

Med 1 RC-led

$$GaindB := 2.62$$

$$Ri := 10 \text{ k}\Omega \quad fHigh := 1000 \text{ Hz} \quad fLow := 20 \text{ Hz}$$

Sett inn verdier

$$G0 := 1$$

$$20 \cdot \log(G0) = GaindB$$

$$G0 = 1.3521$$

$$G0 := \text{Find}(G0) = 1.3521$$

$$G0 := 10^{\frac{GaindB}{20}} = 1.3521$$

Sett inn verdier

$$G1 := 1$$

$$20 \cdot \log(G1) = 0$$

$$G1 = 1$$

$$G1 := \text{Find}(G1) = 1$$

$$G1 := 10^{\frac{0}{20}} = 1$$

$$Rf := Ri \cdot G0 = 13.521 \text{ k}\Omega$$

$$Rf' := G1 \cdot Ri = 10 \text{ k}\Omega$$

$$R1 := \frac{Rf \cdot Rf'}{Rf - Rf'} = 38.403 \text{ k}\Omega$$

$$Rf' := \frac{R1 \cdot Rf}{R1 + Rf} = 10 \text{ k}\Omega$$

$$R1 = 38.403 \text{ k}\Omega \quad Rf' = 13.521 \text{ k}\Omega$$

$$C1 := \frac{1}{(R1 + Rf') \cdot 2 \cdot \pi \cdot fLow} = 153.258 \text{ nF}$$

overføringsfunktion

$$\frac{V0}{Vi} = \frac{Rf \cdot (R1 + 1)}{Ri(R1 + Rf' + 1)}$$

Med 2 RC-led

$$Ri := 10 \text{ k}\Omega$$

SoftcalculatorValues

$$G0 := 1$$

$$20 \cdot \log(G0) = GaindB$$

$$G0 := \text{Find}(G0) = 1.3521$$

$$\mathbf{G0} = 1.352$$

$$Rf := Ri \cdot G0 = 13.521 \text{ k}\Omega$$

$$G0.5 := GaindB \cdot \frac{1}{2} = 1.31$$

SoftcalculatorValues

$$G1 := 1$$

$$20 \cdot \log(G1) = G0.5$$

$$G1 := \text{Find}(G1) = 1.1628$$

$$\mathbf{G1} = 1.163$$

$$G1 := 10^{\frac{G0.5}{20}} = 1.1628$$

SoftcalculatorValues

$$G2 := 1$$

$$20 \cdot \log(G2) = 0$$

$$G2 := \text{Find}(G2) = 1$$

$$\mathbf{G2} = 1$$

$$G2 := 10^{\frac{0}{20}} = 1$$

$$Rf' := G1 \cdot Ri = 11.628 \text{ k}\Omega$$

$$Rf'' := G2 \cdot Ri = 10 \text{ k}\Omega$$

$$R1 := \frac{Rf \cdot Rf'}{Rf - Rf'} = 83.058 \text{ k}\Omega$$

$$R2 := \frac{Rf' \cdot Rf''}{Rf' - Rf''} = 71.43 \text{ k}\Omega$$

$$R1 = 83.058 \text{ k}\Omega \quad Rf' := \frac{R1 \cdot Rf}{R1 + Rf} = 11.628 \text{ k}\Omega$$

$$R2 = 71.43 \text{ k}\Omega$$

$$Rf = 13.521 \text{ k}\Omega \quad Rf'' := \frac{R2 \cdot Rf'}{R2 + Rf'} = 10 \text{ k}\Omega$$

$$f_logstep := \frac{1}{2} \log \left(\frac{fHigh}{fLow} \right) = 0.849$$

$$p1 := fLow = 20 \text{ Hz}$$

$$C1 := \frac{1}{(R1 + Rf) \cdot 2 \cdot \pi \cdot p1} = 82.396 \text{ nF}$$

$$p2 := p1 \cdot 10^{1 \cdot f_logstep} = 141.421 \text{ Hz}$$

$$C2 := \frac{1}{(R2 + Rf') \cdot 2 \cdot \pi \cdot p2} = 13.55 \text{ nF}$$

Med 3 RC-led

$$Ri := 10 \text{ k}\Omega$$

$G0 := 1$ $20 \cdot \log(G0) = GaindB$ $G0 := \text{Find}(G0) = 1.3521$	$G0 = 1.352$
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$$Rf := Ri \cdot G0 = 13.521 \text{ k}\Omega$$

$$G0.6 := GaindB \cdot \frac{2}{3} = 1.747 \quad G0.3 := GaindB \cdot \frac{1}{3} = 0.873$$

