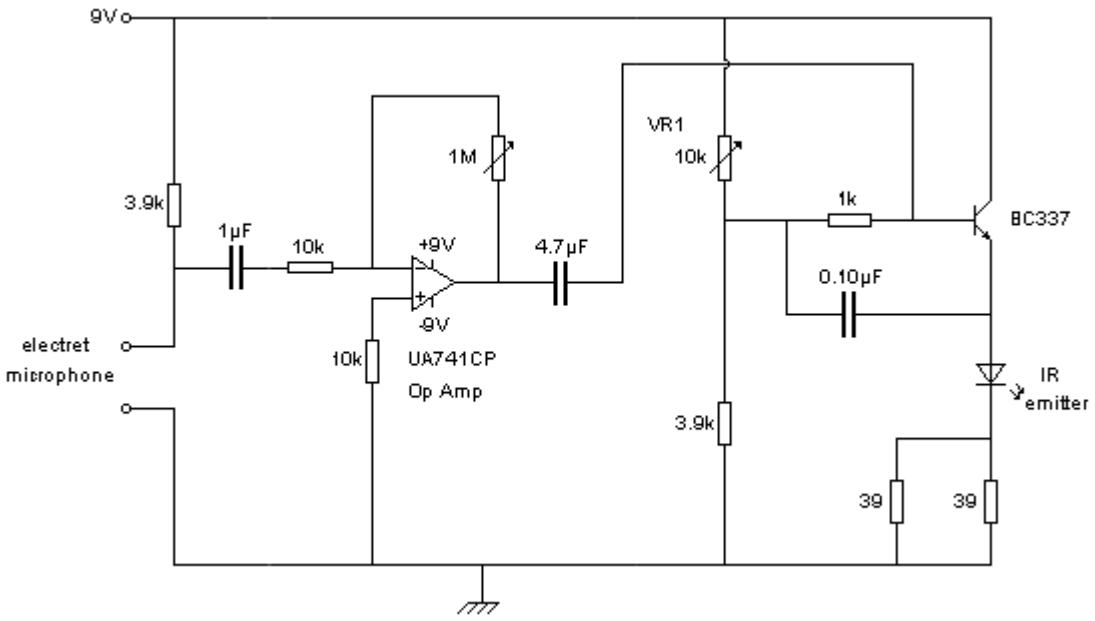
An Infra Red Voice Link

See also Suggested course outline for Electronics and Control Technology Year 13: Topic 2: Operational Amplifiers and Year 13: Topic 1: Transistor as a Voltage Amplifier

This simple circuit works by setting up an Infra Red LED so that with no input signal it is carrying its recommended average forward current. This current is then modulated by the input signal. This modulated IR signal causes the leakage current in the photodiode in the receiver circuit to vary, and this is picked up and amplified by the rest of the receiver circuit. It works surprisingly well, with a range of 10m or more, is cheap and simple to build, but is susceptible to interference from other IR sources such as fluorescent lights. It's a good project for Year 13 students studying analogue electronics as it has three different types of amplifier (and could be modified to have four).

The Transmitter

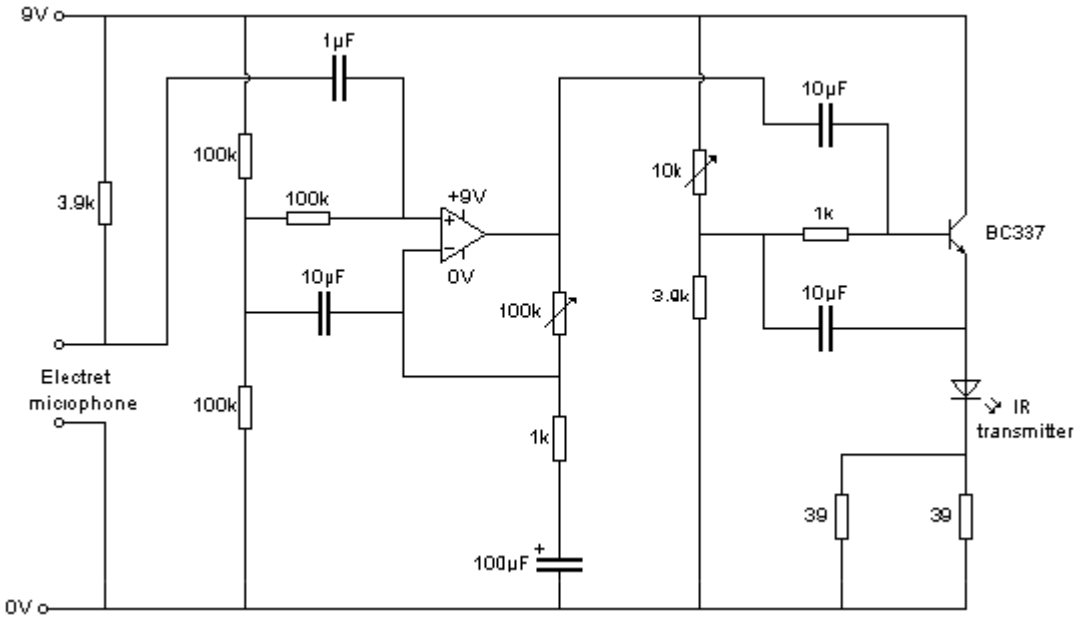


The op amp drives the bootstrapped emitter follower. The potential divider sets the base of the transistor at about 5V, so that the quiescent current in the IR LED is about 100mA, which is the quoted average forward current for the one I used. (see below) Adjust VR1to achieve the required voltage. I found a value of about 3k did the trick. The two 39 ohm resistors are used instead of a single 18 ohm so that the power rating is not exceeded.

