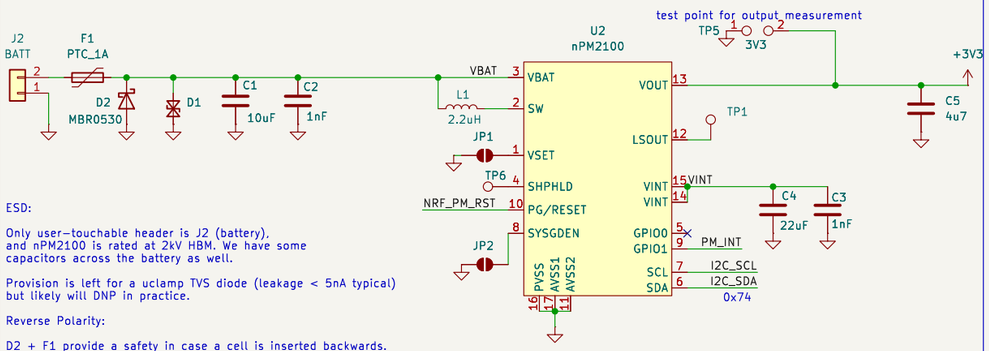
Power Input

Battery boost converter and fuel gauge

Battery Inputs:

We'll design around an expected pair of AA batteries in series.
These will likely be NiMH, though this circuit will never charge them.

We also want to be able to support 1x coin cell batteries and
1x AA batteries depending on form factor.



ESD:

Only user-touchable header is J2 (battery),
and nPM2100 is rated at 2kV HBM. We have some
capacitors across the battery as well.

Provision is left for a uclamp TVS diode (leakage < 5nA typical)
but likely will DNP in practice.

Reverse Polarity:

D2 + F1 provide a safety in case a cell is inserted backwards.
nPM2100 doesn't specifically specify if it's safe against
reverse polarity, but it does specify a min VBAT of -0.3V.

Config:

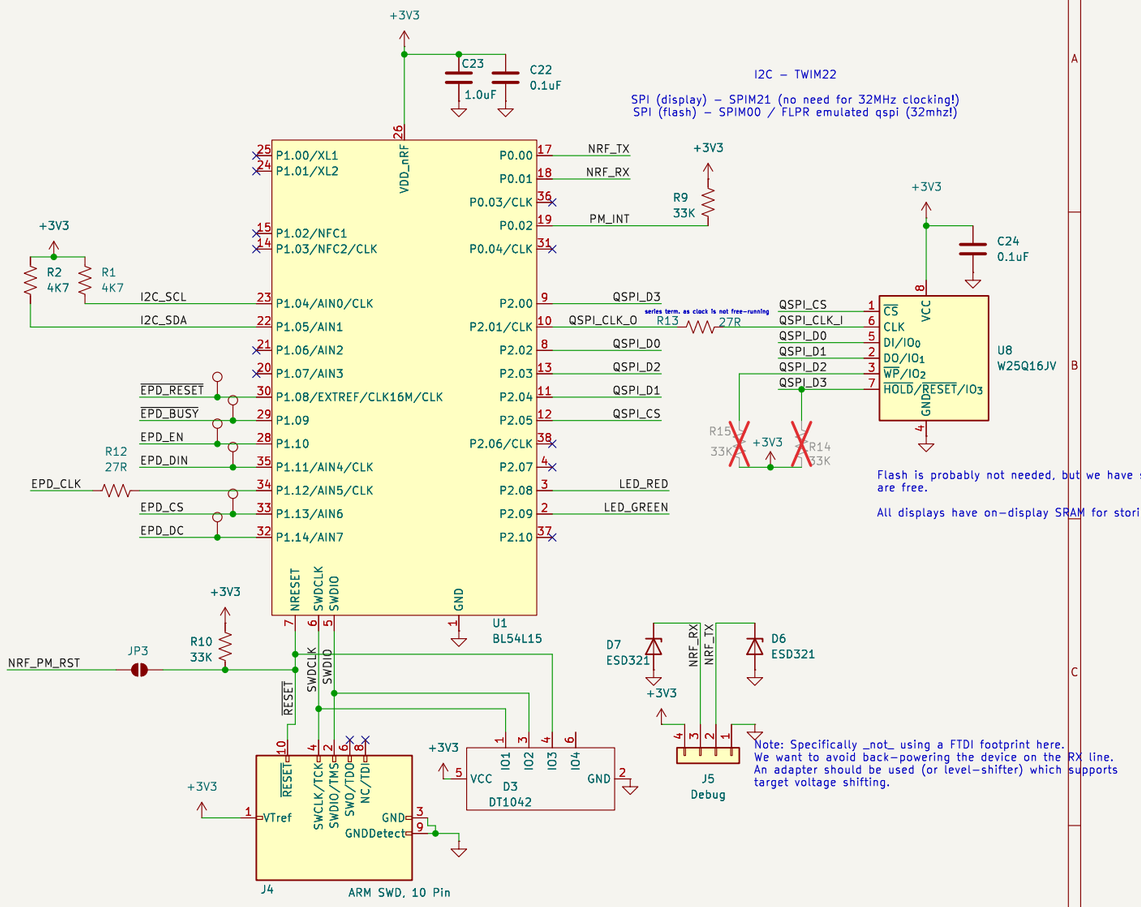
VSET=float=3.0V for Vout by default. Will set in software to 3V3.
SHPHLD goes to button in case we want to use it, likely DNP.
SYSGDEN is solder-jumpered open (boot monitor enabled.