$G1 := 1$ $20 \cdot \log(G1) = G0.6$ $G1 := \text{Find}(G1) = 1.2227$	$G1 := 10^{\frac{G0.6}{20}} = 1.2227$
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$G2 := 1$ $20 \cdot \log(G2) = G0.3$ $G2 := \text{Find}(G2) = 1.1058$	$G2 := 10^{\frac{G0.3}{20}} = 1.1058$
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$G3 := 1$ $20 \cdot \log(G3) = 0$ $G3 := \text{Find}(G3) = 1$	$G3 := 10^{\frac{0}{20}} = 1$
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$$\begin{aligned} Rf' &:= G1 \cdot Ri = 12.227 \text{ k}\Omega \\ Rf'' &:= G2 \cdot Ri = 11.058 \text{ k}\Omega \\ Rf''' &:= G3 \cdot Ri = 10 \text{ k}\Omega \end{aligned}$$

$$R1 := \frac{Rf \cdot Rf'}{Rf - Rf'} = 127.826 \text{ k}\Omega$$

$$R2 := \frac{Rf' \cdot Rf''}{Rf' - Rf''} = 115.598 \text{ k}\Omega$$

$$R3 := \frac{Rf'' \cdot Rf'''}{Rf'' - Rf'''} = 104.541 \text{ k}\Omega$$

$$Rf' := \frac{R1 \cdot Rf}{R1 + Rf} = 12.227 \text{ k}\Omega$$

$$Rf'' := \frac{R2 \cdot Rf'}{R2 + Rf'} = 11.058 \text{ k}\Omega$$

$$Rf''' := \frac{R3 \cdot Rf''}{R3 + Rf''} = 10 \text{ k}\Omega$$

$$\begin{aligned} R1 &= 127.826 \text{ k}\Omega & Rf &= 13.521 \text{ k}\Omega \\ R2 &= 115.598 \text{ k}\Omega \\ R3 &= 104.541 \text{ k}\Omega \end{aligned}$$

$$f_logstep := \frac{1}{3} \log\left(\frac{fHigh}{fLow}\right) = 0.566$$

$$\omega p1 := fLow = 20 \text{ Hz}$$

$$\omega p2 := \omega p1 \cdot 10^{1 \cdot f_logstep} = 73.681 \text{ Hz}$$

$$\omega p3 := \omega p1 \cdot 10^{2 \cdot f_logstep} = 271.442 \text{ Hz}$$

$$\omega p4 := \omega p1 \cdot 10^{3 \cdot f_logstep} = 1000 \text{ Hz}$$

$$C1 := \frac{1}{(R1 + Rf) \cdot 2 \cdot \pi \cdot \omega p1} = 56.3 \text{ nF}$$

$$C2 := \frac{1}{(R2 + Rf') \cdot 2 \cdot \pi \cdot \omega p2} = 16.899 \text{ nF}$$

$$C3 := \frac{1}{(R3 + Rf'') \cdot 2 \cdot \pi \cdot \omega p3} = 5.072 \text{ nF}$$

$$\omega z1 := \frac{1}{2 \pi \cdot R1 \cdot C1} = 22.115 \text{ Hz}$$

$$\omega z2 := \frac{1}{2 \pi \cdot R2 \cdot C2} = 81.474 \text{ Hz}$$

$$\omega z3 := \frac{1}{2 \pi \cdot R3 \cdot C3} = 300.153 \text{ Hz}$$

Med 4 RC-led

$$Ri := 10 \text{ k}\Omega$$

$G0 := 1$ $20 \cdot \log(G0) = GaindB$ $G0 := \text{Find}(G0) = 1.3521$	$\text{G0} = 1.352$
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$$Rf := Ri \cdot G0 = 13.521 \text{ k}\Omega$$

