

CASCADED AMPLIFIER

Design two stage amplifier cascade common emitter
Amplifier that will amplify a 1mVp input at 15 kHz to 7Vp.

Required:

- Design computation
- Schematic diagram
- Simulation graphs and Frequency response
- PCB Layout
- Cost estimate

SCHEMATIC DIAGRAM

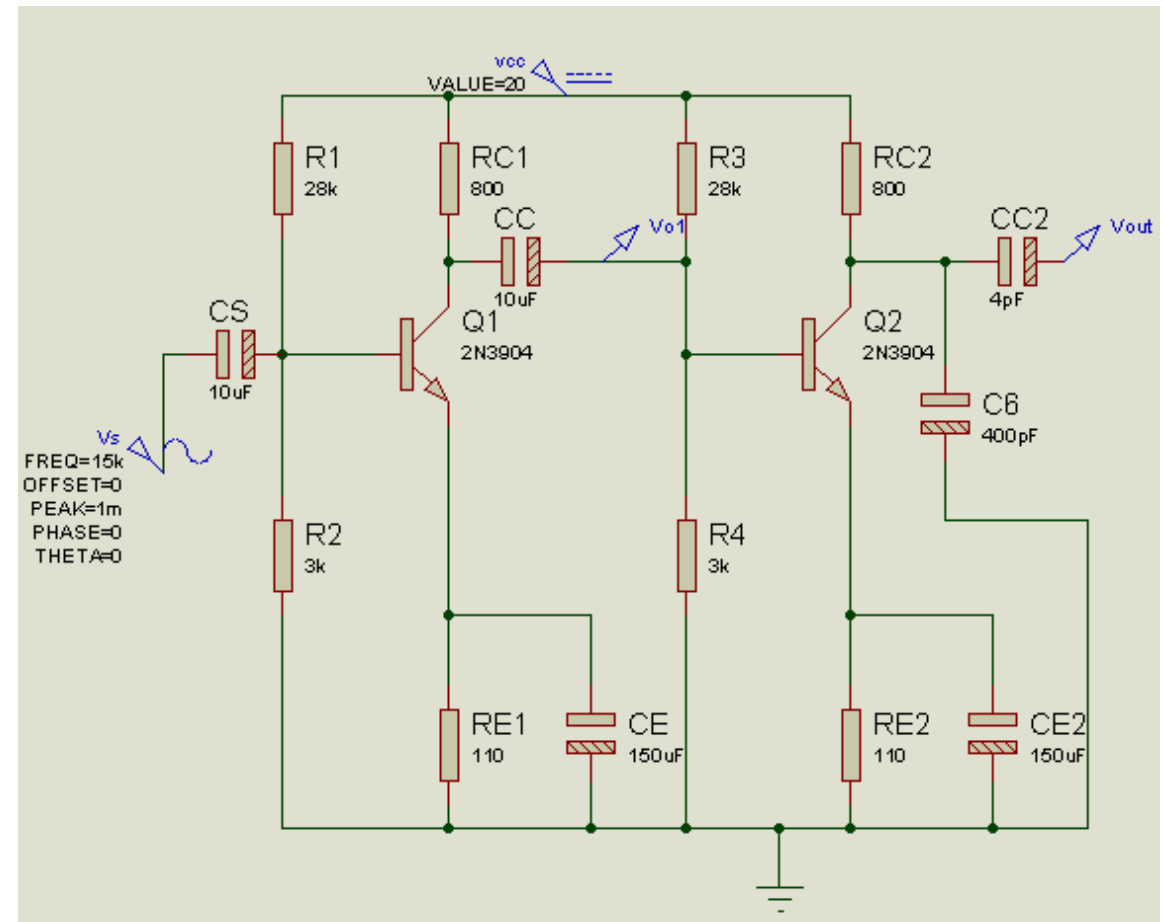


Plate No. 4
Cascaded Amplifier

Instructor:
Engr. Edgardo Martinez

Student:
Jomerey P. Sioson

Date:
5 / 5 /13

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DESIGN COMPUTATION

$$V_{CC} := 20V \quad I_B := 40\mu A \quad V_O := 7V \quad I_E := 10.3mA$$

$$I_C := 10.3mA \quad V_{CE} := 11.2V \quad V_{IN} := 1mV \quad V_{BE} := 0.7V$$

$$\beta := \frac{I_C}{I_B} = 257.5 \quad A_V := \frac{V_O}{V_{IN}} = 7 \times 10^3 \quad A_{V1} := 3500$$

