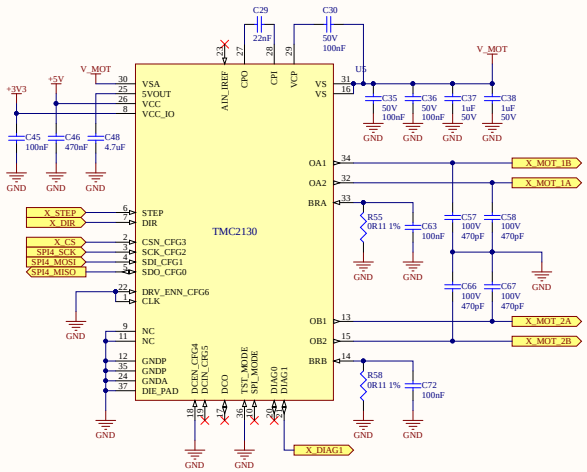
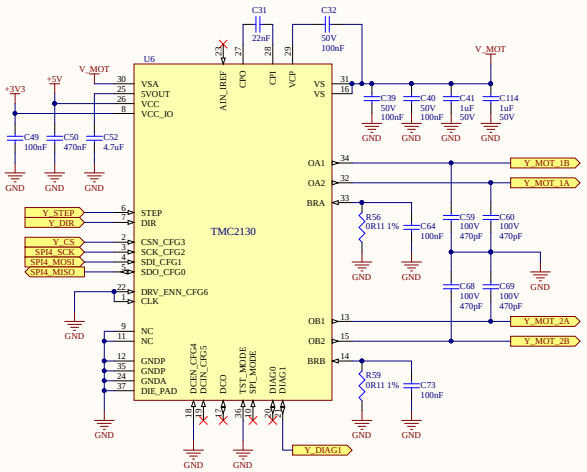
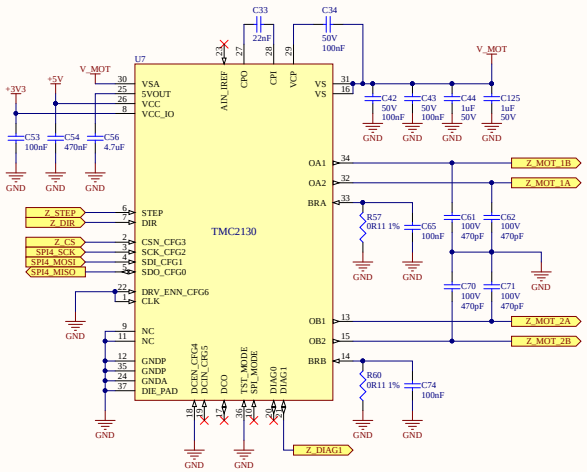
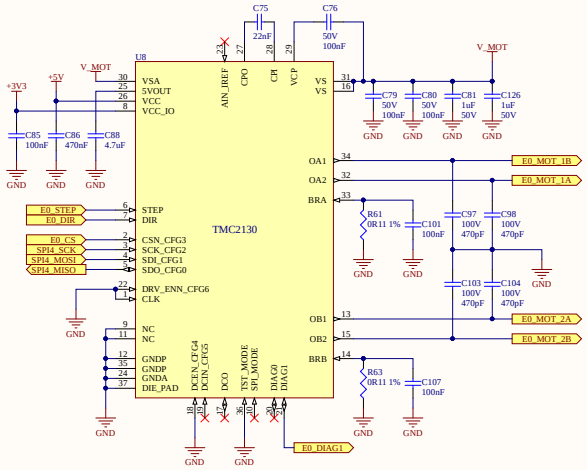
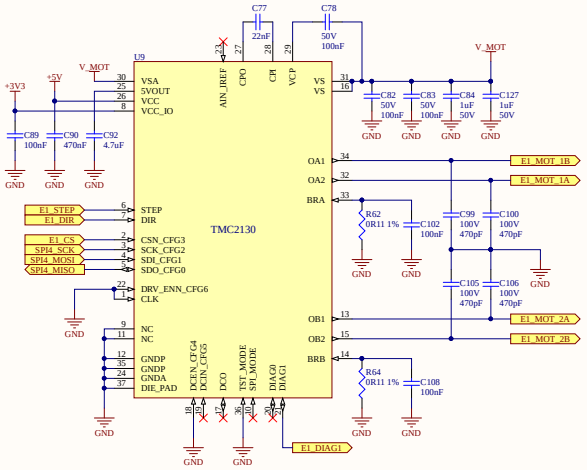
Stepper Drivers

