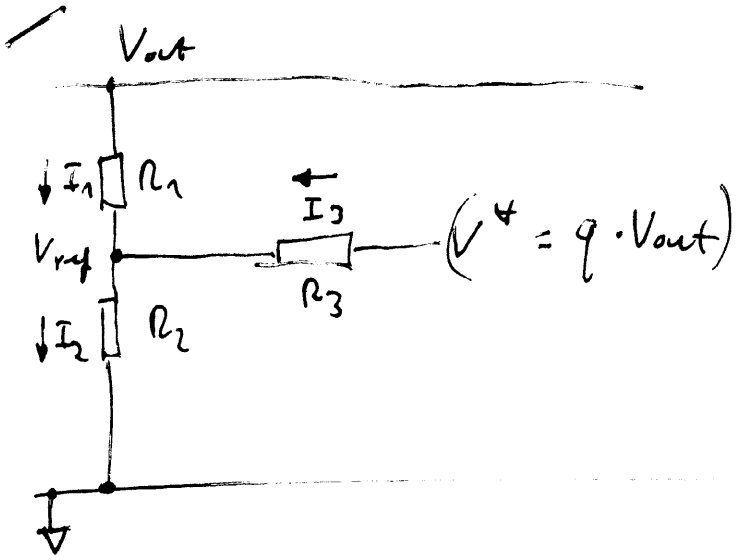

$V_{ref} \doteq 0{,}925\,V$;

$R_1 = 25.5\,k$

$R_2 = 10\,k$

$R_3 = 3.3\,k$

KIS-3R33S

I): $I_2 = I_1 + I_3$;

II): $V_{ref} = I_2 \cdot R_2$;

III): $V_{out} = I_1 R_1 + I_2 R_2$

IV): $V^* = I_3 R_3 + I_2 R_2$; $I_3 = \dfrac{V^* - I_2 R_2}{R_3}$

$$V_{ref} = (I_1 + I_3) \cdot R_2$$

$$= \left(I_1 + \frac{V^* - I_2 R_2}{R_3}\right) R_2 = \left(I_1 + \frac{V^* - \frac{V_{ref}}{R_2} \cdot R_2}{R_3}\right) \cdot R_2$$

$$V_{ref} = \left(I_1 + \frac{(V^* - V_{ref})}{R_3}\right) \cdot R_2$$

$$V_{ref} = R_2 I_1 + \frac{(V^* - V_{ref})}{R_3} \cdot R_2 / R_3$$

$$V_{ref} - \frac{(V^* - V_{ref})}{R_3} \cdot R_2 = R_2 I_1$$

$$V_{ref} - \left(\frac{V^*}{R_3} - \frac{V_{ref}}{R_3}\right) \cdot R_2 = R_2 I_1$$

$$V_{ref} - V^* \cdot \frac{R_2}{R_3} + \frac{V_{ref}}{R_3} \cdot R_2 = R_2 I_1$$

$$V_{rf}\left(1+\frac{R_2}{R_3}\right) - V^{+}\frac{R_2}{R_3} = R_2 I_1 \; ;$$

$$V_{rf} = \frac{R_2 I_1 + V^{+}\frac{R_2}{R_3}}{1+R_2/R_3} \quad ; \quad I_1 = \frac{V_{out}-V_{rf}}{R_1}$$

$$V_{rf} = \frac{R_2\left(\frac{V_{out}-V_{rf}}{R_1}\right) + V^{+}\cdot\frac{R_2}{R_3}}{1+R_2/R_3}$$

$$V_{rf}\left(1+\frac{R_2}{R_3}\right) = V_{out}\cdot\frac{R_2}{R_1} - V_{rf}\cdot\frac{R_2}{R_1} + V^{+}\cdot\frac{R_2}{R_3}$$

$$V_{rf}\left(1+\frac{R_2}{R_3}\right) + V_{rf}\frac{R_2}{R_1} = V_{out}\cdot\frac{R_2}{R_1} + V^{+}\frac{R_2}{R_3} \; ;$$

$$V_{rf}\left[1+\frac{R_2}{R_3}+\frac{R_2}{R_1}\right] = V_{out}\cdot\frac{R_2}{R_1} + V^{+}\frac{R_2}{R_3}$$

$$V_{rf} = \frac{V_{out}\cdot R_2/R_1 + V^{+}R_2/R_3}{1+R_2/R_3+R_2/R_1} \quad ; \quad \begin{aligned} R_2/R_1 &= 0{,}392 \\ R_2/R_3 &= 3{,}03 \end{aligned}$$

$$V_{rf} = \frac{V_{out}\cdot 0{,}392 + V^{+}\cdot 3{,}03}{4{,}422}$$

$$0.925V = \frac{V_{-4} \cdot 0.392}{4.422}$$

- $V_{-4} = \frac{0.925V \cdot 4,422}{0,392} = 10.43V$ ✓; $(V^+ = 0)$

- $0.925V = \frac{V_{-4} \cdot 0,392 + V_{out} \cdot 3,03}{4,422}$; $(V^+ = V_{out})$

$$= \frac{V_{out}(0,392 + 3,03)}{4,422}$$

$$V_{out} = 0,925V \cdot \frac{4,422}{0,392 + 3,03} = 0,925V \cdot 1.29$$

$V_{out} = 1,19V$; ✓ $(V^+ = V_{out})$;

$$V_{ref} = \frac{V_{out} \cdot 0,392 + q \cdot V_{out} \cdot 3,03}{4,422}$$

$$V_{ref} = V_{out} \frac{(0,392 + q \cdot 3,03)}{4,422}$$

$$V_{out} = V_{ref} \cdot \frac{4,422}{q \cdot 3,03 + 0,392}; \quad q \in [0 \ldots 1];$$

$V_{out}\left(\frac{10k}{35k5} + q\cdot\frac{10k}{13k3}\right) \overset{!}{=} V_{ref}$ NOPE!

$\Rightarrow V_{out} = \frac{V_{ref}}{10k\left[\frac{1}{35k5} + q\cdot\frac{1}{13k3}\right]} = \frac{925\,mV}{0.281 + q\cdot 0.075}$; ?

$\frac{1.21V\cdot 10k}{35k5} + \frac{1.21V\cdot 10k}{13k3} = 1.21V\left(\frac{10}{35.5} + \frac{10}{13.3}\right) = 1.25V$;

$\frac{1.21V}{(25.5k \| 3.3k)}\cdot 10k = 1.21V\cdot\frac{10k}{2.92k} =$

$\frac{V_{out}}{25.5k + \underbrace{(10k\|3.3k)}_{2.48k}}\cdot\underbrace{(10k\|3.3k)}_{2.48k} \overset{!}{=} V_{ref}$;

$V_{out} = V_{ref}\cdot\frac{25.5k+2.48k}{2.48k} = V_{ref}\cdot 11.28 = 10.43V$; ✓ $V^+ = 0$

$\frac{V_{out}}{\underbrace{(25k5\|3k3)}_{2.92k} + 10k}\cdot 10k \overset{!}{=} V_{ref}$ ..... $\frac{2.92k+10k}{10k} = 1.20V$; ✓

$\left(\frac{V_{out}}{35.5k} + \frac{V^*}{13.3k}\right)\cdot 10k \overset{!}{=} V_{ref}$;