



Pre-Laboratorio #3  
Electrónica Analógica  
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### Valores obtenidos en Simulación

Icq etapa 2= 3.518mA

Icq etapa 1 = 2.581mA

Vbb etapa 1 = 1.189 V

Vbb etapa 2 = 1.032 V

Vce etapa 1 = 6.323 V

Vce Etapa 2 = 4.964 V

Amp max = 4.1379 V

frec corte bajo = 74.589 Hz

Frec corte alto = 2.719MHz

Ancho de banda = 2.719MHz

Vo max = 3.042v - 3.3676v

Vo p = 3.205 v

Vi max = 0.07v - 0.7 v

Avt =43.457 v

Io max = 1.52mA -1.683mA

Io p = 1.6015 mA

Iimax = 16.244 uA -16172 uA

Ait=93.573

Vo 1era etapa =0.357812V

Vi 1era etapa = 69.989mV

Av etapa 1 = 5.112

$I_i \text{ primera etapa} = 16.244 \mu\text{A}$

$I_o \text{ primera etapa} = 166.410 \mu\text{A}$

$A_i \text{ primera etapa} = 10.244$

$V_i \text{ etapa 2} = 1.3889 - 1.031088 = 0.357812\text{V}$

$V_o \text{ etapa 2} = 3.0412\text{V}$

$A_v \text{ etapa 2} = 8.499$

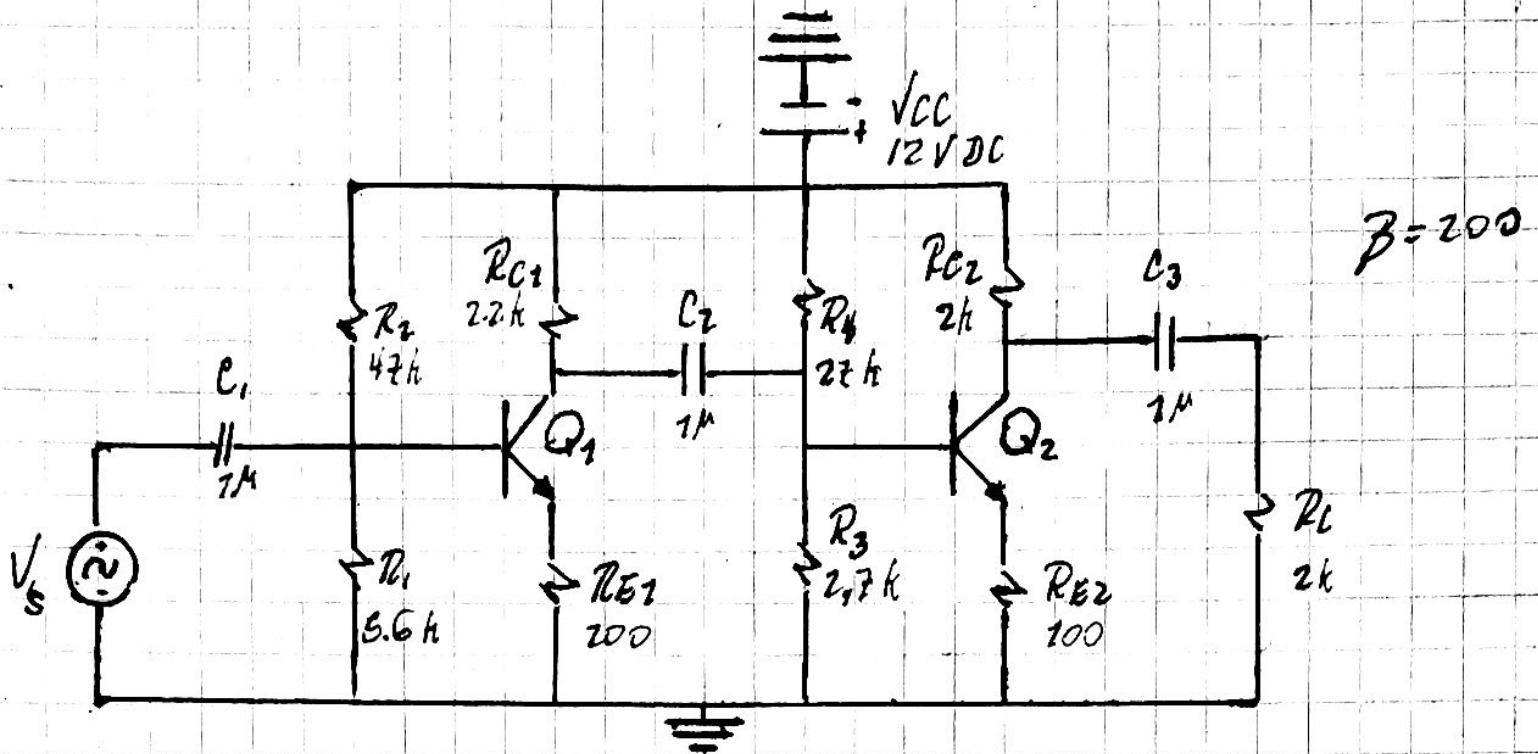
$I_o \text{ Etapa2} = 1.5206 \text{ mA}$

$I_i \text{ etapa2} = 169.087 \mu\text{A}$

$A_i \text{ Etapa 2} = 8.989$

$P_{ot} p = 2.568 \text{ mW}$

$\text{Eficiencia} = 6.083\%$



## ► Analisis DC

### • Etapa 1

$$V_{BB1} = \frac{V_{CC} R_2}{R_1 + R_2} = 1.27 \text{ V}$$

$$R_{B1} = \frac{R_1 R_2}{R_1 + R_2} = 5 \text{ k}\Omega$$

Lvh (malla entrada)  $V_{BB1} = \frac{I_{CQ1} R_{B1}}{\beta} + V_{BE} + I_{CQ1} R_{E1}$