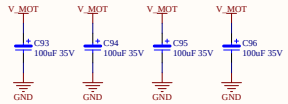












Notes

Digital 5V is provided by board's 5V rail, not TMC2130's internal regulator, in order to minimise internal power dissipation. TMC2130's internal analog domain is still powered from internal regulator.

SPI_MODE has internal pull-up, defaults to SPI mode enabled.

DRV_ENN_CFG6 is tied to GND so drivers are always enabled. Can be disabled via SPI command if required.

CLK is tied to GND to enable internal clock.

DIAG1 can be used for sensorless-homing if SPI readout is not supported by firmware. Defaults to open-drain output, and will be left floating unless otherwise configured.

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github.com/Aus3D/PicoPrint
www.aus3d.com/picoprint

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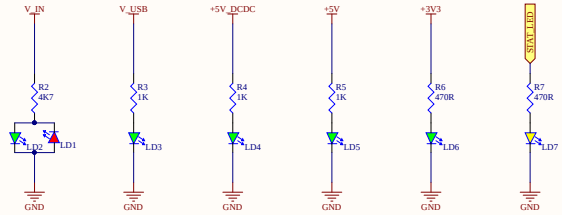
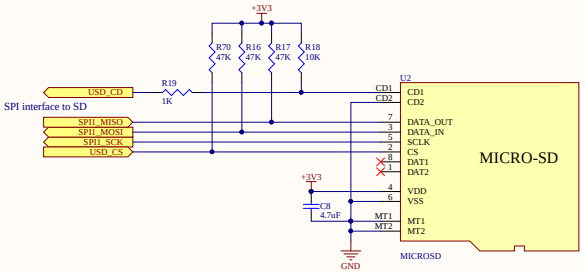
Indicator LEDs