$$G0.75 := GaindB \cdot \frac{3}{4} = 1.965$$

$$G0.5 := GaindB \cdot \frac{2}{4} = 1.31$$

$$G0.25 := GaindB \cdot \frac{1}{4} = 0.655$$

$G1 := 1$ $20 \cdot \log(G1) = G0.75$ $G1 := \text{Find}(G1) = 1.2539$	$\text{G1} = 1.254$ $\frac{G0.75}{20}$ $G1 := 10^{\frac{G0.75}{20}} = 1.2539$
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$G2 := 1$ $20 \cdot \log(G2) = G0.5$ $G2 := \text{Find}(G2) = 1.1628$	$\text{G2} = 1.163$ $\frac{G0.5}{20}$ $G2 := 10^{\frac{G0.5}{20}} = 1.1628$
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$G3 := 1$ $20 \cdot \log(G3) = G0.25$ $G3 := \text{Find}(G3) = 1.0783$	$\text{G3} = 1.078$ $\frac{G0.25}{20}$ $G3 := 10^{\frac{G0.25}{20}} = 1.0783$
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$G4 := 1$ $20 \cdot \log(G4) = 0$ $G4 := \text{Find}(G4) = 1$	$\text{G4} = 1$ $\frac{0}{20}$ $G4 := 10^{\frac{0}{20}} = 1$
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$$\begin{aligned}
Rf' &:= G1 \cdot Ri = 12.539 \text{ k}\Omega \\
Rf'' &:= G2 \cdot Ri = 11.628 \text{ k}\Omega \\
Rf''' &:= G3 \cdot Ri = 10.783 \text{ k}\Omega \\
Rf'''' &:= G4 \cdot Ri = 10 \text{ k}\Omega
\end{aligned}$$