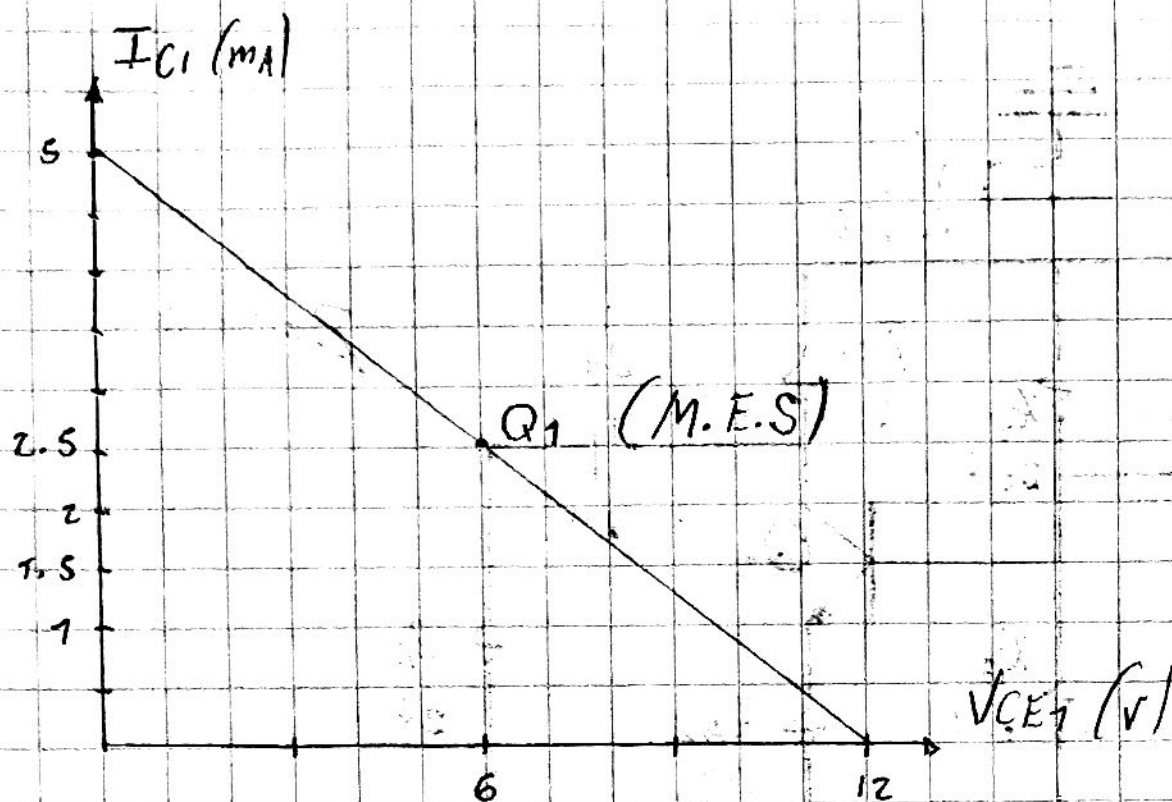
$$\left[ I_{CQ1} = \frac{V_{BB1} - V_{BE}}{\frac{R_{B1}}{\beta} + R_{E1}} = 2.53 \text{ mA} \right]$$

Lvh (malla salida)  $V_{CC} = I_{CQ1} R_{C1} + V_{CE1} + I_{CQ1} R_{E1}$

$$\left[ V_{CEQ1} = V_{CC} - I_{CQ1} (R_{C1} + R_{E1}) = 5.928 \text{ V} \right]$$

$$V_{CE1, \max} (I_{C1} = 0) = V_{CC} = 12 \text{ V}$$

$$I_{C1, \max} (V_{CE1} = 0) = \frac{V_{CC}}{R_{C1} + R_{E1}} = 5 \text{ mA}$$



• Etapa 2

$$V_{BB2} = \frac{V_{CC} R_3}{R_3 + R_4} = 3.09 \text{ V}$$

$$R_{B2} = \frac{R_4 R_3}{R_4 + R_3} = 2.45 \text{ k}\Omega$$

Lvh (malha de entrada)

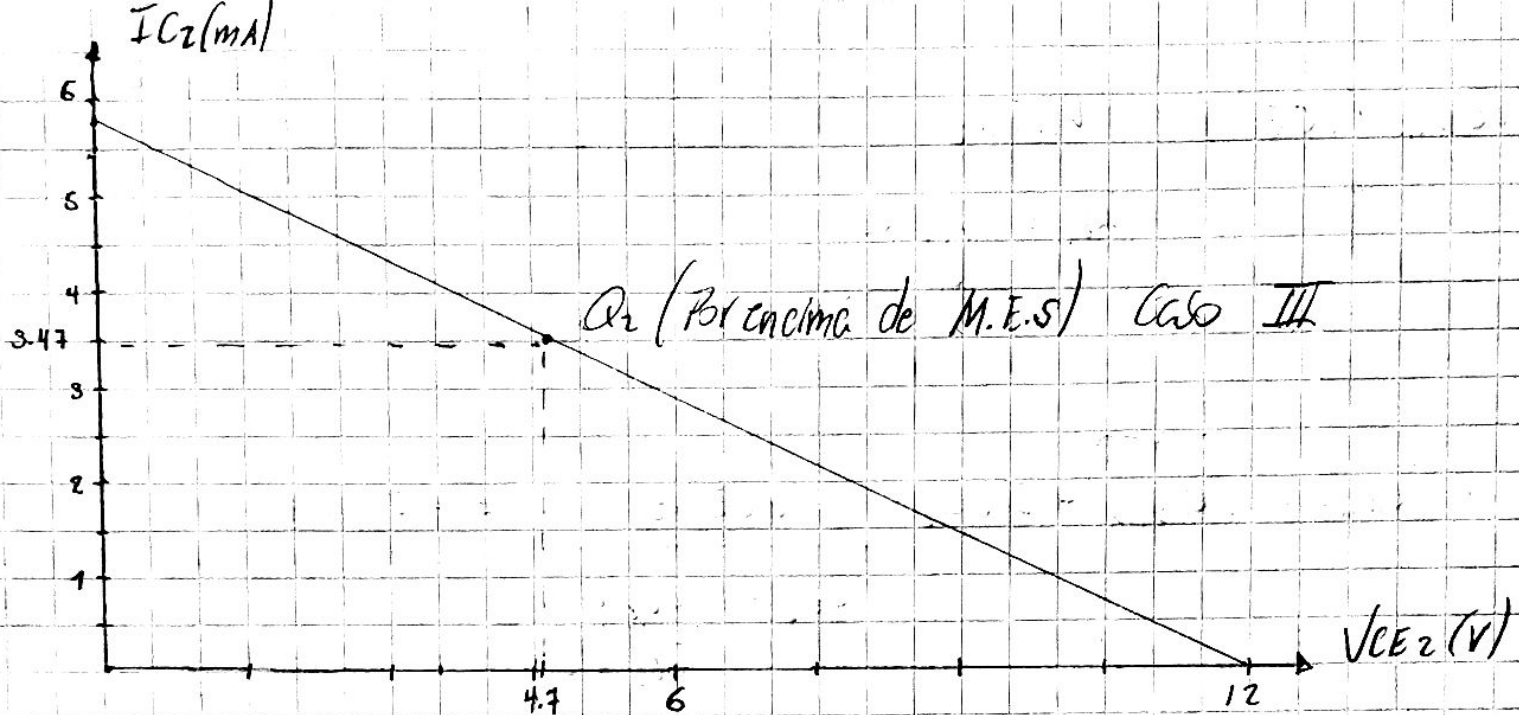
$$\left[ I_{CQ2} = \frac{V_{BB2} - V_{BE}}{\frac{R_{B2}}{\beta} + R_{E2}} = 3.47 \text{ mA} \right]$$

