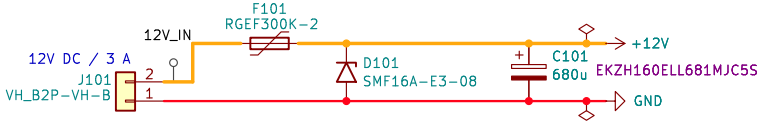
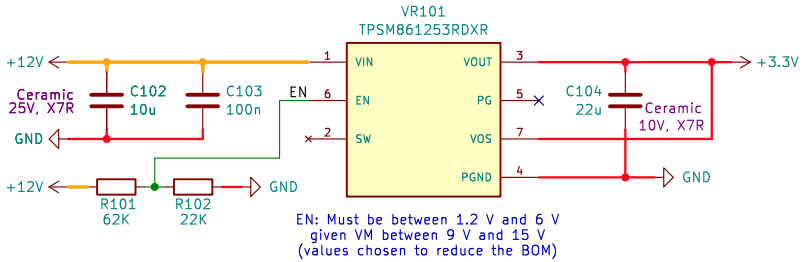
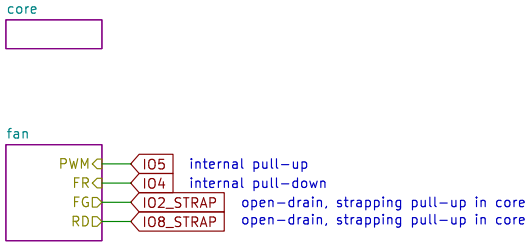
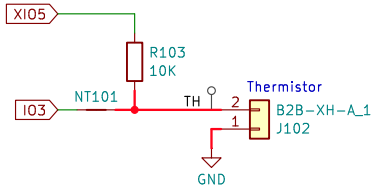
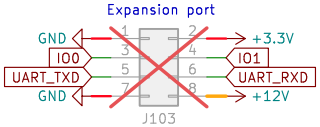
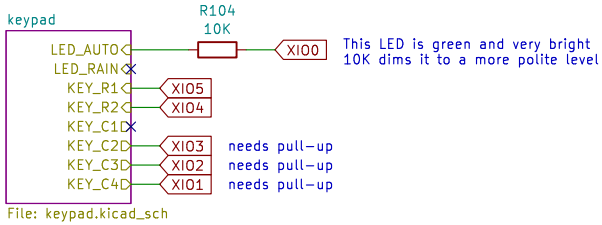