$$R1 := \frac{Rf \cdot Rf'}{Rf - Rf'} = 172.622 \text{ k}\Omega$$

$$R2 := \frac{Rf' \cdot Rf''}{Rf' - Rf''} = 160.083 \text{ k}\Omega$$

$$Rf' := \frac{R1 \cdot Rf}{R1 + Rf} = 12.539 \text{ k}\Omega$$

$$R3 := \frac{Rf'' \cdot Rf'''}{Rf'' - Rf'''} = 148.455 \text{ k}\Omega$$

$$Rf'' := \frac{R2 \cdot Rf'}{R2 + Rf'} = 11.628 \text{ k}\Omega$$

$$R4 := \frac{Rf''' \cdot Rf''''}{Rf'''' - Rf'''} = 137.672 \text{ k}\Omega$$

$$Rf''' := \frac{R3 \cdot Rf''}{R3 + Rf''} = 10.783 \text{ k}\Omega$$

$$Rf'''' := \frac{R4 \cdot Rf'''}{R4 + Rf'''} = 10 \text{ k}\Omega$$

$$R1 = 172.622 \text{ k}\Omega \quad Rf = 13.521 \text{ k}\Omega$$

$$R2 = 160.083 \text{ k}\Omega$$

$$R3 = 148.455 \text{ k}\Omega$$

$$R4 = 137.672 \text{ k}\Omega$$

$$f_logstep := \frac{1}{4} \log \left(\frac{fHigh}{fLow} \right) = 0.425$$

$$p1 := fLow = 20 \text{ Hz}$$

$$p2 := p1 \cdot 10^{1+f_logstep} = 53.183 \text{ Hz}$$

$$p3 := p1 \cdot 10^{2+f_logstep} = 141.421 \text{ Hz}$$

$$C1 := \frac{1}{(R1 + Rf) \cdot 2 \cdot \pi \cdot p1} = 42.751 \text{ nF}$$

$$p4 := p1 \cdot 10^{3+f_logstep} = 376.06 \text{ Hz}$$

$$p5 := p1 \cdot 10^{4+f_logstep} = 1000 \text{ Hz}$$

$$C2 := \frac{1}{(R2 + Rf') \cdot 2 \cdot \pi \cdot p2} = 17.336 \text{ nF}$$

$$C3 := \frac{1}{(R3 + Rf'') \cdot 2 \cdot \pi \cdot p3} = 7.03 \text{ nF}$$

$$C4 := \frac{1}{(R4 + Rf''') \cdot 2 \cdot \pi \cdot p4} = 2.866 \text{ nF}$$

Med 8 RC-led

$$Ri := 10 \text{ k}\Omega$$

$G0 := 1$ $20 \cdot \log(G0) = GaindB$ $G0 := \text{Find}(G0) = 1.3521$

$$G0 := 10^{\frac{GaindB}{20}} = 1.3521$$

$$\mathbf{G0} = 1.352$$

$$Rf := Ri \cdot G0 = 13.521 \text{ k}\Omega$$

$$G0.87 := GaindB \cdot \frac{7}{8} = 2.293$$

$$G0.5 := GaindB \cdot \frac{4}{8} = 1.31$$

$$G0.75 := GaindB \cdot \frac{6}{8} = 1.965$$

$$G0.37 := GaindB \cdot \frac{3}{8} = 0.983$$

$$G0.62 := GaindB \cdot \frac{5}{8} = 1.638$$

$$G0.25 := GaindB \cdot \frac{2}{8} = 0.655$$

$$G0.12 := GaindB \cdot \frac{1}{8} = 0.328$$

$G1 := 1$ $20 \cdot \log(G1) = G0.87$ $G1 := \text{Find}(G1) = 1.302$

$$\mathbf{G1} = 1.302$$

$$G1 := 10^{\frac{G0.87}{20}} = 1.302$$

$G2 := 1$ $20 \cdot \log(G2) = G0.75$ $G2 := \text{Find}(G2) = 1.2539$
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$$\mathbf{G2} = 1.254$$

$$G2 := 10^{\frac{G0.75}{20}} = 1.2539$$

$G3 := 1$ $20 \cdot \log(G3) = G0.62$ $G3 := \text{Find}(G3) = 1.2075$
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$$\mathbf{G3} = 1.207$$

$$G3 := 10^{\frac{G0.62}{20}} = 1.2075$$

$G4 := 1$ $20 \cdot \log(G4) = G0.5$ $G4 := \text{Find}(G4) = 1.1628$

$$\mathbf{G4} = 1.163$$

$$G4 := 10^{\frac{G0.5}{20}} = 1.163$$

$G5 := 1$
 $20 \cdot \log(G5) = G0.37$
 $G5 := \text{Find}(G5) = 1.1198$

$$G5 = 1.12$$

$$G5 := 10^{\frac{G0.37}{20}} = 1.12$$

$G6 := 1$
 $20 \cdot \log(G6) = G0.25$
 $G6 := \text{Find}(G6) = 1.0783$

$$G6 = 1.078$$

$$G6 := 10^{\frac{G0.25}{20}} = 1.078$$

$G7 := 1$
 $20 \cdot \log(G7) = G0.12$
 $G7 := \text{Find}(G7) = 1.0384$

$$G7 = 1.038$$

$$G7 := 10^{\frac{G0.12}{20}} = 1.038$$

$G8 := 1$
 $20 \cdot \log(G8) = 0$
 $G8 := \text{Find}(G8) = 1$

$$G8 = 1$$

$$G8 := 10^{\frac{0}{20}} = 1$$

$$Rf' := G1 \cdot Ri = 13.02 \text{ k}\Omega$$

$$Rf''''' := G5 \cdot Ri = 11.198 \text{ k}\Omega$$

$$Rf'' := G2 \cdot Ri = 12.539 \text{ k}\Omega$$

$$Rf''''' := G6 \cdot Ri = 10.783 \text{ k}\Omega$$

$$Rf''' := G3 \cdot Ri = 12.075 \text{ k}\Omega$$

$$Rf''''''' := G7 \cdot Ri = 10.384 \text{ k}\Omega$$

$$Rf'''' := G4 \cdot Ri = 11.628 \text{ k}\Omega$$

$$Rf''''''' := G8 \cdot Ri = 10 \text{ k}\Omega$$

$$R1 := \frac{Rf \cdot Rf'}{Rf - Rf'} = 351.876 \text{ k}\Omega$$

$$R5 := \frac{Rf''''' \cdot Rf'''''}{Rf''''' - Rf''''' = 302.615 \text{ k}\Omega}$$

$$R2 := \frac{Rf' \cdot Rf''}{Rf' - Rf''} = 338.856 \text{ k}\Omega$$

$$R6 := \frac{Rf'''' \cdot Rf''''}{Rf'''' - Rf''''} = 291.417 \text{ k}\Omega$$

$$R3 := \frac{Rf'' \cdot Rf'''}{Rf'' - Rf'''} = 326.317 \text{ k}\Omega$$

$$R7 := \frac{Rf'''''' \cdot Rf''''''}{Rf'''''' - Rf''''''} = 280.634 \text{ k}\Omega$$