Lvh (malha de saída)

$$\left[ V_{CEQ2} = V_{CC} - I_{CQ2} (R_{C2} + R_{E2}) = 4.713 \text{ V} \right]$$

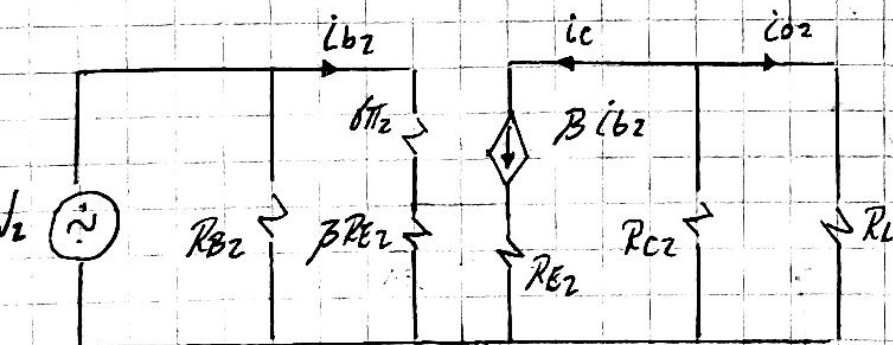
$$V_{CE2 \text{ max}} (I_{C2} = 0) = V_{CC} = 12 \text{ V}$$

$$I_{C2 \text{ max}} (V_{CE2} = 0) = \frac{V_{CC}}{R_{C2} + R_{E2}} = 5.71 \text{ mA}$$



## Analisis Ac

### • Etapa 2



$$r_{\pi 2} = \frac{\beta \cdot 26 \text{ mV}}{I_{CQ2}} = 1.5 \text{ k}\Omega$$

$$A_{i2} = \frac{i_{o2}}{i_{i2}}$$

$$i_{o2} = \frac{-\beta i_{b2} R_{C2}}{R_{C2} + R_L}$$

$$i_{i2} = \frac{i_{b2} (R_{B2} + r_{\pi 2} + \beta R_{E2})}{R_{B2}}$$

$$[A_{i2}] = \frac{-\beta R_{C2} R_{B2}}{(R_{C2} + R_L)(R_{B2} + r_{\pi 2} + \beta R_{E2})} = [-10.23]$$

$$[A_{V2}] = \frac{v_{o2}}{v_2} = \frac{-\beta R_{C2} R_L}{R_{C2} + R_L} \cdot \frac{1}{r_{\pi 2} + \beta R_{E2}} = [+9.3]$$

Caso III:  $i_{C\text{max}} = i_{C\text{max}} - I_{CQ2}$

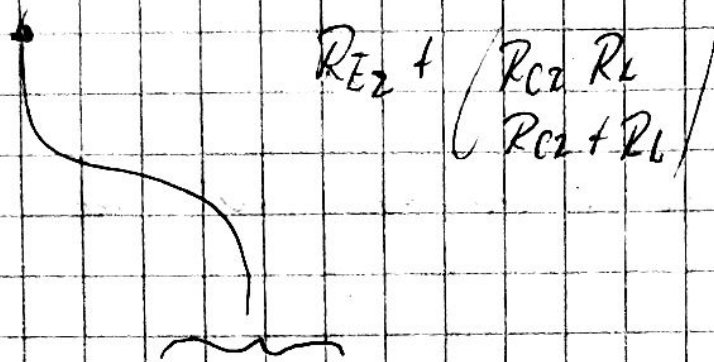
$$V_{CE} - i_C (R_{E2} + R_{C2} \parallel R_L) = V_{CE} - V_{CEQ2}$$

$$i_C = i_{CQ} - I_{CQ2}$$

$$V_{CE} - V_{CEQ2} = -(i_{CQ} - I_{CQ2})(R_{E2} + R_{C2} \parallel R_L)$$



$$i_{Cmax}(V_{CE=0}) = V_{CEQ_2} + I_{CQ_2}$$



$$\bullet i_{Cmax} = i_{Cmax} - I_{CQ_2} = \frac{V_{CEQ_2}}{R_{E2} + \frac{R_{C2} R_L}{R_{C2} + R_L}} = 4,28 \text{ mA}$$

Divisor de corriente

$$i_{Cmax} = \frac{i_{Cmax} R_L}{R_{C2} + R_L} = 2,14 \text{ mA}$$

$$\bullet [V_{omax} = i_{Cmax} \cdot R_L = 4,28 \text{ V}]$$

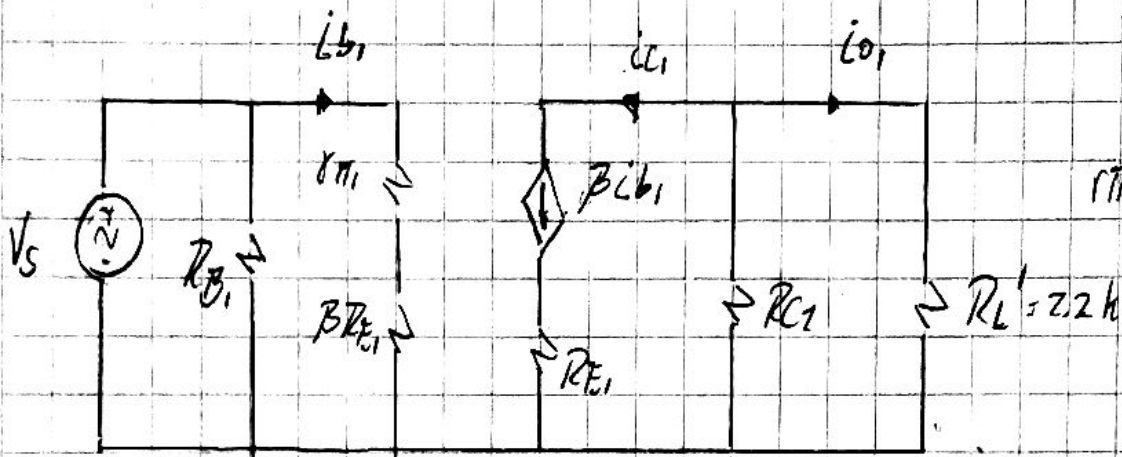
$$\bullet [P_L = \frac{V_{omax}^2}{2 R_L} = 4,38 \text{ mW}]$$

