

$$R_{top}(R_{bot}) := R_{bot} \cdot \left( \frac{V_{out} - V_{ref}}{V_{ref}} \right) \rightarrow 3.4$$

$$R_{eq}(R_{bot}) := R_{bot} \cdot \frac{R_{top}(R_{bot})}{R_{bot} + R_{top}(R_{bot})} \rightarrow 0.$$

$$Z_{eq}(R_{bot}, C_{top}) := Z_{cc} + R_{eq}(R_{bot}) \cdot \frac{Z_{to}}{R_{eq}(R_{bot})}$$

$$Z_{\text{tot}}(\text{Rbot}, \text{Ctop}) := \text{Rvesr} + \frac{Z_{\text{eq}}(\text{Rbot}, \text{Ctop}) \cdot Z_{\text{cl}}}{Z_{\text{eq}}(\text{Rbot}, \text{Ctop}) + Z_{\text{cl}}}$$

$$Z_{\text{tot}}(\text{Rbot}, \text{Ctop}) \rightarrow \frac{\frac{0.00391}{\text{Ctop} \cdot (0.772727272727)}}{(2.459) \cdot \text{Ctop} \cdot (0.772727272727)}$$

$$\text{Im}(Z_{\text{tot}}(\text{Rbot}, \text{Ctop})) \left| \begin{array}{l} \text{assume, Rbot} > 0, \text{Ctop} > 0 \\ \text{simplify} \end{array} \right.$$

$$\text{Im}(Z_{\text{tot}}(\text{Rbot}, \text{Ctop})) \left| \begin{array}{l} \text{assume, ALL} > 0 \\ \text{simplify} \end{array} \right. \rightarrow -\frac{1}{\dots}$$

$$\text{Rtot}(\text{Rbot}, \text{Ctop}) := \text{Re}(Z_{\text{tot}}(\text{Rbot}, \text{Ctop}))$$

$$C_{tot}(R_{bot}, C_{top}) := \overline{\omega \cdot I_r}$$

$$\operatorname{Re}(V_{fb1}(R_{bot}, C_{top})) \left| \begin{array}{l} \text{assu} \\ \text{simf} \end{array} \right.$$

$$\operatorname{Im}(V_{fb1}(R_{bot}, C_{top})) \left| \begin{array}{l} \text{assume} \\ \text{simplif} \end{array} \right.$$

variables need to be defined: Ccl, Vin, Vout, Vref, Cc,  $\omega$ , Rvesr, f, Ton

$$C_{cl} := 20 \cdot 10^{-12}$$

$$C_c := 10.5 \cdot 10^{-12}$$

$$V_{out} := 3.3$$

$$f := 500000$$

$$V_{ref} := 0.75$$

$$R_{vesr} := 442500$$

$$V_{in} := 12$$

$$\omega := 2 \cdot \pi \cdot f = 3.142 \times 10^6$$

$$T_{on} := \frac{V_{out}}{V_{in} \cdot f} = 5.5 \times 10^{-7}$$

$$Z_{cl} := \frac{1}{i \cdot \omega \cdot C_{cl}} = -1.592i \times 10^4$$

$$Z_{cc} := \frac{1}{i \cdot \omega \cdot C_c} = -3.032i \times 10^4$$

$$Z_{top}(C_{top}) := \frac{1}{i \cdot \omega \cdot C_{top}} \rightarrow -\frac{3.183098861837906957e-7i}{C_{top}}$$

·Rbot

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$$\frac{p(C_{top})}{) + Z_{top}(C_{top})} \rightarrow -\frac{(2.45966730232929173949e-7i) \cdot R_{bot}}{C_{top} \cdot \left( 0.7727272727272727 \cdot R_{bot} - \frac{3.183098861837906957e-7i}{C_{top}} \right)} - (30315.22725i)$$

$$\begin{aligned} & \frac{0.00391468209527214230853 \cdot R_{bot}}{C_{top} \cdot \left( 0.7727272727272727 \cdot R_{bot} - \frac{3.183098861837906957e-7i}{C_{top}} \right)} - 4.82481826868275260396e8 \\ \rightarrow & \frac{(2.45966730232929173949e-7i) \cdot R_{bot}}{C_{top} \cdot \left( 0.7727272727272727 \cdot R_{bot} - \frac{3.183098861837906957e-7i}{C_{top}} \right)} - (46230.721564788652i) \end{aligned}$$

$$\begin{aligned} & \frac{468209527214230853 \cdot R_{bot}}{272727 \cdot R_{bot} - \frac{3.183098861837906957e-7i}{C_{top}}} - 4.82481826868275260396e8 \\ & \frac{66730232929173949e-7i \cdot R_{bot}}{272727 \cdot R_{bot} - \frac{3.183098861837906957e-7i}{C_{top}}} - (46230.721564788652i) + 442500 \end{aligned}$$