$$R4 := \frac{Rf''' \cdot Rf''''}{Rf''' - Rf''''} = 314.242 \text{ k}\Omega$$

$$R8 := \frac{Rf''''''' \cdot Rf'''''''}{Rf''''''' - Rf'''''''} = 270.249 \text{ k}\Omega$$

$$R1 = 351.876 \text{ k}\Omega$$

$$R5 = 302.615 \text{ k}\Omega$$

$$Rf = 13.521 \text{ k}\Omega$$

$$R2 = 338.856 \text{ k}\Omega$$

$$R6 = 291.417 \text{ k}\Omega$$

$$R3 = 326.317 \text{ k}\Omega$$

$$R7 = 280.634 \text{ k}\Omega$$

$$R4 = 314.242 \text{ k}\Omega$$

$$R8 = 270.249 \text{ k}\Omega$$

$$Rf' := \frac{R1 \cdot Rf}{R1 + Rf} = 13.02 \text{ k}\Omega \quad Rf''' := \frac{R4 \cdot Rf'''}{R4 + Rf'''} = 11.628 \text{ k}\Omega$$

$$Rf'' := \frac{R2 \cdot Rf'}{R2 + Rf'} = 12.539 \text{ k}\Omega \quad Rf'''' := \frac{R5 \cdot Rf''''}{R5 + Rf''''} = 11.198 \text{ k}\Omega$$

$$Rf''' := \frac{R3 \cdot Rf''}{R3 + Rf''} = 12.075 \text{ k}\Omega \quad Rf''''' := \frac{R6 \cdot Rf'''''}{R6 + Rf'''''} = 10.783 \text{ k}\Omega$$

$$Rf'''''' := \frac{R7 \cdot Rf''''''}{R7 + Rf''''''} = 10.384 \text{ k}\Omega$$

$$f_logstep := \frac{1}{8} \log \left(\frac{1000 \text{ Hz}}{20 \text{ Hz}} \right) = 0.212$$

$$p1 := 20 \text{ Hz}$$

$$p2 := p1 \cdot 10^{1 \cdot f_logstep} = 32.614 \text{ Hz}$$

$$p3 := p1 \cdot 10^{2 \cdot f_logstep} = 53.183 \text{ Hz}$$

$$C1 := \frac{1}{(R1 + Rf) \cdot 2 \cdot \pi \cdot p1} = 21.778 \text{ nF}$$

$$p4 := p1 \cdot 10^{3 \cdot f_logstep} = 86.725 \text{ Hz}$$

$$p5 := p1 \cdot 10^{4 \cdot f_logstep} = 141.421 \text{ Hz}$$

$$C2 := \frac{1}{(R2 + Rf') \cdot 2 \cdot \pi \cdot p2} = 13.868 \text{ nF}$$

$$p6 := p1 \cdot 10^{5 \cdot f_logstep} = 230.614 \text{ Hz}$$

$$p7 := p1 \cdot 10^{6 \cdot f_logstep} = 376.06 \text{ Hz}$$

$$C3 := \frac{1}{(R3 + Rf'') \cdot 2 \cdot \pi \cdot p3} = 8.831 \text{ nF}$$

$$p8 := p1 \cdot 10^{7 \cdot f_logstep} = 613.238 \text{ Hz}$$

$$C4 := \frac{1}{(R4 + Rf''') \cdot 2 \cdot \pi \cdot p4} = 5.624 \text{ nF}$$

$$p9 := p1 \cdot 10^{8 \cdot f_logstep} = 1000 \text{ Hz}$$

$$C1 := \frac{1}{(R5 + Rf''') \cdot 2 \cdot \pi \cdot p5} = 3.586 \text{ nF}$$

$$C2 := \frac{1}{(R6 + Rf''''') \cdot 2 \cdot \pi \cdot p6} = 2.284 \text{ nF}$$

$$C3 := \frac{1}{(R7 + Rf''''') \cdot 2 \cdot \pi \cdot p7} = 1.452 \text{ nF}$$

$$C4 := \frac{1}{(R8 + Rf''''') \cdot 2 \cdot \pi \cdot p8} = 0.925 \text{ nF}$$