$$\bullet Z_{out_2} = [Z_{out_2}] R_{C2} = [2 \text{ k}\Omega]$$

$$\bullet Z_{in_2} = R_L' = (r_{\pi 2} + \beta R_{E2}) \parallel R_{B2} = 2,2 \text{ k}\Omega$$

$$\bullet [\eta\% = \frac{P_L}{P_{DC}} = \frac{4,38 \text{ mW}}{V_{CC} I_{CQ_2}} \times 100 = 10,99\%]$$

• Etapa 1



$$r_{\pi} = \frac{26 \text{ mV}}{I_{CQ}} = 2035 \Omega$$

$$\blacktriangleright A_{i1} = \frac{i_{o1}}{i_{i1}} = \frac{-\beta R_C R_B}{(R_C + R_L')(R_B + r_{\pi} + \beta R_E)} = -10,62$$

$$\blacktriangleright A_{v1} = \frac{v_{o1}}{v_s} = \frac{-\beta R_C R_L'}{r_{\pi} + \beta R_E} = -3,23$$

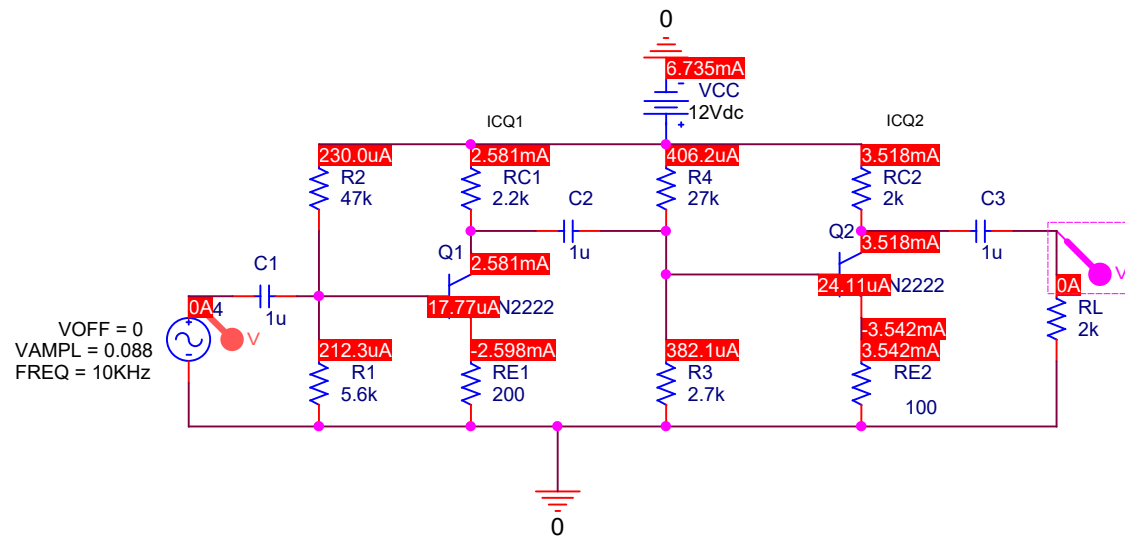
$$\blacktriangleright Z_{in1} = [Z_{in}] = R_B \parallel (r_{\pi} + \beta R_E) = [4,47 \text{ k}\Omega]$$

$$\blacktriangleright [A_{vT} = A_{v1} \cdot A_{v2} = 48,64]$$

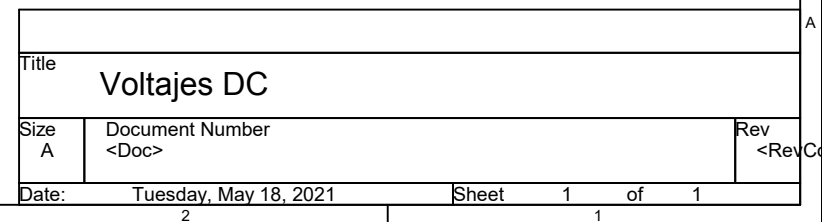
$$\blacktriangleright [A_{iT} = A_{i1} \cdot A_{i2} = 108,64]$$

