طراحی تقویت‌کننده امیتر مشترک

مریم لیاقت

طراحی:

$$I_{CQ} = \frac{V_{CC} - V_{CE(sat)}}{R_{ac} + R_{DC}} = \frac{V_{CC} - V_{CE(sat)}}{R_C + (R_C + R_E)}$$

100 kΩ

$R_{out} = R_C = 1\,k\Omega$

$|A_v| = g_m R_C = 40 \rightarrow g_m = 40 \rightarrow g_m = \frac{I_C}{V_T} \rightarrow I_C = 1\,mA$

$I_{CQ} = \frac{10 - 0}{1 + (R_E + 1)} \approx \rightarrow R_E = 8\,k\Omega$

$V_{CEQ} = R_C I_C = 1\,V$

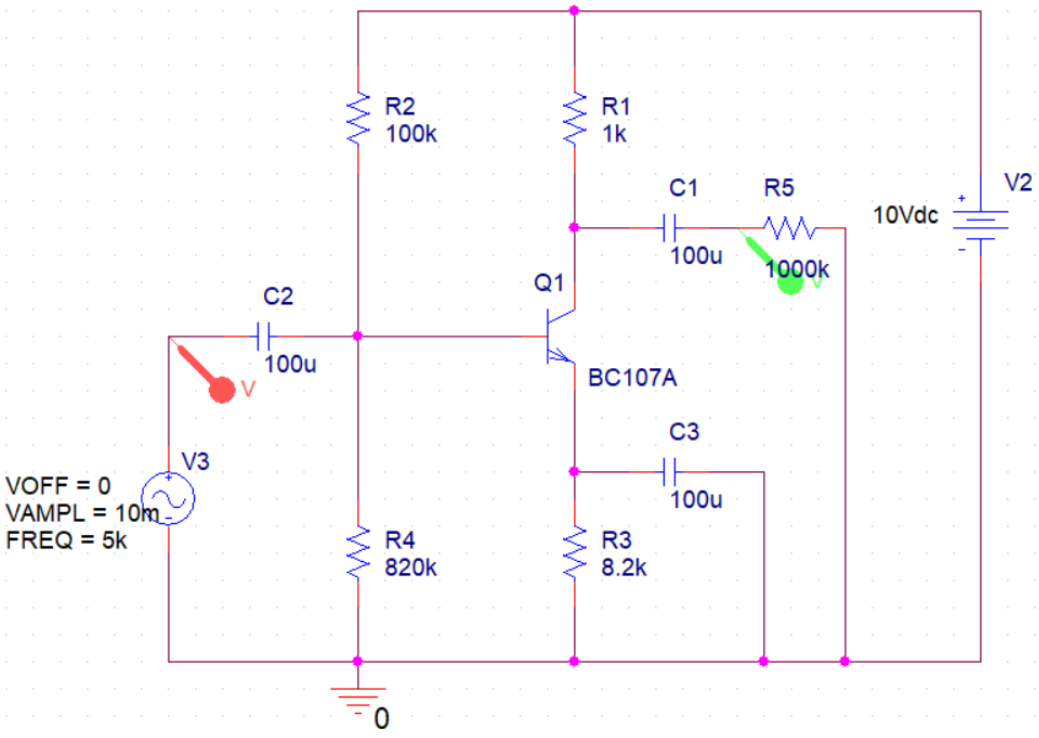
$R_{in} = R_1 \| R_2 \| r_\pi = R_1 \| R_2 \| \frac{200}{40}$