$$r_e := \frac{26mV}{I_E} = 2.524 \Omega \quad A_{V2} := 3500$$

$$V_E := \frac{V_{CE}}{10} = 1.12V$$

$$V_B := V_{BE} + V_E = 1.82V$$

$$V_C := V_{CE} + V_E = 12.32V$$

$$R_E := \frac{V_E}{I_E} = 108.738 \Omega$$

$$R_2 := \frac{\beta \cdot R_E}{10} = 2.8 \cdot k\Omega$$

$$R_1 := \frac{V_{CC} \cdot R_2 - V_B \cdot R_2}{V_B} = 27.969 \cdot k\Omega$$

$$R_C := \frac{V_{CC} - V_C}{I_C} = 745.631 \Omega$$

$$F_{HI} := 700kHz \quad C_S := 10\mu F \quad C_{bc} := 4pF$$

$$f_{Le} := 90Hz \quad C_C := 10\mu F$$

$$R_{Thi} := \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{\beta \cdot r_e}} = 517.77 \Omega$$

$$C_{wo} := \frac{1}{2\pi \cdot R_{Thi} \cdot F_{HI}} - \left(1 - \frac{1}{A_{V2}}\right) \cdot C_{bc} = 435.123 \cdot pF$$

$$C_O := C_{wo} + \left(1 - \frac{1}{A_{V2}}\right) \cdot C_{bc} = 439.122 \cdot pF$$

$$F_{HI} := \frac{1}{2\pi \cdot R_{Thi} \left[C_{wo} + \left(1 - \frac{1}{A_{V2}}\right) \cdot C_{bc} \right]} = 700kHz$$

$$R_i := \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{\beta \cdot r_e}} = 517.77 \Omega$$

$$f_{Ls} := \frac{1}{2\pi \cdot R_i \cdot C_S} = 30.739 \cdot Hz$$

$$f_{Lc} := \frac{1}{2\pi \cdot (R_C) \cdot C_C} = 21.345 \cdot Hz$$

$$R_s := \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}} = 2.545 \cdot k\Omega$$

$$R_e := \frac{1}{\frac{1}{R_E} + \frac{1}{\left(\frac{R_s}{\beta} + r_e\right)}} = 11.138 \Omega$$