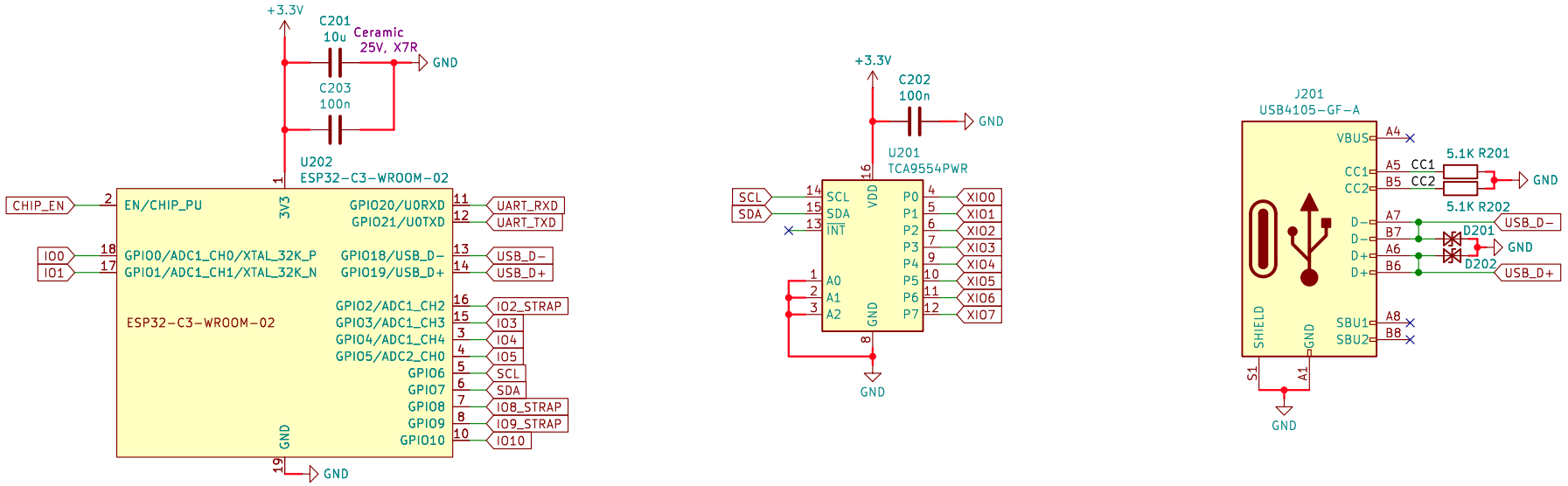




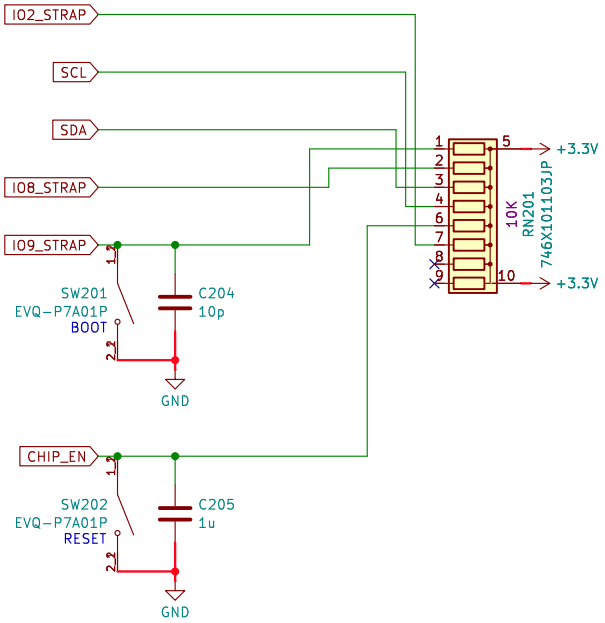
Sheet: /
File: minuet.kicad_sch

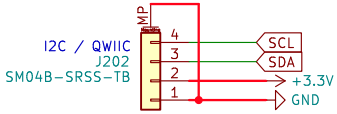
Title: Minuet Fan Controller

Size: A4	Date:	Rev: v1.1
KiCad E.D.A. 8.0.7		Id: 1/5

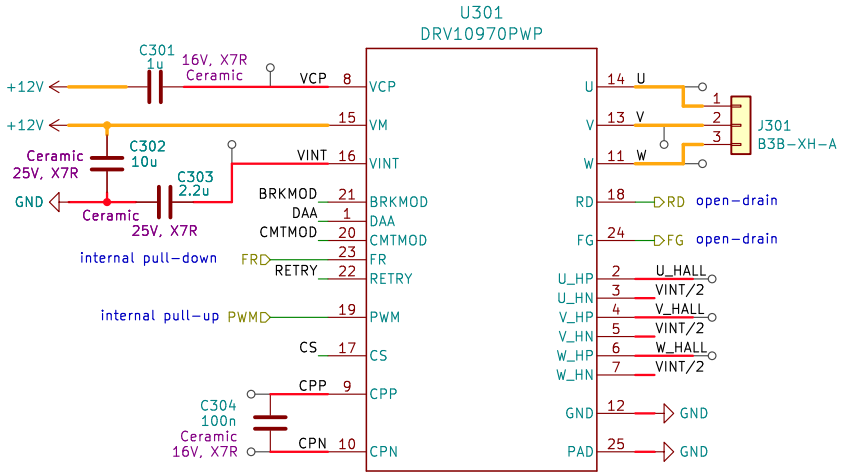


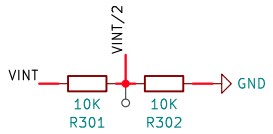
STRAPPING PINS
GPIO2 – don't care but recommended to pull up anyway to avoid glitches
GPIO8 – must be high for download mode, don't care for SPI mode
GPIO9 – boot select: low for download mode, high for SPI mode

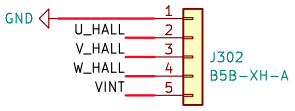


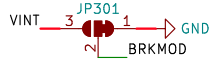


Sheet: /core/ File: core.kicad_sch		
Title: Minuet Core		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 8.0.7		Id: 2/5

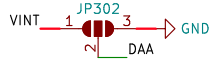




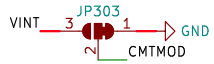




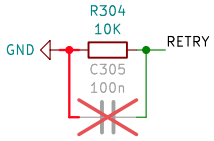
Brake mode:
- Low (default): Coasting mode (phases are tri-stated)
- High: Brake mode (phases are driven low)



Drive angle adjustment: adaptive
- Low: 10° drive angle adjustment
- High: 5° drive angle adjustment
- Floating (default):
  - if CMTMOD is low: adaptive drive angle adjustment
  - if CMTMOD is high: 0° drive angle adjustment



Commutation mode:
- Low (default): Sinusoidal operation mode with 0° Hall placement
- High: Sinusoidal operation mode with 30° Hall placement
- Floating: Trapezoidal operation mode with 30° Hall placement



Retry motor spin-up after motor is locked:
- Tlock_ex = 15.36 × 10^6 × Cretry (in seconds)

Instead we want the retry behavior to be handled by the microcontroller so we pull it to ground to prevent the lock-out from expiring until the device is put to sleep.

If needed for testing, we can remove the resistor and solder a capacitor in its place using the same pad.

