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#2

$$Y_{tr,new} = \begin{bmatrix} 0.01 + j0.006 & 0 \\ 0.067 - j0.094 & 0.007 + j0.008 \end{bmatrix} \quad \begin{matrix} Y_i & Y_r \\ Y_f & Y_o \end{matrix}$$

$$\begin{cases} G_t = G_{t,max} - 1.75\ dB \\ f_o = 600\ MHz \\ Q = 20 \end{cases}$$

$$Q_{tin} = \frac{\omega_o}{BW} = 20 \Rightarrow 20 = \frac{2\pi \times 600 \times 10^6}{BW}$$

$$\Rightarrow BW = 1.88 \times 10^8 = 188\ MHz$$

$$G_t = \frac{1}{R_t} = G_s + G_{in} = Re\{Y_s\} + Re\left\{Y_i - \frac{Y_f Y_r}{Y_o + Y_L}\right\} \quad (I)$$

$$Q_{tin} = R_t C_t \omega_o \quad (II)$$

$$L_1 = \frac{1}{C_t \omega_o^2} \quad (III)$$

$$G_s = n^2 G_g = \frac{n^2}{R_g} \Rightarrow C_t = C_t C_{in} \Rightarrow C = C_t - \frac{B_{in}}{\omega_o}$$

$$\begin{cases} C = \frac{C_1 C_2}{C_1 + C_2} \\ n = \frac{C}{C_1 + C_2} \end{cases} \xrightarrow{(I),(II),(III)} \begin{cases} Y_s = 0.01 - j0.006\ \mho \\ C_2 = 146.48\ PF \\ C_1 = 358.62\ PF \\ L = 0.66\ nH \end{cases}$$

$$\Rightarrow G_{tu,max} = \frac{|Y_f|^2}{4 g_i g_o} = 10\log(37.598) = 15.75\ dB \Rightarrow G_t = 14\ dB \Rightarrow G_t = 10^{1.4} = 25.12$$

$$G_t = g_s g_L |Y_f|^2 \Rightarrow g_s g_L = \frac{25.12}{0.0133} = 1888.6$$

$$g_s = g_{s,max} = \frac{1}{2 g_i} = 50 \Rightarrow g_{Lo} = \frac{1888.6}{50} = 37.77$$

$$O_L \Rightarrow \left[\frac{1}{g_{Lo}} - g_o, -b_o\right] = \left[\frac{1}{37.77} - 0.007, -0.008\right] = 0.014 - j0.008$$

$$r_L = \left[\frac{1}{g_{Lo}^2 - \frac{2 g_o}{g_{Lo}}}\right]^{1/2} = \left[0.0004 - \frac{0.14}{47.55}\right]^{1/2} = 0.012 \Rightarrow Y_L = O_L - r_L = 0.002 - j0.008\ \mho$$

$$C_t = \frac{20(0.002+0.007)}{2\pi \times 10^8 \times 6} = 47.7^{PF} = \frac{C_3C_4}{C_3+C_4} + \frac{0.008}{2\pi \times 6 \times 10^8} \Rightarrow \frac{C_3C_4}{C_3+C_4} = 45.6^{PF}$$

$$\Rightarrow \quad C_3 = 142.5^{PF} \;, \quad C_4 = 67^{PF}$$

$$L = \frac{1}{36 \times 4\pi^2 \times 10^{16} \times 47.7 \times 10^{-12}} = 1.47^{nH}$$

$$G_t = \frac{P_o}{P_i} = \left| \frac{Y_f}{Y_o + Y_L} \right| \cdot \frac{G_L}{G_{in}} = 25$$