$$C_E := \frac{1}{2\pi \cdot R_e \cdot f_{Le}} = 158.777 \cdot \mu F$$



SIMULATION GRAPHS

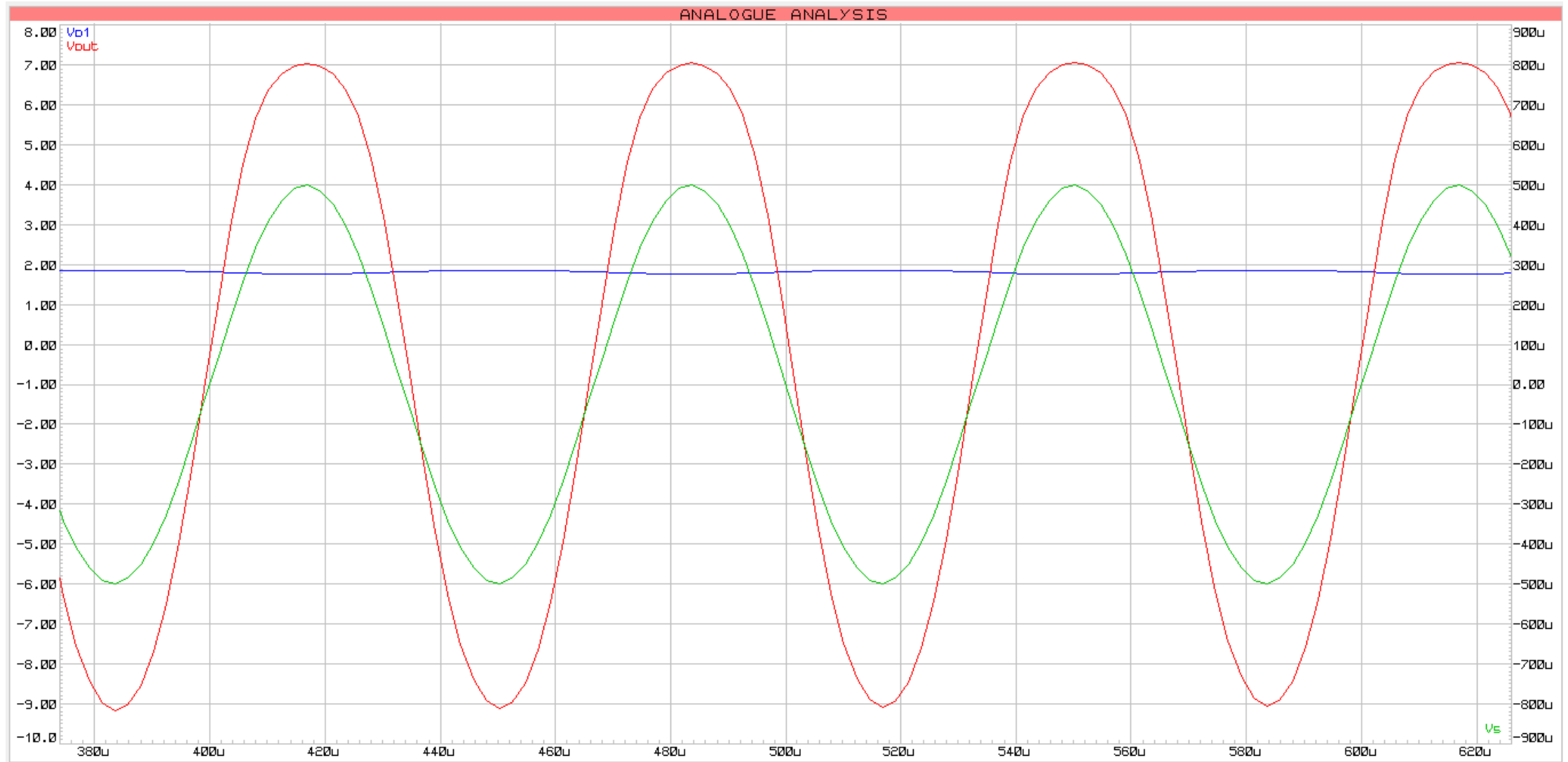