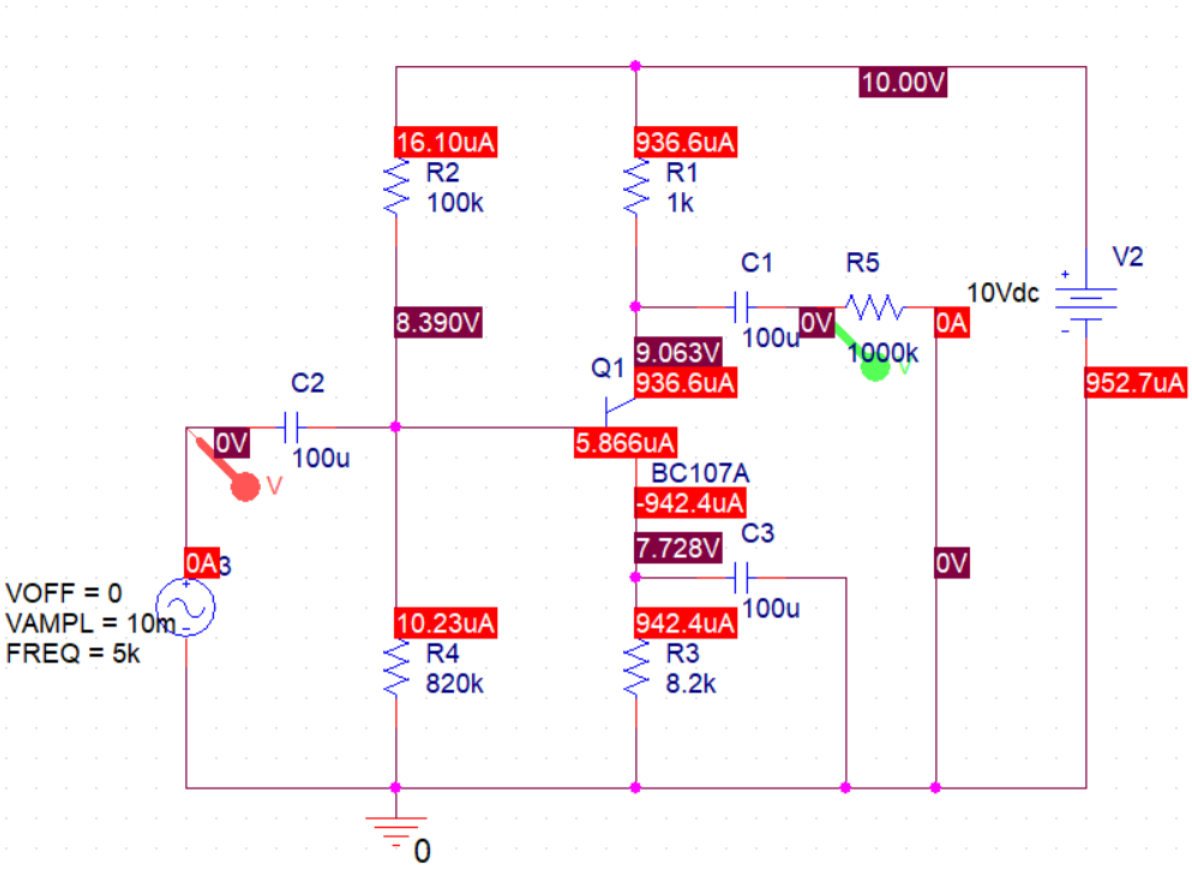
$R_{th} = \frac{1}{10} \times 200 \times R_E = 20 \times 8 = 160\,k\Omega$

$1 = \frac{V_{th} - 0.7}{8 + \frac{1}{201}} \rightarrow V_{th} \simeq 8$

$R_1 = R_{th} \frac{V_{cc}}{V_{th}} = 160 \times \frac{10}{8} = 200$

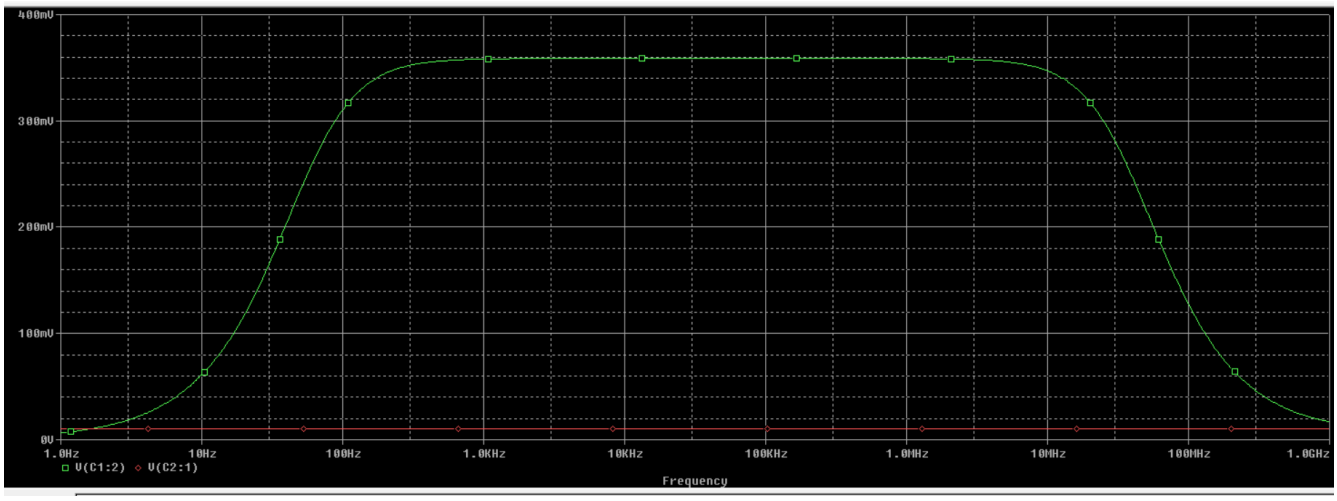
$R_2 = R_{th} \frac{1}{1 - \frac{V_{th}}{V_{cc}}} = 160 \times \frac{1}{1 - \frac{8}{10}} = 800$