Current limit settings in trapezoidal mode:
- Ilimit = (Vilim_thr × Acl) / Rcs
- Acl = 25000 A/A
- Vilim_thr = 1.2 V

Current limit in sinusoidal mode is 1.5x Ilimit
Device is rated for 1.5 A peak output, 2 A absolute maximum

Using Rcs = 20K yields Ilimit = 1.5 A (peak sinusoidal 2.25 A)
Using Rcs = 22K yields Ilimit = 1.36 A (peak sinusoidal 2.04 A)
Using Rcs = 27K yields Ilimit = 1.11 A (peak sinusoidal 1.66 A)

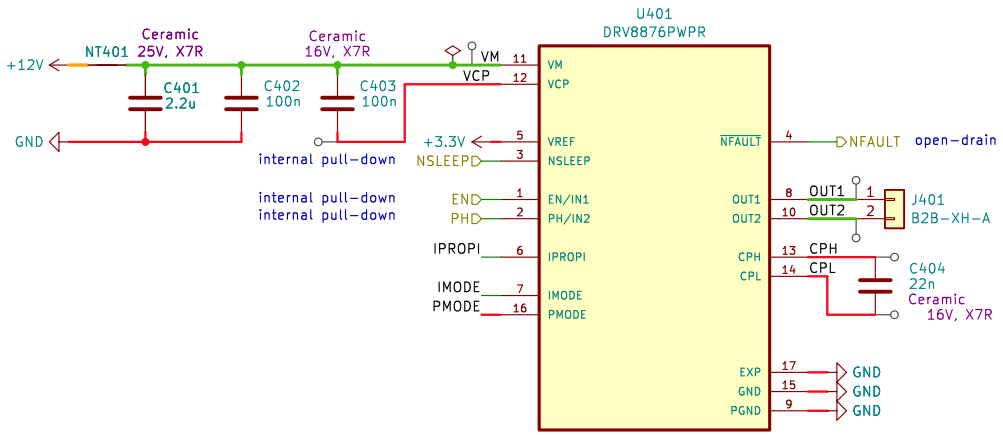
Design motor ratings:
- 12 V, 5.9 A, 50 W
- 12 V, 1.9 A, 15 W

DRV10970 supports sensored operation
For sensorless operation, perhaps consider DRV10974 or DRV11873

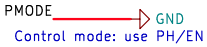
Sheet: /fan/
File: fan.kicad_sch

Title: Minuet Fan Motor Driver

Size: A4	Date:	Rev:
KiCad E.D.A. 8.0.7		Id: 3/5



Current limit mode: use level 3
When Itrip or Iocp exceeded (motor stall),
brake motor, latch outputs off, and assert
NFAULT until inputs change



Control mode: use PH/EN

Set overcurrent protection trip current:
  Itrip (A) = Vref (V) / Ripropi (Ω) * 1000
  Ripropi (Ω) = 1000 * Vref (V) / Itrip (A)

Given Vref = 3.3 V and Itrip = 0.5 A, set Ripropi = 6.6K
Use R = 6.8K so Itrip = 0.48 A

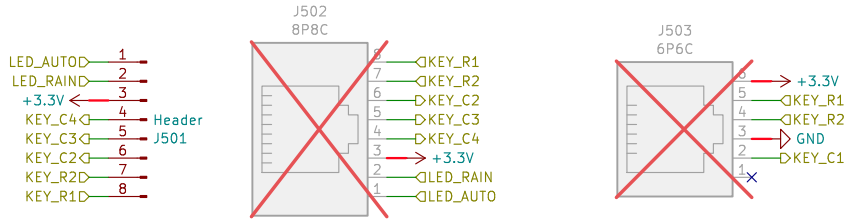
The lid motor draws about 100 to 250 mA in operation until it stalls at end of travel.
Both DRV8876 and DRV8874 are good choices for driving the motor and detecting stalls
with a minimum number of auxiliary components. They differ only in current rating and price.

- DRV8876: 3.5 A max, 200 mOhm Rds-on
- DRV8874: 6 A A max, 700 mOhm Rds-on, a little more expensive

Sheet: /lid/
File: lid.kicad_sch

Title: Minuet Cover Motor Driver

Size: A4	Date:	Rev:
KiCad E.D.A. 8.0.7		Id: 4/5



Original fan control scheme:

- R1+C1: Off
- R1+C2: Speed Up
- R1+C3: Speed Down
- R1+C2+C3: Open/Close Vent
- R1+C4: Rain sensor (only model 4500)
- R2+C1: On and Speed Cycle
- R2+C2: On/Off
- R2+C3: In/Out Direction
- R2+C4: Auto

Fan normally holds R1 and R2 high and has pull-ups on C1-C4
Fan strobes R1 low for 100 us then strobes R2 low for 80 us, every 2.5 ms
Fan detects button press when C1-C4 goes low during strobe of R1-R2
Fan originally provided +5V supply to remote but +3.3V is fine

LED_AUTO is green with 2.4 V voltage drop
LED_RAIN is unpopulated in model 7500

Sheet: /keypad/
File: keypad.kicad_sch

Title: Minuet Keypad Interface

Size: A4	Date:	**Rev:**
KiCad E.D.A. 8.0.7		Id: 5/5