$$\blacktriangleright [V_{i,max} = \frac{V_{o,max}}{A_{vT}} = 0,088 \text{ V}]$$

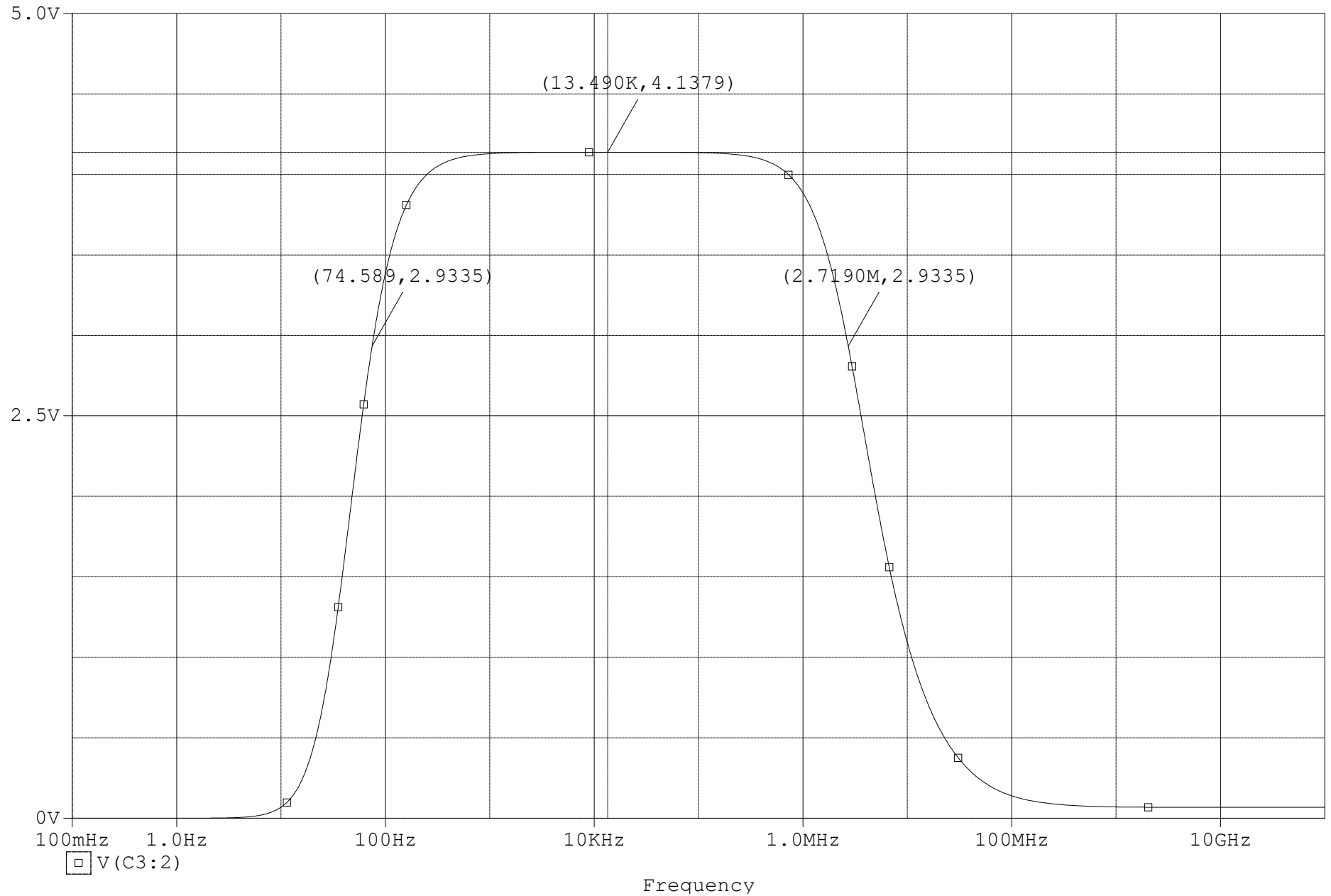




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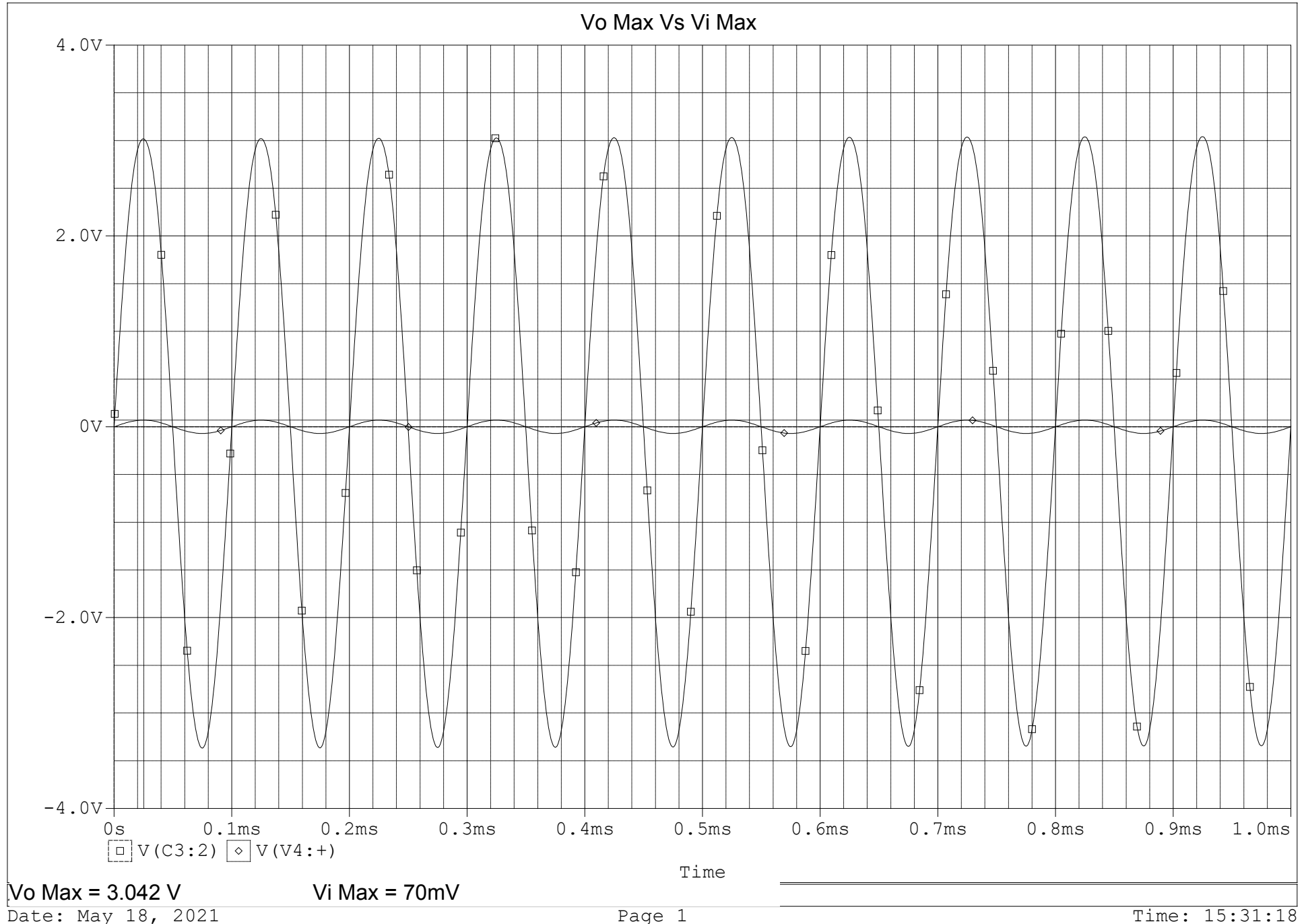


