

Single Stage Transistor Amplifier Design

Get the data sheets for your 2N4401 and 2N4403 transistors.

Use the 2N4401 npn-transistor first. In the block diagram (left side of figure 1) below, use $V_{CC} = +12\text{ V}$, and $V_{EE} = 0$. Choose the collector resistor R such that $V_C = (6 \pm 1)\text{ V}$ and $I_C = (1.0 \pm 0.2)\text{ mA}$. Document how you chose that resistor value and the biasing circuitry that will replace *your circuit* blocks in the diagram.

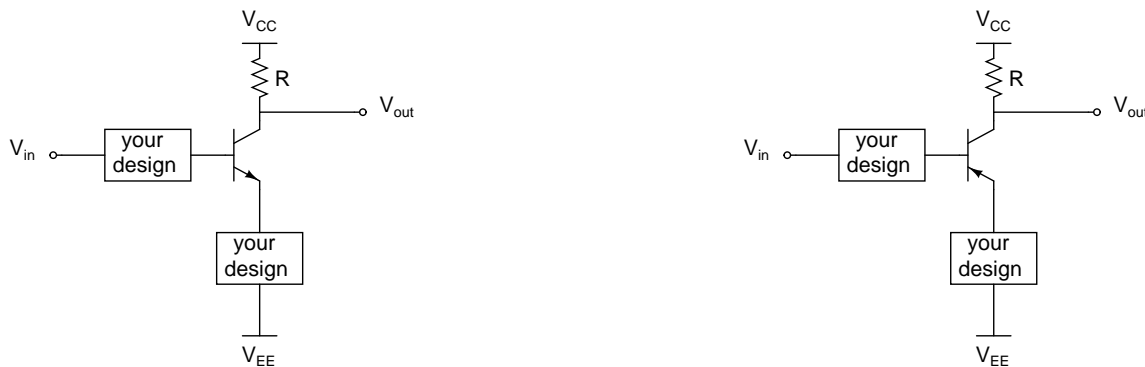


Figure 1: Block diagrams

Task 1: Put a 25 mV, 1 kHz signal into the input and measure the voltage gain. You will need to go through a capacitor in order not to disturb your transistor biasing. How do you determine what capacitance to choose? Discuss with the TA whether the measured gain is reasonable. Remember: Your circuit must be designed such that it does not depend on the specific transistor that you chose; if the TA replaces the transistor with another one of the same make, it should not change the behavior of your circuit!

Task 2: Increase the source resistance of your 25 mV source to the point that the output amplitude of your circuit is halved. What is the input impedance of your circuit?

Task 3: Now switch over to the 2N4403 pnp-transistor, as on the right side of figure 1. Use $V_{EE} = 0$ and $V_{CC} = -12\text{ V}$, and design your biasing in the block diagram below so that $V_C = (-6 \pm 1)\text{ V}$ and $I_C = (-1 \pm 0.2)\text{ mA}$. Put a 25 mV, 1 kHz signal into the input as in task 1. Discuss your measured gain with the TA again.

Task 4: Connect the photo-transistor with the same supply voltages as used for task 1, but leave the base unconnected and connect the emitter straight to V_{EE} . The output is as in task 1.

What is your output voltage with the transistor exposed to full room light?

What is your output voltage with the transistor shielded from light?

Is the transistor of the npn or the pnp type?