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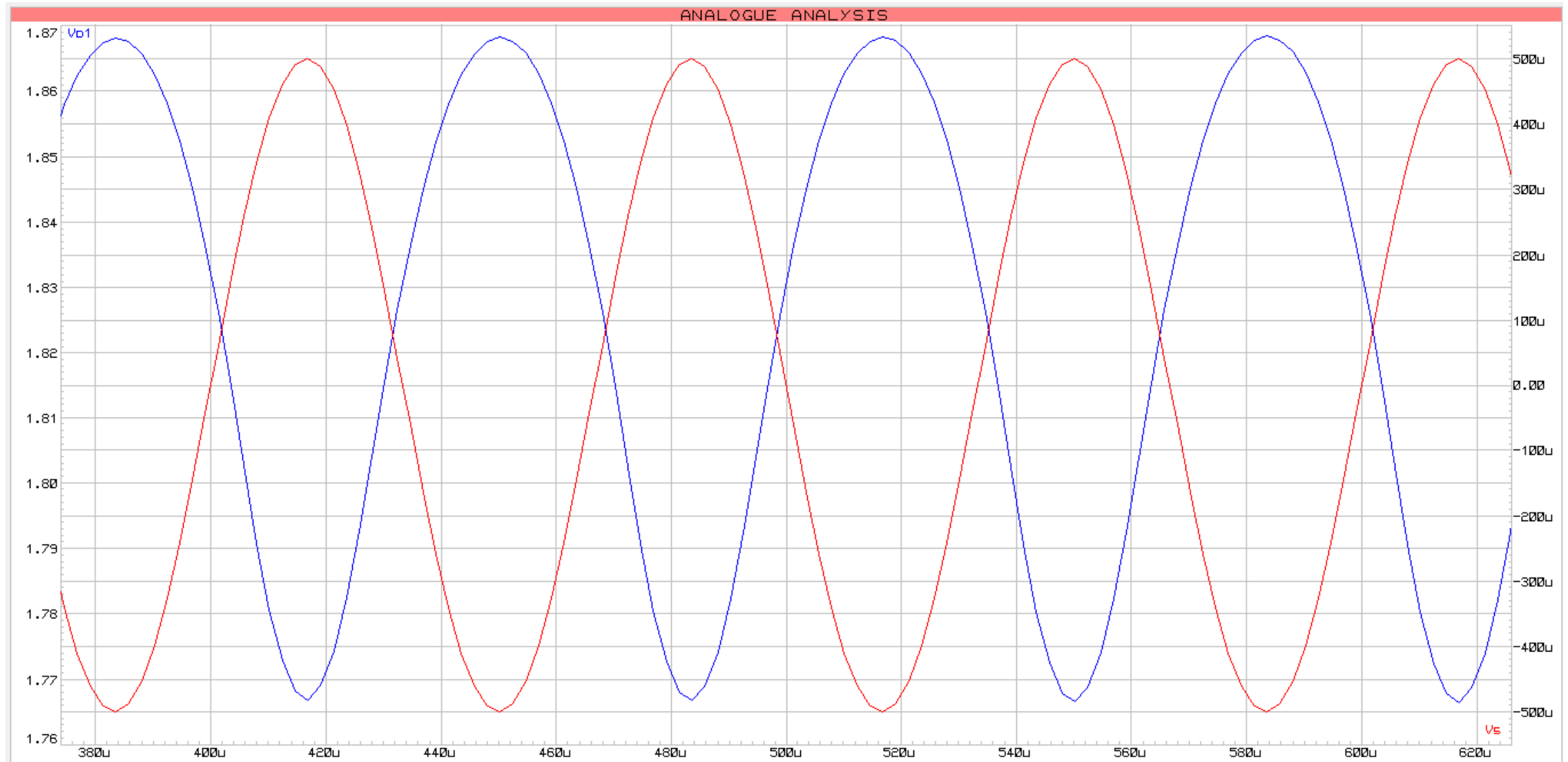
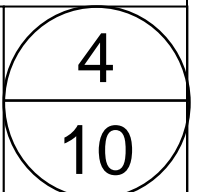