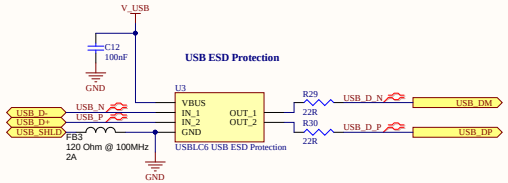
microSD



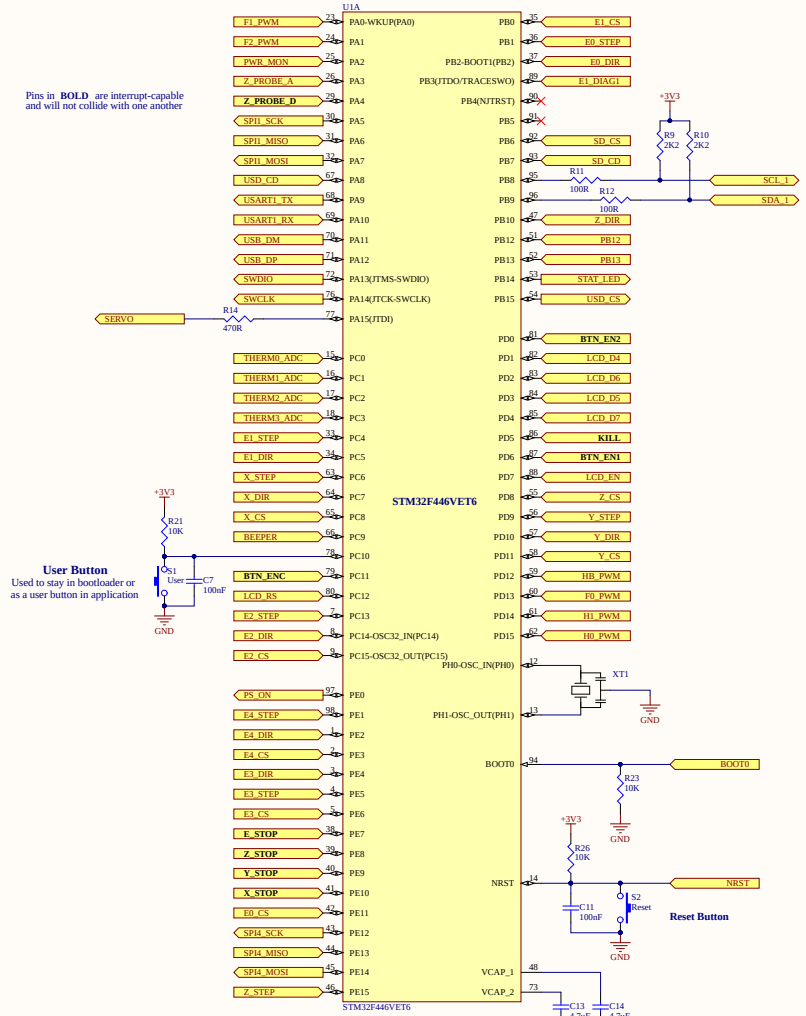
microSD card reader is connected to STM32 via SPI1. SDIO would be a superior alternative to SPI as it would allow higher speed access, but existing firmware and libraries cater to SPI-based SD card access.

SPI1 is shared with external connector EXP2, which optionally connects an external LCD + SD card reader to the board. The SPI bus is shared so that either option can be used in firmware that only supports a single SPI bus (as is common).

USB



Microcontroller



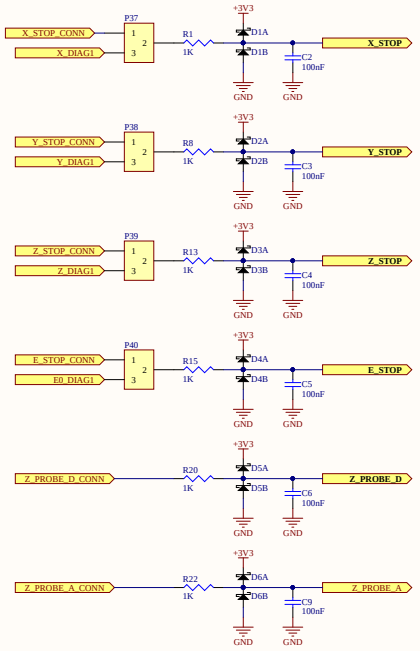
Endstops

Jumpers allow selecting between external sensors or TMC2130 stall-detection for sensorless homing.

TMC2130 outputs will default to disabled, and must be configured via SPI in firmware to work.

Selected signal is passed through RC filter for switch debouncing.

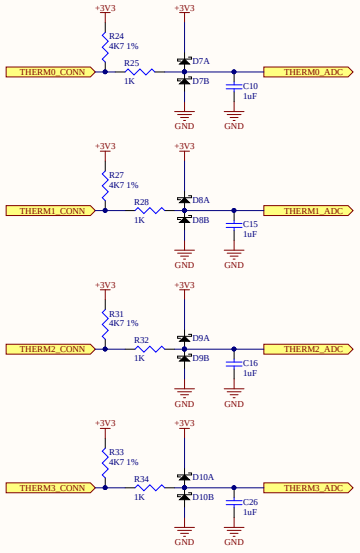
Diodes clamp to 3.3V/GND with current limited by R, so 5V/12V/24V signals on endstop pins are safe and will be detected as HIGH.



Thermistors

Signal is passed through RC filter to reduce high-frequency noise in thermistor reading.

Diodes clamp to 3.3V/GND with current limited by R, so accidental connection to non logic-level signals will not cause damage.



Aus3D

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4 x M3 mounting holes
MH1 MH2 MH3 MH4

OSH_LOGO1
OSH_LOGO