$$\rightarrow \frac{1.0 \cdot \left( 2.0810577822918206355e46 \cdot C_{top}^2 \cdot R_{bot}^2 + 3.6179701280663535597e35 \cdot C_{top} \cdot R_{bot}^2 + 1.5045024294929 \cdot R_{bot}^2 \right)}{1.9940399313658742021e42 \cdot C_{top}^2 \cdot R_{bot}^2 + 2.7458910530284167357e31 \cdot C_{top} \cdot R_{bot}^2 + 9.453067559606024 \cdot R_{bot}^2}$$

$$\frac{1.0 \cdot \left( 2.0810577822918206355e46 \cdot C_{top}^2 \cdot R_{bot}^2 + 3.6179701280663535597e35 \cdot C_{top} \cdot R_{bot}^2 + 1.5045024294929 \cdot R_{bot}^2 \right)}{1.9940399313658742021e42 \cdot C_{top}^2 \cdot R_{bot}^2 + 2.7458910530284167357e31 \cdot C_{top} \cdot R_{bot}^2 + 9.453067559606024 \cdot R_{bot}^2}$$

$$\text{ot, } C_{top}) \left| \begin{array}{l} \text{assume, ALL} > 0 \\ \text{simplify} \end{array} \right. \rightarrow \frac{3.0987517459096910473e44 \cdot R_{bot} + 7.5943966675624827926e20 \cdot R_{bot}^2}{1.9940399313658742021e58 \cdot C_{top}^2 \cdot R_{bot}^2 + 2.7458910530284167357e47 \cdot C_{top} \cdot R_{bot}^2 + 9.453067559606024 \cdot R_{bot}^2}$$

$$\frac{1}{n(Z_{tot}(R_{bot}, C_{top}))} \left| \begin{array}{l} \text{assume, ALL} > 0 \\ \text{simplify} \end{array} \right. \rightarrow 3.0499999999999996827e-11 - \frac{2.5e-11 \cdot (3.2910}{1.0838842616103232477e42 \cdot C_{top}}$$

$$\left( \frac{-T_{on}}{\quad} \right)$$

$$\begin{array}{l} \text{ime, ALL} > 0 \\ \text{plify} \end{array} \rightarrow -\text{Re} \left( 2.459667302329291739491e-7i \cdot \frac{1}{C_{top}} \cdot R_{bot} \cdot e^{\left( \frac{R_{bot} \cdot 3.09875174590}{R_{bot}^2 \cdot 9.4530675596060} \right)} \cdot \frac{R_{bot}^2 \cdot 8.2277476612}{R_{bot}^2 \cdot 7.8359501536090573767e19 + C_{top}^2} \right) \quad (2342)$$

$$\begin{array}{l} \text{me, ALL} > 0 \\ \text{y} \end{array} \rightarrow \frac{2.0649359059178379712e26 \cdot R_{bot} - 2.0649359059178379712e26 \cdot R_{bot} \cdot e^{\frac{1.45847799123175686}{\quad}}}{\quad}$$

5599115i)

- + 442500

$$\frac{294929390163e24 \cdot R_{bot}^2 + 3.5312780298018820687e33}{6060241453e19 \cdot R_{bot}^2 + 3.3836203204436320467e29}$$

$$\frac{390163e24 \cdot R_{bot}^2 + 3.5312780298018820687e33}{1453e19 \cdot R_{bot}^2 + 3.3836203204436320467e29}$$

$$\frac{+ 3.9512295081967212518e32 \cdot C_{top} \cdot R_{bot}^2 + 4.1431201290565707022e30}{p \cdot R_{bot}^2 + 9.4530675596060241453e35 \cdot R_{bot}^2 + 3.3836203204436320467e45} + 442500.0$$



$$\frac{990645158039762e19 \cdot R_{bot}^2 + 4.7799295937015251678e30 \cdot C_{top} \cdot R_{bot}^2 + 5.5732855443115701715e8}{p^2 \cdot R_{bot}^2 + 1.8843594417012258123e31 \cdot C_{top} \cdot R_{bot}^2 + 7.8359501536090573767e19 \cdot R_{bot}^2 + 1.839207307188}$$

$$\left[ \frac{\frac{3.0987517459096910473e44 \cdot R_{bot} + 7.5943966675624827926e20 \cdot R_{bot}^2 + 3.9512295081967212518e32 + 4.1431201290565707022e30}{9.4530675596060741453e35 \cdot R_{bot}^2 + 1.9940399313658742021e58 \cdot C_{top}^2 \cdot R_{bot}^2 + 2.7458910530284167357e47 + 3.3836203204436320467e45}}{1} \right]$$

