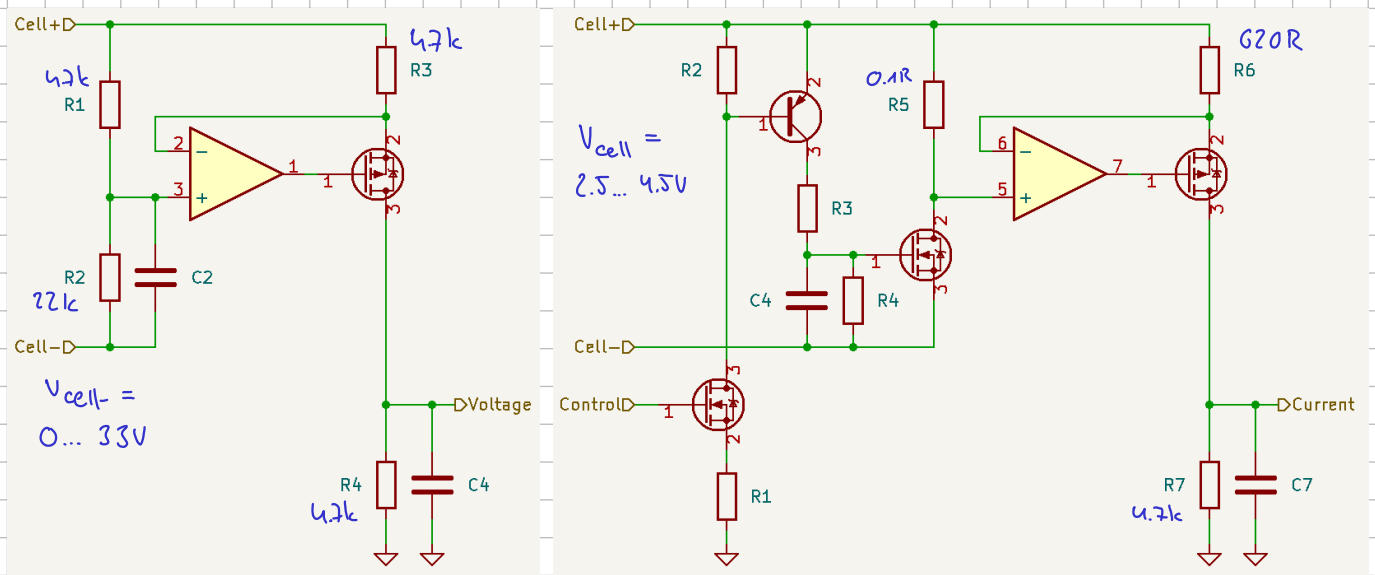
Analoge Dimensionierung



Spannungsmessung:

$$V_{ADC} = V_{Cell} \cdot \frac{R_1}{R_1+R_2} \cdot \frac{R_4}{R_3} \Rightarrow \frac{V_{ADC}}{V_{Cell}} = \frac{R_1}{R_1+R_2} \cdot \frac{R_4}{R} \approx \frac{0.825V}{4.5V} = 0.183$$

$$R_4 = R_3 = \frac{0.825V}{0.1mA} = 8.3k\Omega \rightarrow \underline{4.7k\Omega}$$

$$\frac{R_1+R_2}{R_1} = 1 + \frac{R_2}{R_1} = 5.45 \rightarrow \frac{R_2}{R_1} = 4.45 \rightarrow R_2 = 4.45 \cdot 4.7k\Omega = 20.1k\Omega \rightarrow \underline{22k\Omega}$$

Strommessung:

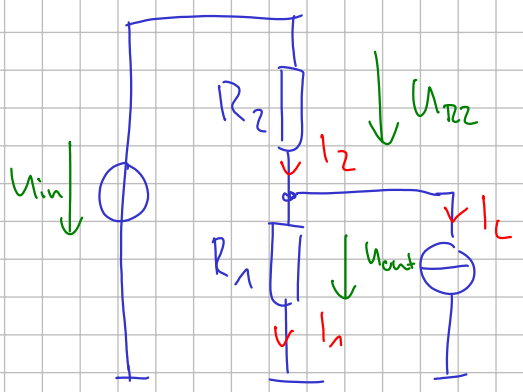
$$V_{ADC} = I_{Bal} \cdot R_5 \cdot \frac{R_7}{R_6} \Rightarrow \frac{V_{ADC}}{I_{Bal}} = R_5 \cdot \frac{R_7}{R_6} \approx \frac{0.825V}{1A} = 0.825\Omega$$

$$R_5 = \frac{P_{0603}}{I_{Bal}} = \frac{0.1W}{1A} = \underline{0.1\Omega}$$

$$V_{ADC} = V_{R5} \cdot \frac{R_7}{R_6} \Rightarrow \frac{V_{ADC}}{V_{R5}} = \frac{R_7}{R_6} \approx \frac{0.825V}{0.1V} = 8.25$$

$R_7 = \underline{4.7k\Omega}$ übernommen von Spannungsmessung

$$R_6 = 4.7k\Omega \cdot \frac{1}{8.25} = 570\Omega \rightarrow \underline{620\Omega}$$



Knotensatz (KCL)

$I_2 = I_L + I_1$

Maschensatz (KVL)

$U_{in} = U_{R2} + U_{out}$

$U_{in} = R_2 \cdot I_2 + R_1 \cdot I_1$

Ohmsche Gesetz (Ohm's Law)

$U_{R2} = R_2 \cdot I_2$

$U_{out} = R_1 \cdot I_1 \rightarrow I_1 = \frac{U_{out}}{R_1}$

$U_{in} = R_2 \cdot I_2 + U_{out}$

$U_{in} = R_2 \cdot (I_L + I_1) + U_{out}$

$U_{in} = R_2 \cdot I_L + R_2 \cdot I_1 + U_{out}$

$U_{in} = R_2 \cdot I_L + R_2 \frac{U_{out}}{R_1} + U_{out}$

$U_{in} = R_2 \cdot I_L + \frac{R_2}{R_1} \cdot U_{out} + U_{out}$

$U_{in} = R_2 \cdot I_L + U_{out}\left(\frac{R_2}{R_1} + 1\right) = R_2 \cdot I_L + U_{out}\left(\frac{R_2 + R_1}{R_1}\right)$

$U_{out} = \left(U_{in} - R_2 \cdot I_L\right)\left(\frac{R_1}{R_2 + R_1}\right)$

$U_{in} = R_2 \cdot (I_L + I_1) + U_{out} = U_{R2} + R_1 \cdot I_1 = U_{R2} + (I_2 - I_L) \cdot R_1$

$U_{in} = U_{R2} + R_1 \cdot (I_2 - I_L) = U_{in} - U_{out} + R_1 (I_2 - I_L)$

$0 = -U_{out} + R_1 (I_2 - I_L)$

$U_{out} = R_1 (I_2 - I_L)$

$$V = \frac{U_{out}\, I_L = 1mA}{U_{out}\, I_L = 0A} = \frac{\cancel{R_1}(I_2 - I_L)}{\cancel{R_1}(I_2 - \cancel{I_L})} = \frac{I_2 - I_L}{I_2} = 1 - \frac{I_L}{I_2}$$

$e = V - 1 = -\frac{I_L}{I_2}$ $\quad |e| \leq 0.01$

$\frac{I_L}{I_2} \leq 0.01$

$100 \cdot I_L = \frac{I_L}{0.01} \leq I_2$

$$\boxed{I_2 \geq 100 \cdot I_L}$$