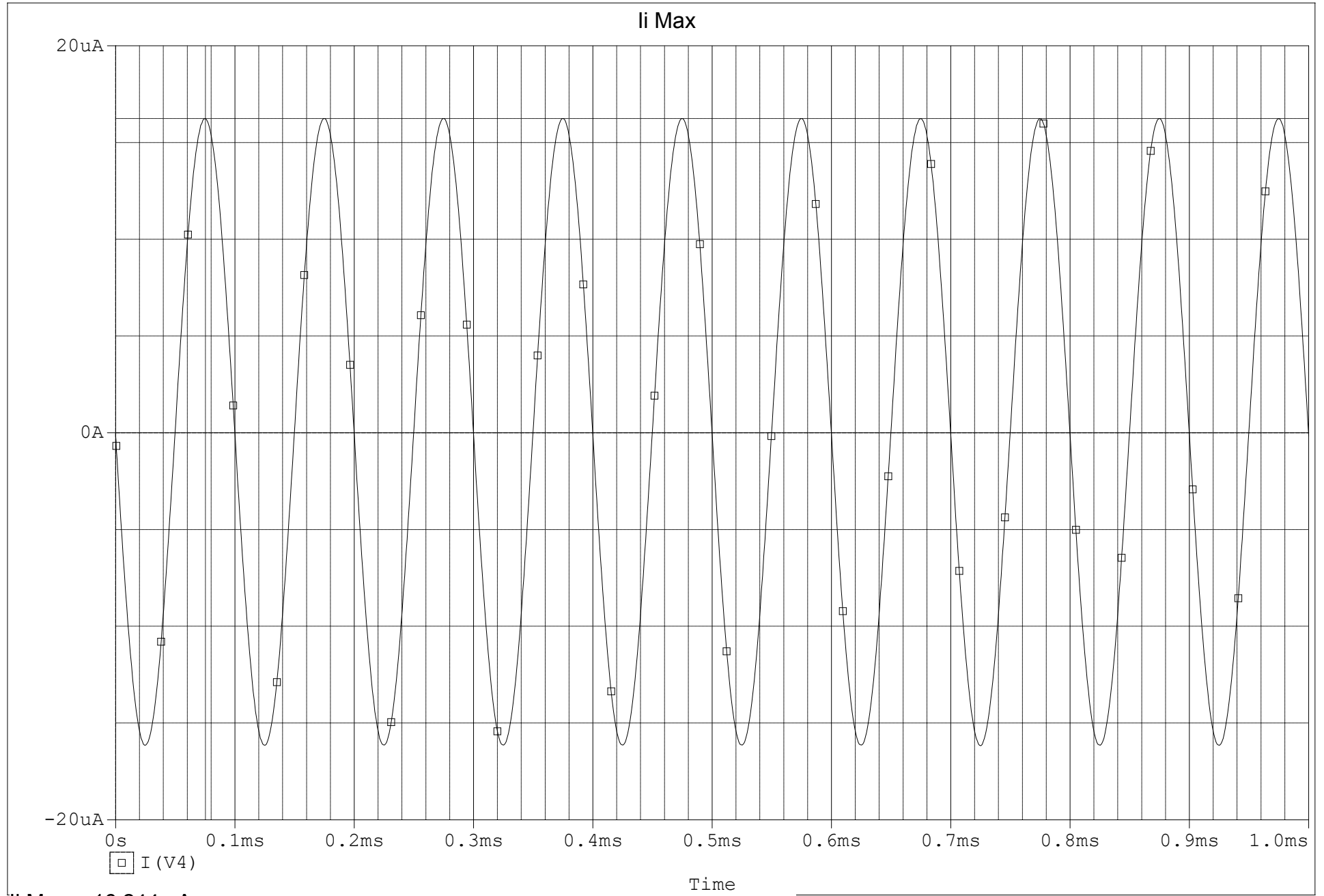
### Análisis en frecuencia



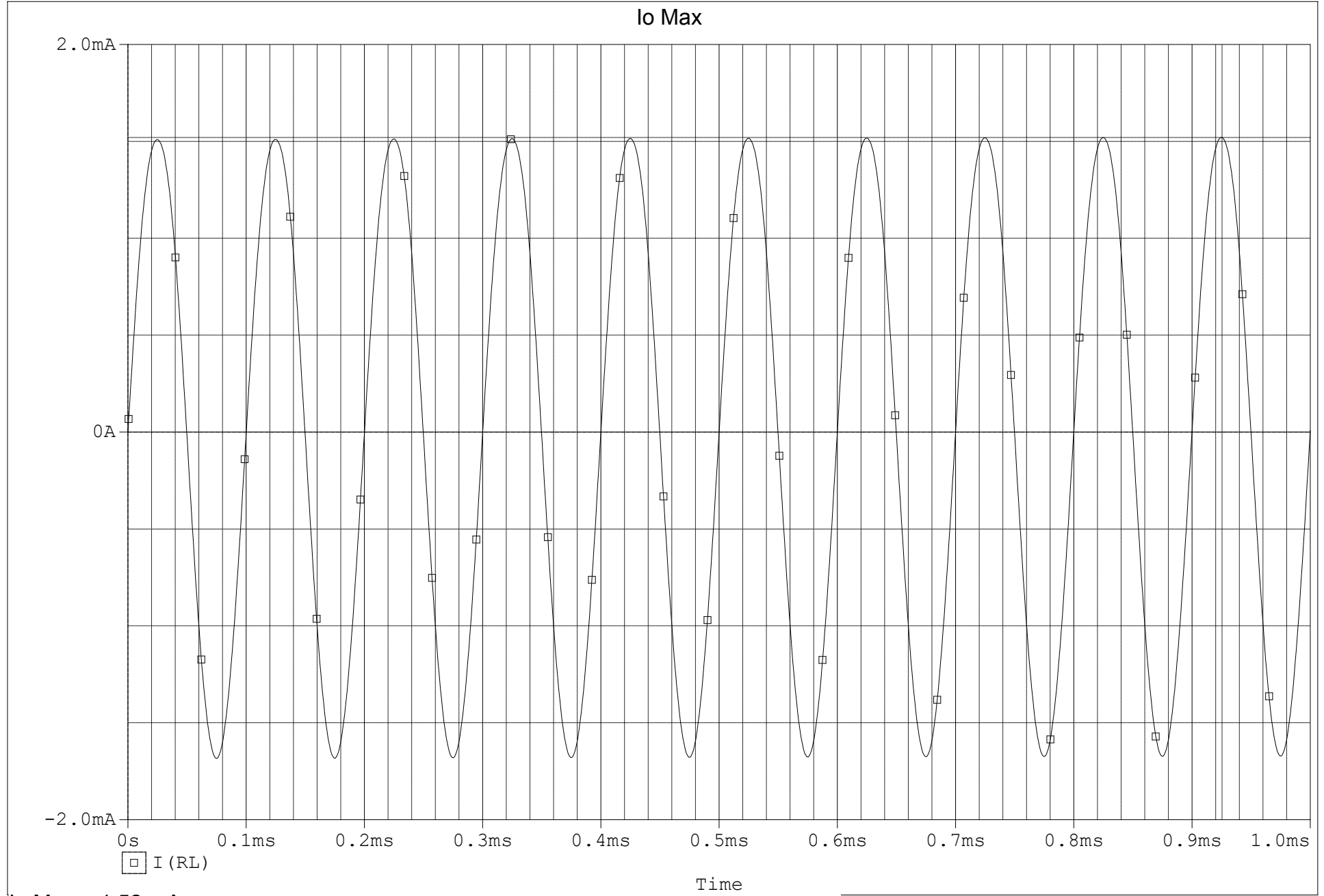
FI = 74.589 Hz