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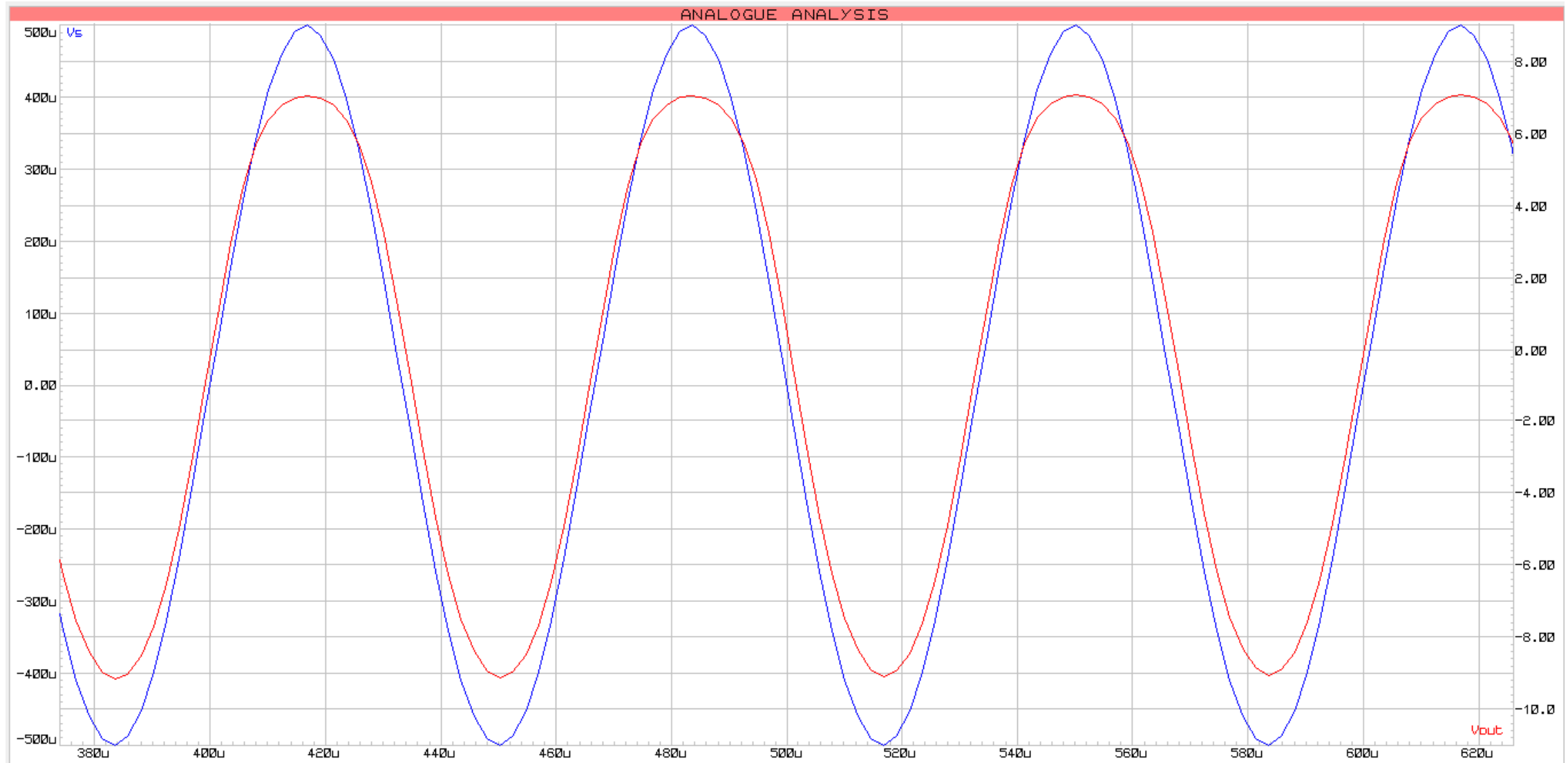


