Contains some of my important notes from reading the datasheet for my DC-DC regulator for my M.2 Hardware Accelerator project.
https://www.analog.com/media/en/technical-documentation/data-sheets/MAX20029-MAX20029D.pdf

General Information:

- Don't get the B variant, that doesn't have 4 channels at 1.5 A on the output. Instead get the "MAX20029" version.
- 2.2 MHz switching frequency
- **Probably** should add some thermal vias below the package to the ground plane to help with heat.
    - The doc also mentioned to connect the exposed thermal pad on the bottom of the IC to a large ground plane system for thermals. So maybe have a large copper pad, then have thermal vias that connect that pad to the ground plane below.
- Use thick copper PCBs (2 oz vs 1 oz)
- Use a single ground plane to avoid chance of ground potential differences. In that case, I'll probably just have all of the grounds and vias connect to the ground plane directly below instead of trying to make vias that also go to ground layers that are further below.

The simplified block diagram on Page 2 is pretty informative.

Pin Specific Information:

- Active high enables for each of the 4 channels
- Need a minimum of 2.2uF ceramic caps for:
    - *PV1* to *PGND1*
    - *PV2* to *PGND2*
    - *OUTS2* and an output capacitor (I think with *LX2*). They didn't include this in the simplified schematic on Pg 2 though.
    - *PV3* to *PGND3*
    - *PV4* to *PGND4*
    - V_A *to GND*
- *LX_* is the switching output that provides the PWM output signal. It needs to be connected to an inductor and capacitor to smooth out that signal.
- *OUTS_* is the feedback input to help us achieve an adjustable output voltage for each channel.
- *PG_* is an open drain, active high output that tells us whether a channel is stable and operating within the proper thresholds (can be used for cascaded startup of multiple channels by linking it to the *EN_* signal).
- **Pin 24 is Analog Ground**. This needs some isolation from Digital ground
- Connect *SYNC* to a *PGND* pin for default switching.
- Also connect V_A to the same supply used for the *PV_* inputs (3.3 V for me).

Output Capacitor:

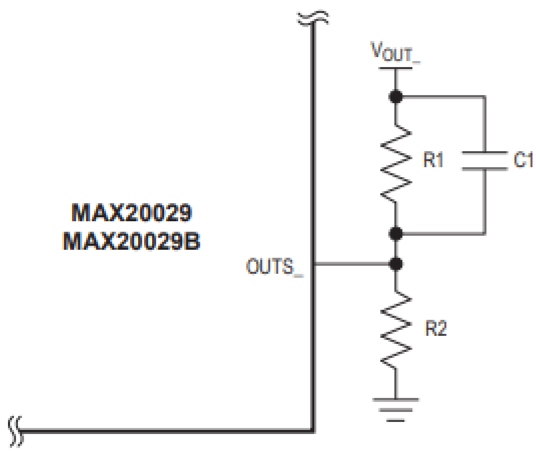
Use a ceramic capacitor to connect the output (after the series inductor connected to *LX_*) to ground for ripple filtering.

For $V_{OUT}/V_{IN} > 0.2$, $C_{OUT_NOM} = (33/V_{OUT})$uF
For $V_{OUT}/V_{IN} <= 0.2$, $C_{OUT_NOM} = (60/V_{OUT})$uF

Output Inductor:

- If output current is 0.5 A, 1 A, or 1.5 A, use a 1.5 uH inductor for the *LX_* outputs.
- If output current is 2 A or 3 A, use a 1 uH inductor.
- If output voltage is less than 0.9 V, use a 0.47 uH inductor.

Adjustable Output Voltage Operation:



- R2 < 100 kOhms max
- R1 = R2[(V_{out}/V_{outs}) - 1], I think V_{out} is the *LX* pin after the smoothing inductor, **also** V_{outs} = 1 V (I don't know why, probably an internal reference)
- If $(\frac{R2}{R1}) > 1$, then use C1 = 15pF * $(\frac{R2}{R1})$, otherwise use C1 = 15pF
  - The capacitor is related to our transfer function and removing noise from switching

If we want 1 V output, then connect *OUTS_* to $V_{OUT\_}$.

Since I need 1 V, 1.2 V, 1.35 V, and 1.8 V, here's what I'll do:

- **1 V:**
  - No resistor network, connect *OUTS_* to the inductor output.
  - For the output capacitor, $\frac{Vout}{Vin} = \frac{1\,V}{3.3\,V}$ = 0.303
    - 0.303 > 0.2, thus $\frac{33}{1\,V}$uF => 33 uF is our nominal output capacitor value.
- **1.2 V:**
  - Again for BoM consolidation, I'll just make R2 = 10 kOhm since I'm using 10 kOhm already as pull-up resistors.
  - R1 = 10 kOhm * [($\frac{1.2\,V}{1\,V}$) - 1] = 2 kOhm
  - Feedback capacitor: $\frac{R2}{R1} = \frac{10\,kOhm}{2\,kOhm}$ = 5 > 1, thus C1 = 15 pF * ($\frac{R2}{R1}$) = 15 pF * (5) = 75 pF
    - Use 47 pF and 33 pF in parallel
  - Output capacitor: $\frac{1.2\,V}{3.3\,V}$ > 0.2
    - $C_{OUT_NOM} = \frac{33}{1.2\,V}$uF = 27.5 uF
      - Like Phil mentioned, I want to practice BoM consolidation, so I'll probably go with a 33 uF

- **1.35 V:**
  - R2 = 10 kOhm
  - R1 = 10 kOhm * [($\frac{1.35\,V}{1\,V}$ - 1)] = 3.5 kOhm
  - Feedback capacitor: $\frac{R2}{R1} = \frac{10\,kOhm}{3.5\,kOhm}$ = 2.857 > 1, thus C1 = 15 pF * (2.857) = 42.857 pF
    - Use 47 pF
  - Output capacitor: $\frac{1.35\,V}{3.3\,V}$ > 0.2
    - $C_{OUT_NOM} = \frac{33}{1.35\,V}$uF = 24.4 uF
      - Use 33 uF
- **1.8 V:**
  - R2 = 10 kOhm
  - R1 = 10 kOhm * [($\frac{1.8\,V}{1\,V}$ - 1)] = 8 kOhm
  - Feedback capacitor: $\frac{R2}{R1} = \frac{10\,kOhm}{8\,kOhm}$ = 1.25 > 1, thus C1 = 15 pF * (1.25) = 18.75 pF
    - Use 22 pF
  - Output capacitor: $\frac{1.8\,V}{3.3\,V}$ > 0.2
    - $C_{OUT_NOM} = \frac{33}{1.8\,V}$uF = 18.33 uF
      - Use 33 uF