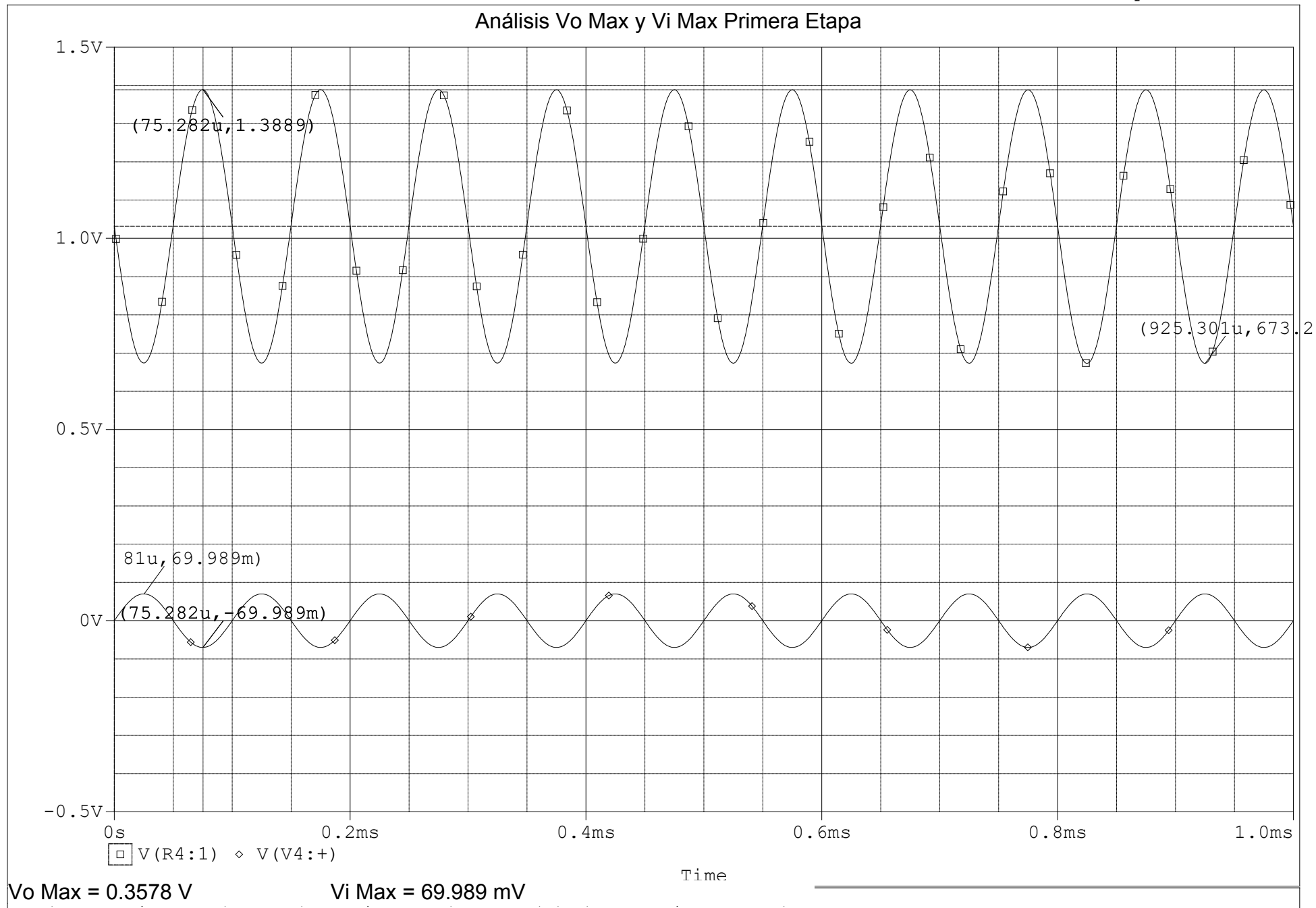
FH = 2.719 MHz

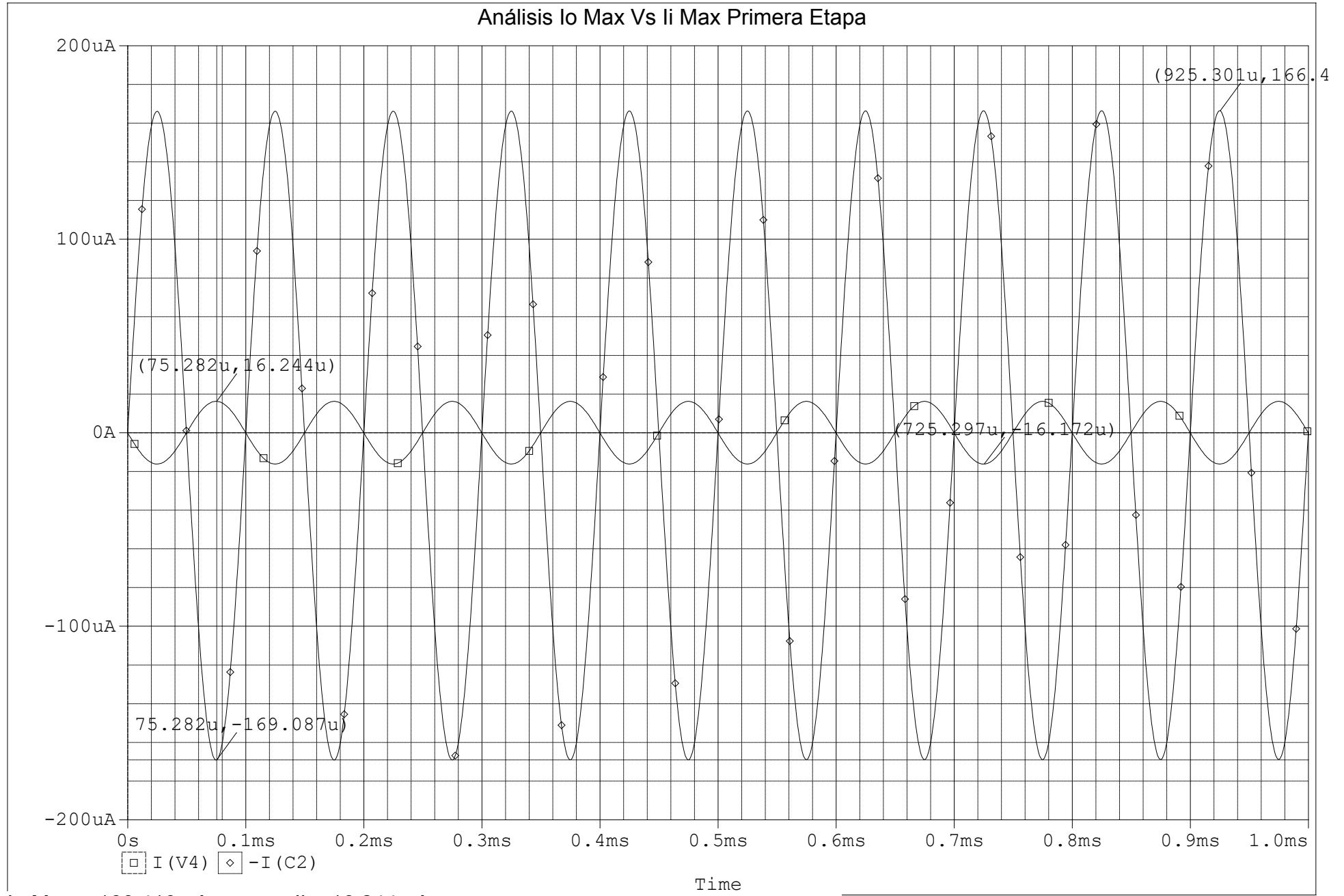