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FREQUENCY RESPONSE

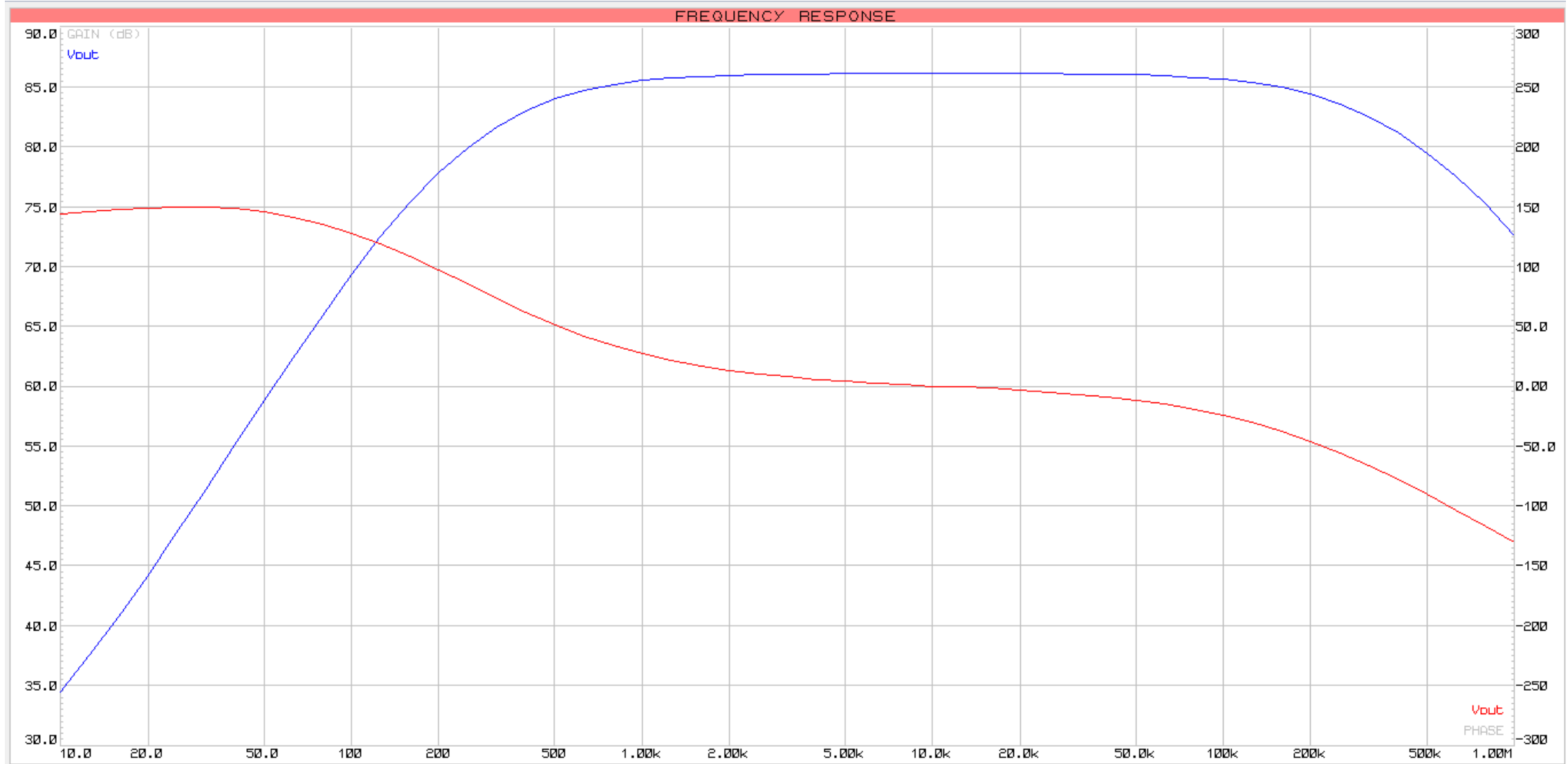


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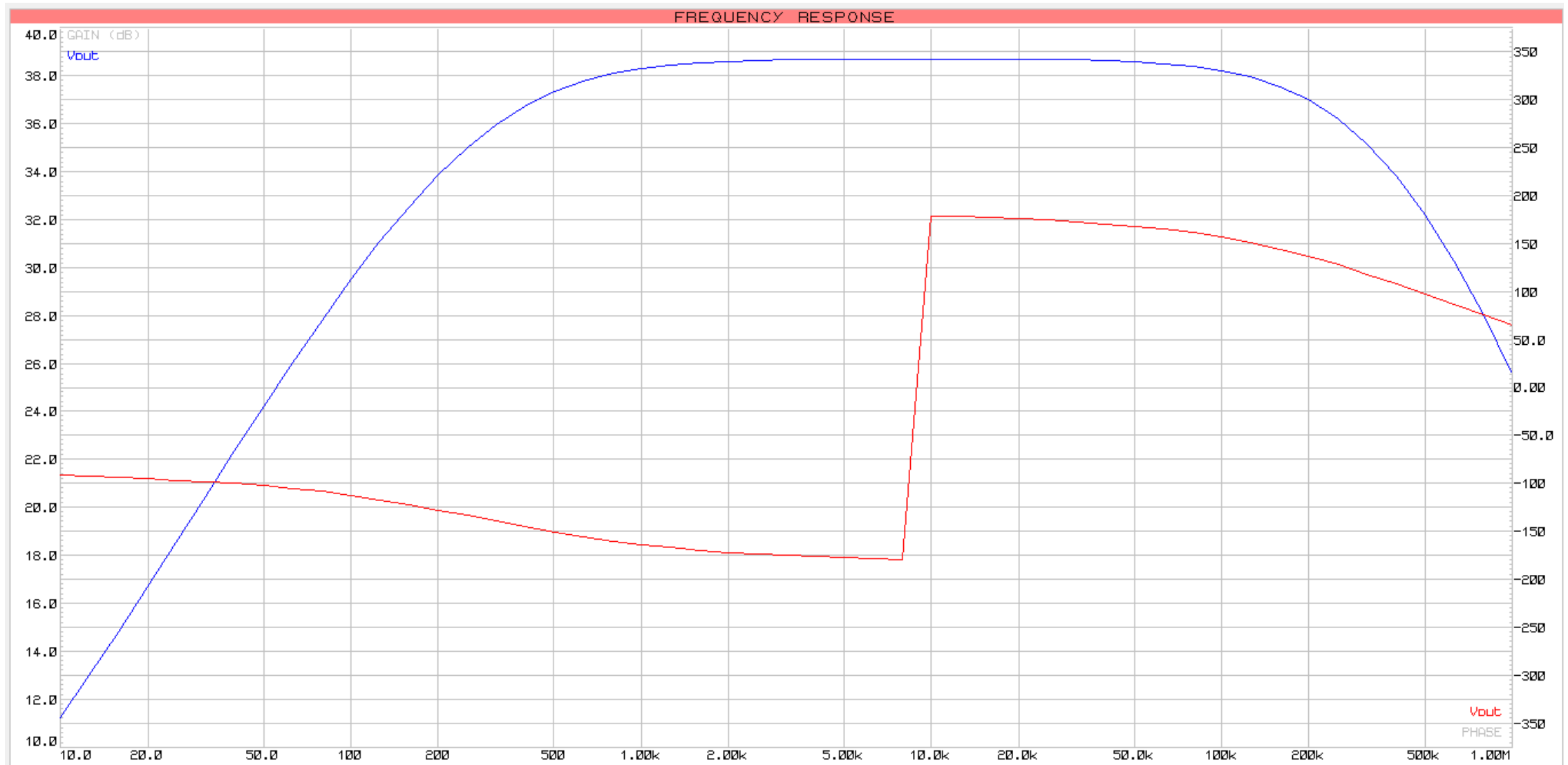