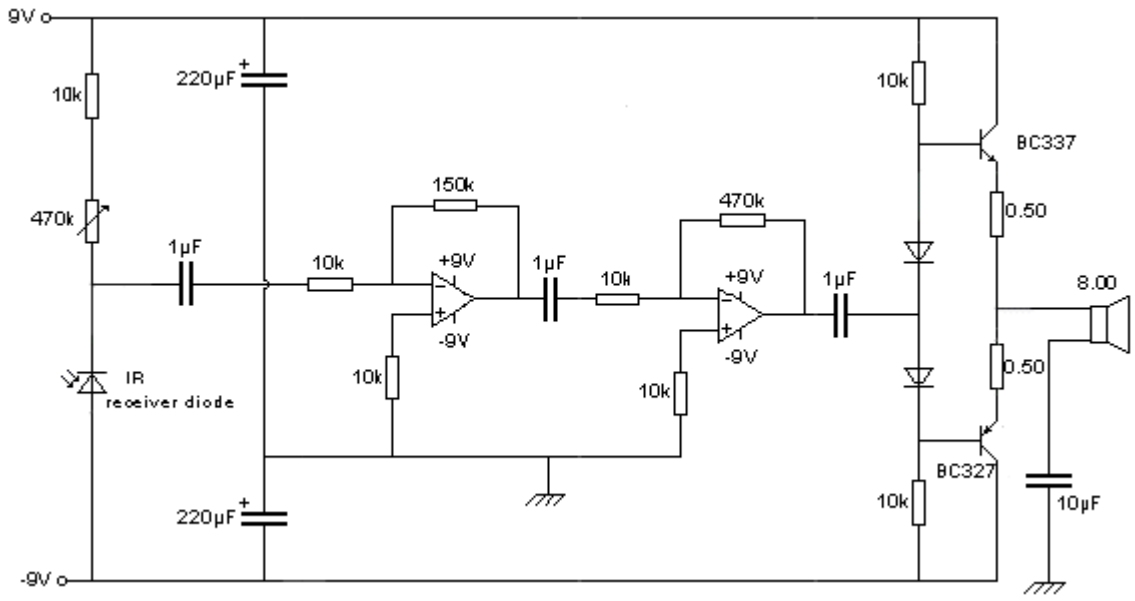
The capacitor values are not critical. These were used because they were in the spares box.

The quiescent current is quite high, so this circuit is not really suitable for battery operation. I used a +/- 9V supply (see my project Op Amp Power Supplies). If you don't have such a supply or if you want to illustrate the use of an Op Amp with a single ended supply, try the circuit below:

The transmitter and receiver diodes I used were Jaycar items ZD1945 and ZD1950 respectively. Hewlett -Packard part no. HSDL-4220 would also be suitable, as would any diode pair with the correct average forward current rating for the transmitter.



The Receiver
I used a double ended power supply (two 9V batteries) for the receiver circuit as I then have 3 (or 4) different types of amplifier in one project.



I originally put two Op Amps in thinking I'd need huge gain, but these values work well. There is some background hiss on max gain (and Max range).

Construction
I used two pieces of veroboard. 12rows X 30 for receiver, 10 X 23 for the transmitter. Take care to get the diode polarity correct!

Things to try:

1. Add a variable resistor between the two diodes on the biasing network of the output amp to fine tune it
2. The first Op Amp in the receiver could be a voltage follower to give a really high input impedance, and the second one could do all the amplifying.
3. Try replacing the microphone with a signal from a radio or cassette player.

Parts

Resistors: all 1/4W, 5% 1 @ 470k 1 @ 150k 9 @ 10k 2 @ 3.9k 1 @ 1k 2 @ 39 2 @ 0.5	**Variable Resistors**: 1 @ 1M 1 @ 470k 1 @ 10k	**Capacitors:** 2 @ 220mF 16V 1 @ 10mF 1 @ 4.7mF 4 @ 1mF 1 @ 0.1mF	**Semiconductors** 3 UA741CP Op Amps 2 BC337 transistors 1 BC327 transistor 2 1N914 diodes 1 IR emitter LED* 2 IR receiver diode* * see text	**Miscellaneous** 3 DIP IC sockets 1 battery clips 1 electret microphone 1 8 ohm speaker 2 veroboards

Overall I'm pleased with the device. Hi FI it isn't, but at shorter ranges the quality (with a telephone mic and tiny speaker) is quite good.