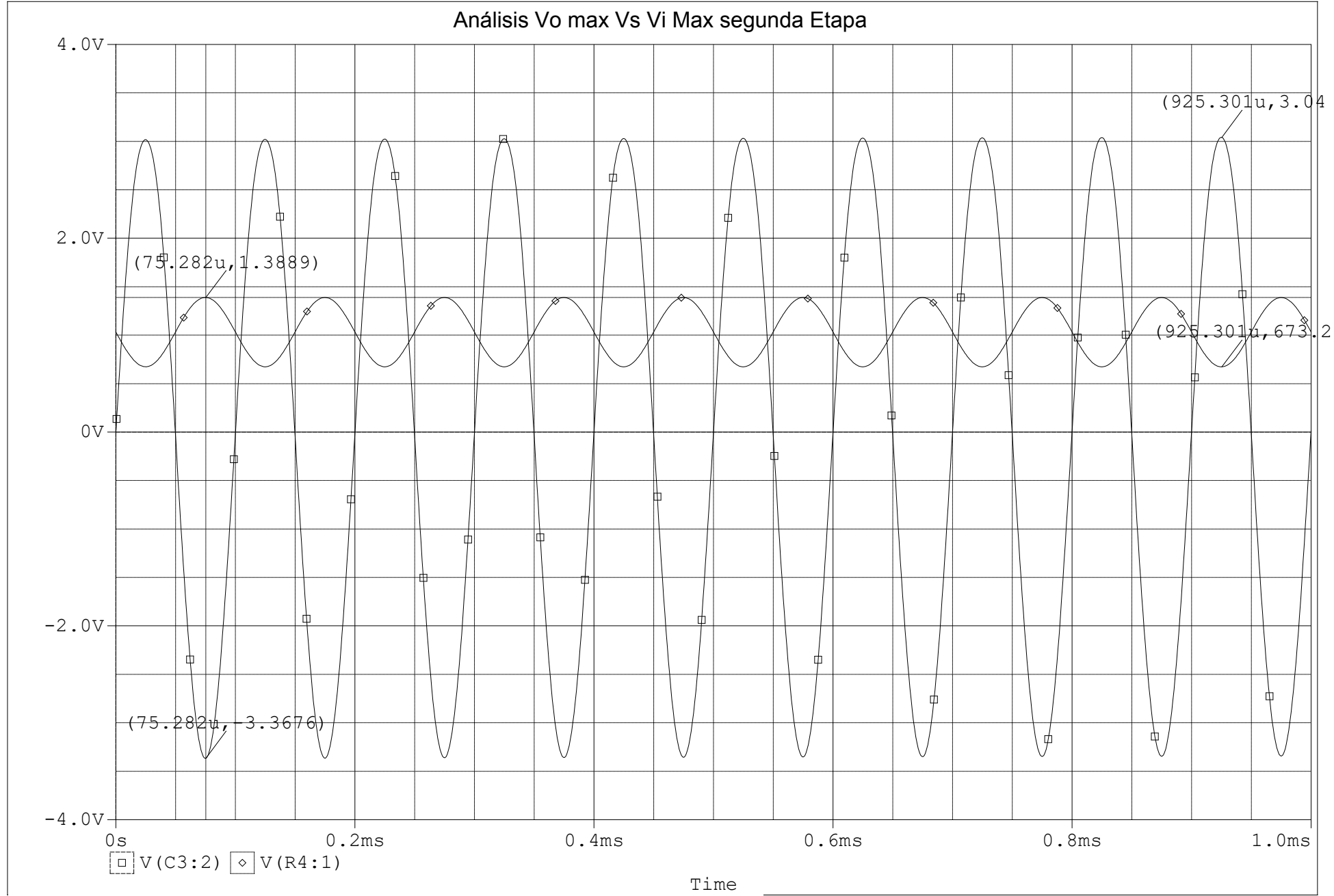








**Io Max = 166.410 uA      Ii = 16.244 uA**



**Vo max = 3.0412 V**      **Vi Max = 0.357 V**