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PCB LAYOUT

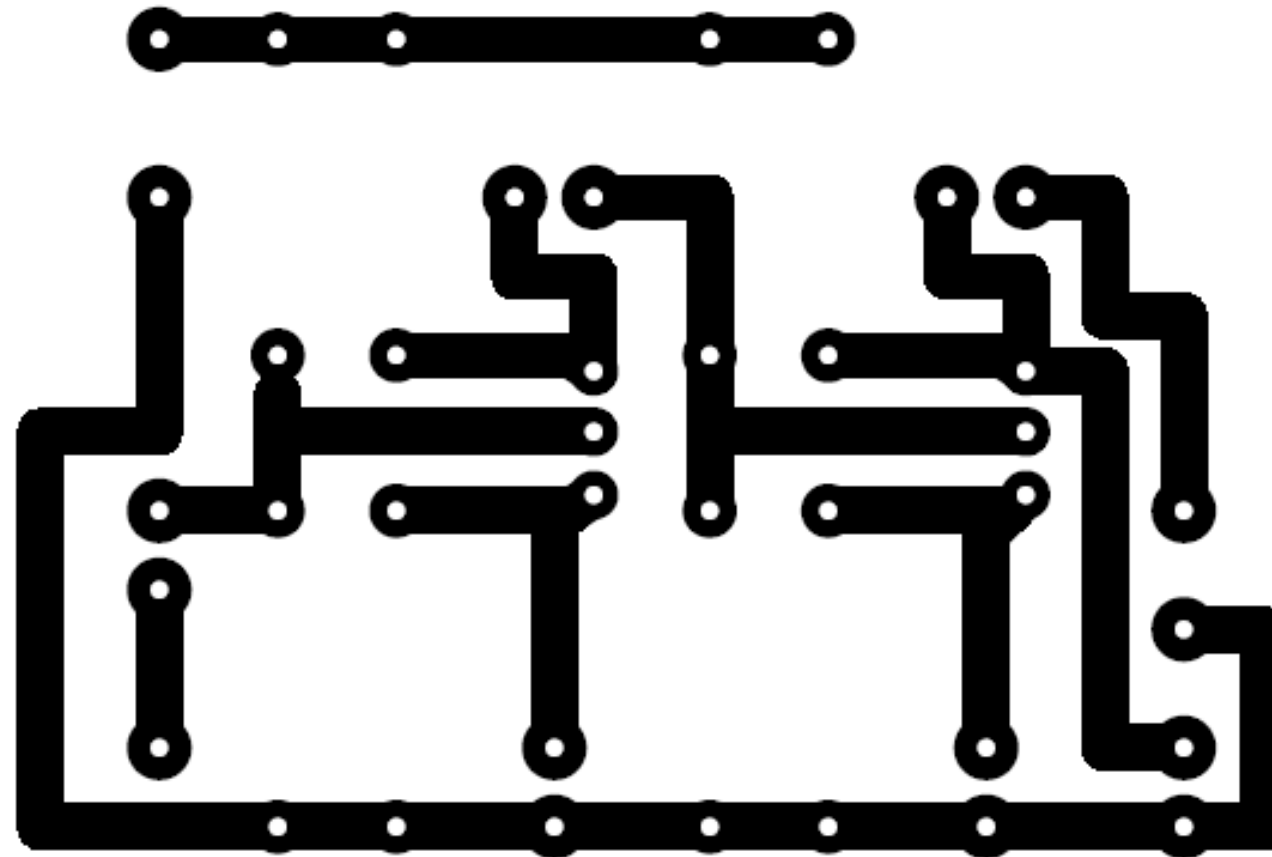


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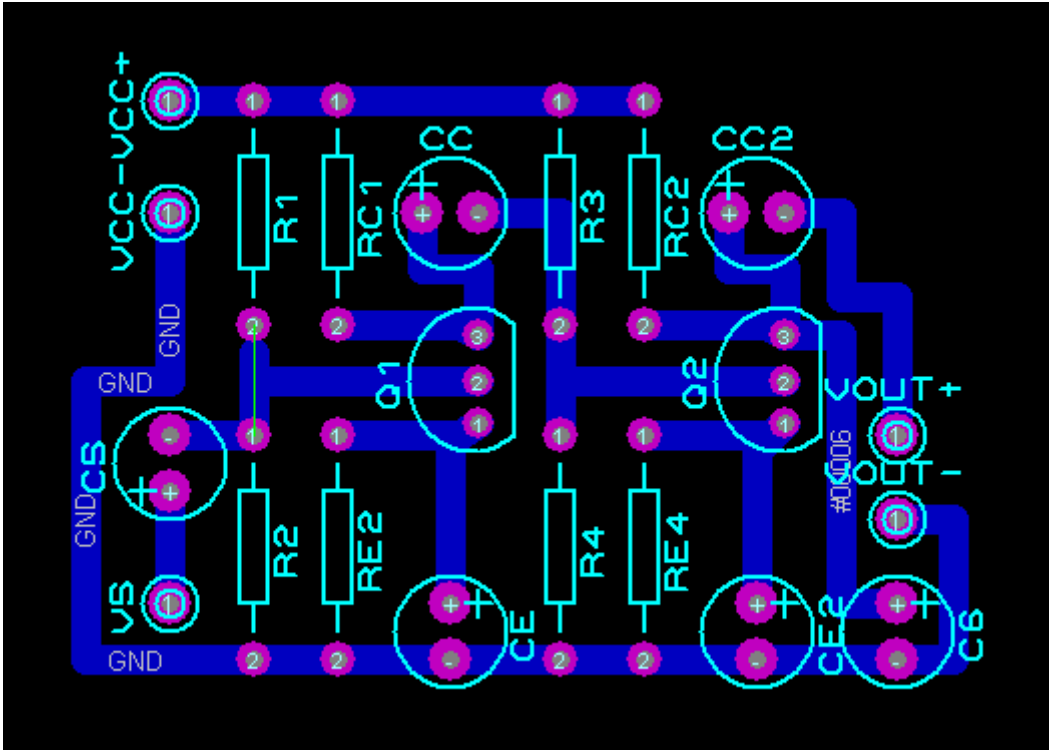
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ARES DESIGN