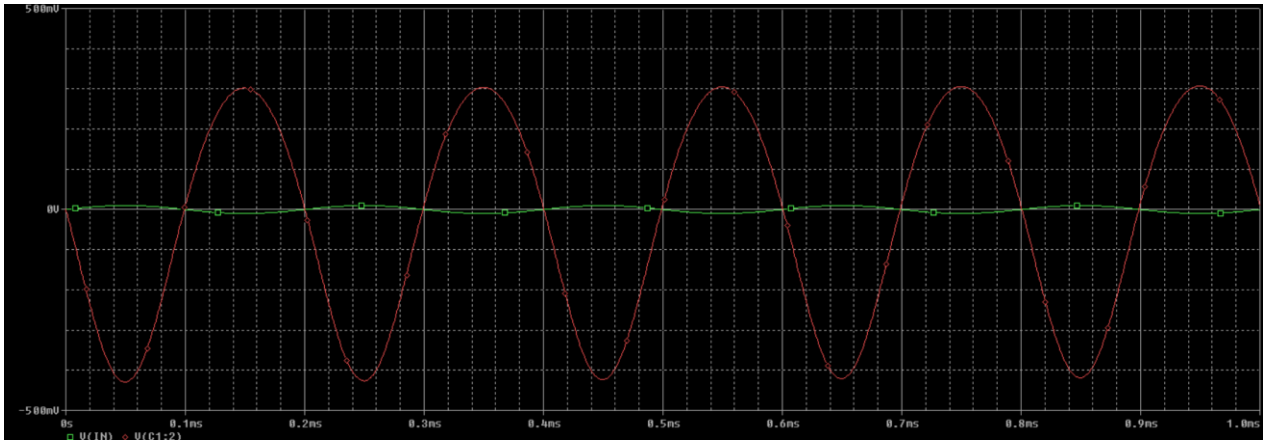




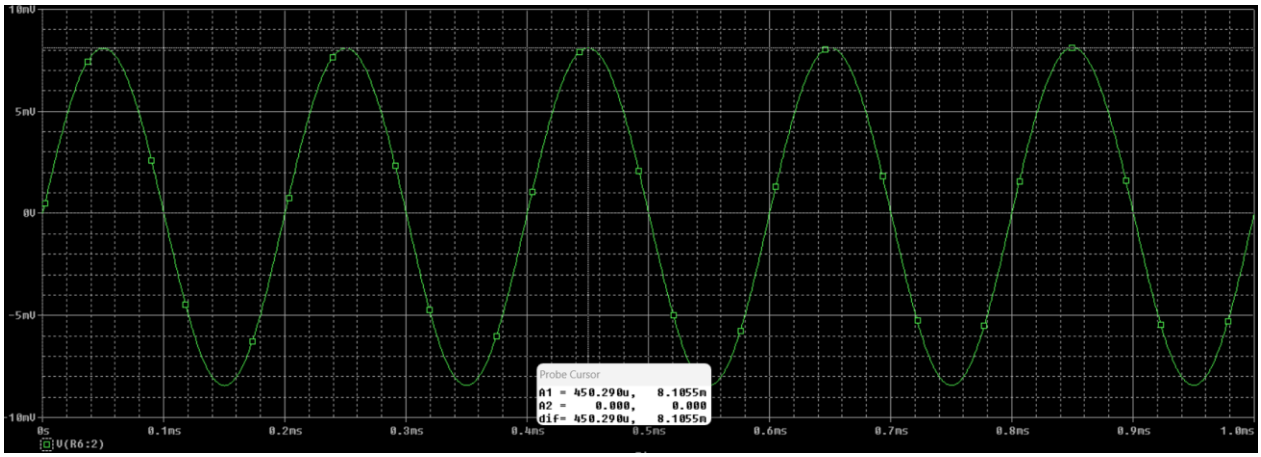
GAIN

$$A_v = \frac{v_0}{v_i} = \frac{358mv}{10mv} = 35.8$$

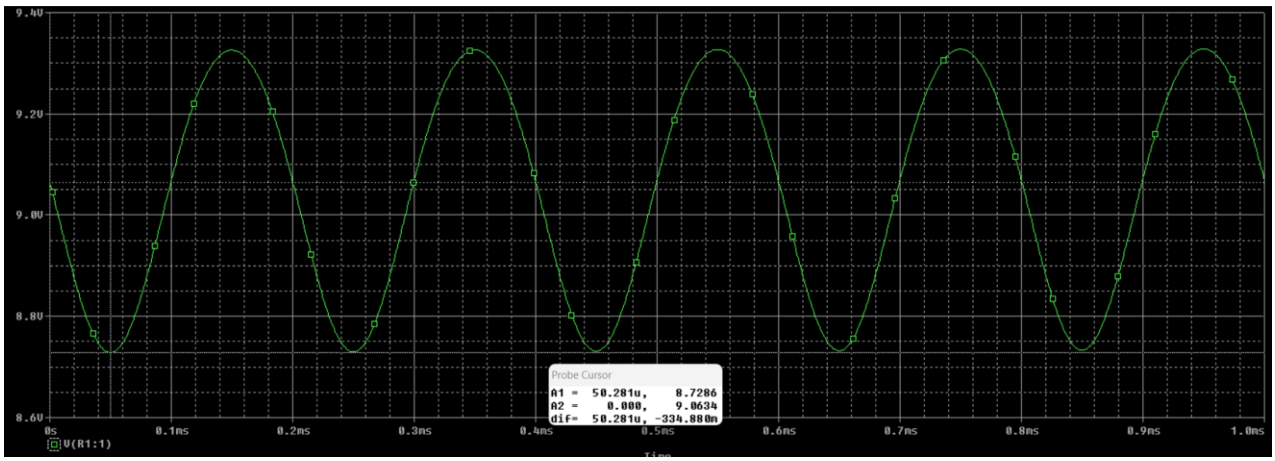



500mV
0V
-500mV
0s
0.1ms
0.2ms
0.3ms
0.4ms
0.5ms
0.6ms
0.7ms
0.8ms
0.9ms
1.0ms
V(IN)
V(C1:2)

Rin


10mV
5mV
0V
-5mV
-10mV
0s
0.1ms
0.2ms
0.3ms
0.4ms
0.5ms
0.6ms
0.7ms
0.8ms
0.9ms
1.0ms
V(R6:2)
Probe Cursor
A1 = 450.290u, 8.1055m
A2 = 0.000, 0.000
dif= 450.290u, 8.1055m

Rout


9.4V
9.2V
9.0V
8.8V
8.6V
0s
0.1ms
0.2ms
0.3ms
0.4ms
0.5ms
0.6ms
0.7ms
0.8ms
0.9ms
1.0ms
V(R1:1)
Probe Cursor
A1 = 50.281u, 8.7286
A2 = 0.000, 9.0634
dif= 50.281u, -334.880m

$$A_V = \frac{V_{out}}{V_s} = \frac{300+430}{20} = 36.5$$

$$R_{in} = \frac{V_{in}}{\frac{V_s - V_{in}}{R_s}} = \frac{8.27}{\frac{10-8.27}{1}} = 4.78 \quad k\Omega$$

$$v_{o_{NL}} = 362.5$$

$$v_{o_{FL}} = 182$$

$$R = \frac{v_{o_{NL}} - v_{o_{FL}}}{\frac{v_{o_{FL}}}{1k}} = 0.99k$$