Main MCU

nRF54L15 module

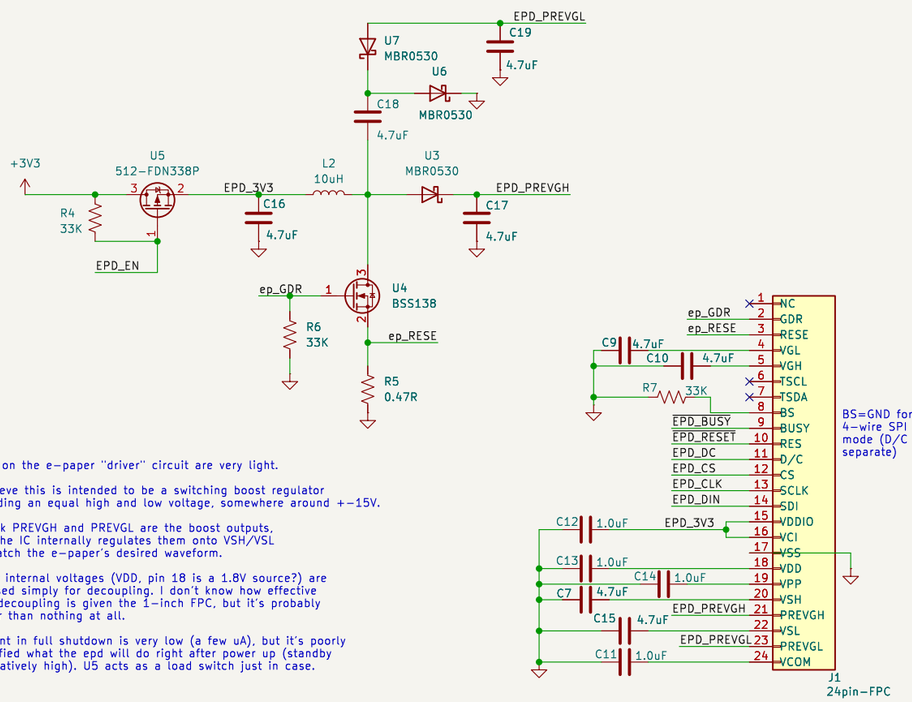
Using a module for now as I don't really have the
right equipment for antenna tuning, and I can't
put an intentional radiator out there without
testing it in good conscience.

Test points on every pad to check for shorts or poor soldering.
Hand-soldering LGA is a pain!



E-Paper Interface

Boost Converter + FPC Connector



Docs on the e-paper "driver" circuit are very light.

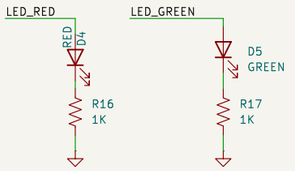
I believe this is intended to be a switching boost regulator
providing an equal high and low voltage, somewhere around +-15V.

I think PREVGH and PREVGL are the boost outputs,
and the IC internally regulates them onto VSH/VSL
to match the e-paper's desired waveform.

Other internal voltages (VDD, pin 18 is a 1.8V source?) are
exposed simply for decoupling. I don't know how effective
that decoupling is given the 1-inch FPC, but it's probably
better than nothing at all.

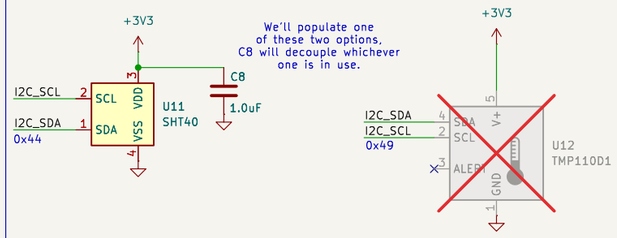
Current in full shutdown is very low (a few uA), but it's poorly
specified what the epd will do right after power up (standby
is relatively high). U5 acts as a load switch just in case.

LEDs



Sensors

Optional temperature or temp + humidity sensor



SHT40 is more expensive,
but is more accurate and includes
RH measurement.

nPM2100 has a temp sensor,
but accuracy is +-8C!

Note ALERT _probably_ can't
be reliably broken out on JLCPCB's
cheaper fabrication options (vias
too large, not enough clearance for a trace).
If needed, we could mod the footprint to give
a little more space for escaping it.

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