3D DESIGN

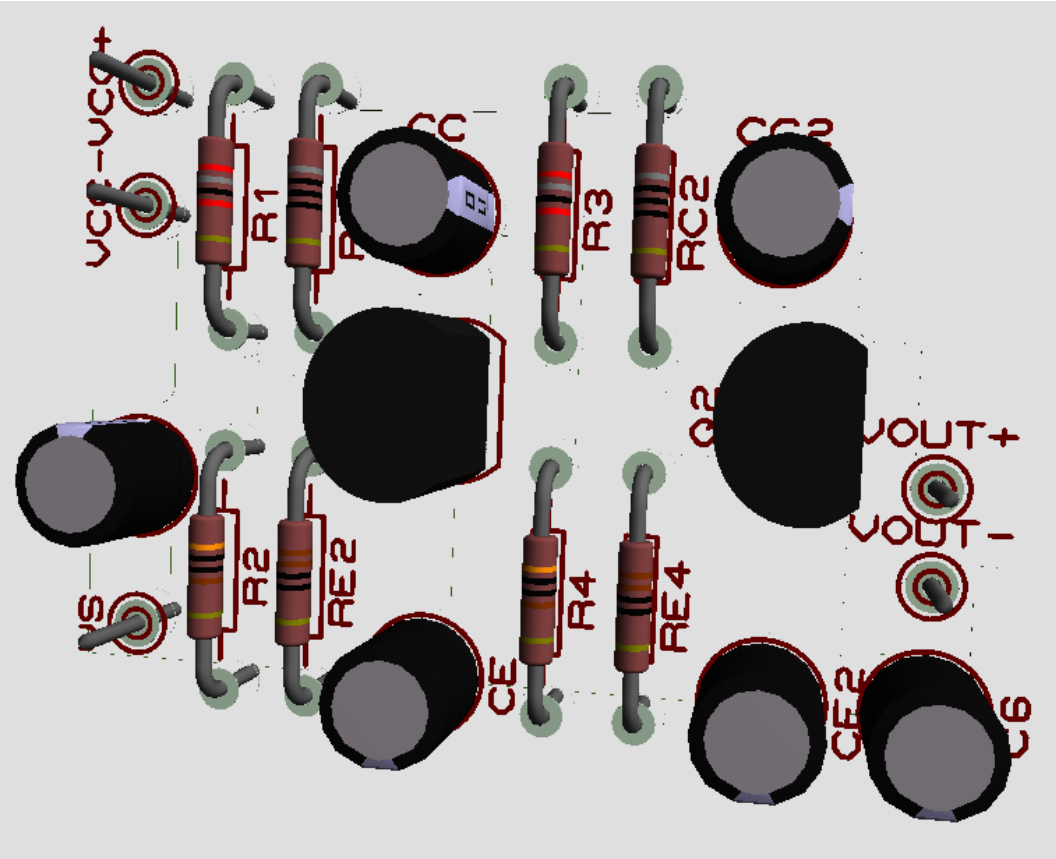


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COST ESTIMATE

Component	Value	Quantity	Unit Price	Total Price
Resistor	28K Ω	2pcs.	P1.00	P8.00
	3K Ω	2pcs.	P1.00	
	800 Ω	2pcs.	P1.00	
	110 Ω	2pcs.	P1.00	
Capacitor	10uF	2pcs.	P2.00	P10.00
	150uF	2pcs.	P2.00	
	4pF	1pc.	P1.00	
	400pF	1pc.	P1.00	
Transistor	2N3904	2pcs.	P10.00	P20.00
PCB Board		1pc.	P15.00	P15.00
Ferrichloride		1bottle	P45.00	P45.00
Soldering lead		1pc.	P8.00	P8.00
			TOTAL	P106.00



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