$$\frac{99910473e44 + R_{bot}^2 \cdot 7.5943966675624827926e20 + C_{top} \cdot R_{bot}^2 \cdot 3.9512295081967212518e32 + 4.1431201290565707022e30}{241453e35 + C_{top}^2 \cdot R_{bot}^2 \cdot 1.9940399313658742021e58 + C_{top} \cdot R_{bot}^2 \cdot 2.7458910530284167357e47 + 3.3836203204436320467e45} + 442500.0$$

$$\frac{2895099405e8 + C_{top} \cdot R_{bot}^2 \cdot 1.1949823984253812919e20 + 0.013933213860778925429}{R_{bot}^2 \cdot 1.0838842616103232477e42 + C_{top} \cdot R_{bot}^2 \cdot 1.8843594417012258123e31 + 1.8392073071884802441e29} - 3.0499999$$

$$5.4028793265888636i) \cdot R_{bot} + \frac{1}{C_{top}} \cdot 0.00964963653736550386496 + (2.45966730232929173949e-7i) \cdot \frac{1}{C_{top}}$$

$$\frac{1.0 \cdot (5.943598371232499705e122 \cdot C_{top}^4 \cdot R_{bot}^4 + 1.851771918774973e124 \cdot C_{top}^4 \cdot R_{bot}^4 + 4.0167918447038546768e113 \cdot C_{top}^3 \cdot R_{bot}^4 + 4.148489937972833219e102 \cdot C_{top}^2 \cdot R_{bot}^4 + 5.121999578}$$

5.48749

4802441e29

$$\frac{5.499999999999992e-7}{\left( \frac{8.22774766128950994}{7.8359501536090573767e19 \cdot R_{bot}^2 + 1.083884} \right) \cdot \left( \frac{653736550386496}{C_{top}} + \frac{(2.45966730232929173949e-7i) \cdot F}{C_{top}} \right)}$$

967212518e32 · C<sub>top</sub> · R<sub>bot</sub><sup>2</sup> + 4.1431201290565707022e30

530784167357e47 · C<sub>top</sub> · R<sub>bot</sub><sup>2</sup> + 3.3836703704436370467e45

999999996827e-11

· 5.499999999999992e-7

· 8.7 - 8.7

R<sub>bot</sub>

$$\frac{7787e112 \cdot C_{top}^3 \cdot R_{bot}^4 + 2.1343763643085197801e101 \cdot C_{top}^2 \cdot R_{bot}^4 + 2.0170990469265520074e110 \cdot C_{top}^2 \cdot R_{bot}^2 + 1.08156}{32442633286e104 \cdot C_{top}^2 \cdot R_{bot}^3 + 4.9496860021968143014e111 \cdot C_{top}^2 \cdot R_{bot}^2 + 1.9042248895613003565e91 \cdot C_{top} \cdot R_{bot}^4 + 7}$$
$$50005876244005e42 \cdot C_{top}^2 \cdot R_{bot}^2 + 1.1523739501234010814e32 \cdot C_{top} \cdot R_{bot}^2 + 6.049963238147855453e20 \cdot F$$

$$\frac{0.05e8 \cdot R_{bot}^2 + 1.1949823984253812919e20 \cdot C_{top} \cdot R_{bot}^2 + 0.013933213860778925429}{12616103232477e42 \cdot C_{top}^2 \cdot R_{bot}^2 + 1.8843594417012258123e31 \cdot C_{top} \cdot R_{bot}^2 + 1.8392073071884802441e29} - 3.049999999$$

$$\frac{R_{bot}}{}$$

$$\frac{51695132605621e90 \cdot C_{top} \cdot R_{bot}^4 + 3.1422104415441900479e99 \cdot C_{top} \cdot R_{bot}^2 + 2.0370285703837193101e78 \cdot R_{bot}^4 + 1.20720532453208609522706e93 \cdot C_{top} \cdot R_{bot}^3 + 6.8159610522054487094e100 \cdot C_{top} \cdot R_{bot}^2 + 3.2777641541628938195e79 \cdot R_{bot}^4}{R_{bot}^2 + 9.3115485303259311269e29}$$

$$\frac{9999996827e-11}{-8.7}$$

$$\frac{508552694912912e88 \cdot Rbot^2 + 1.7113742849806224107e97}{+2.4281664219357374916e82 \cdot Rbot^3 + 2.3464783950215477469e89 \cdot Rbot^2 + 8.691351452716250144e91 \cdot Rbot + 4.19947912}$$

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26121768394e98

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