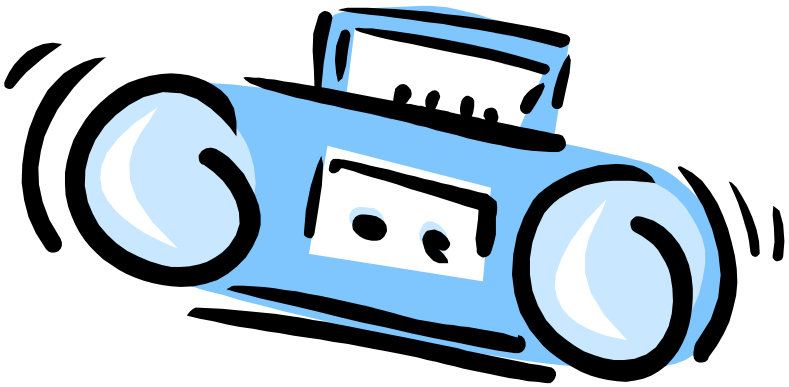
Wireless Speaker



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ECE 121

Final Project, Spring 2003

SEAS, GWU

Design Requirements

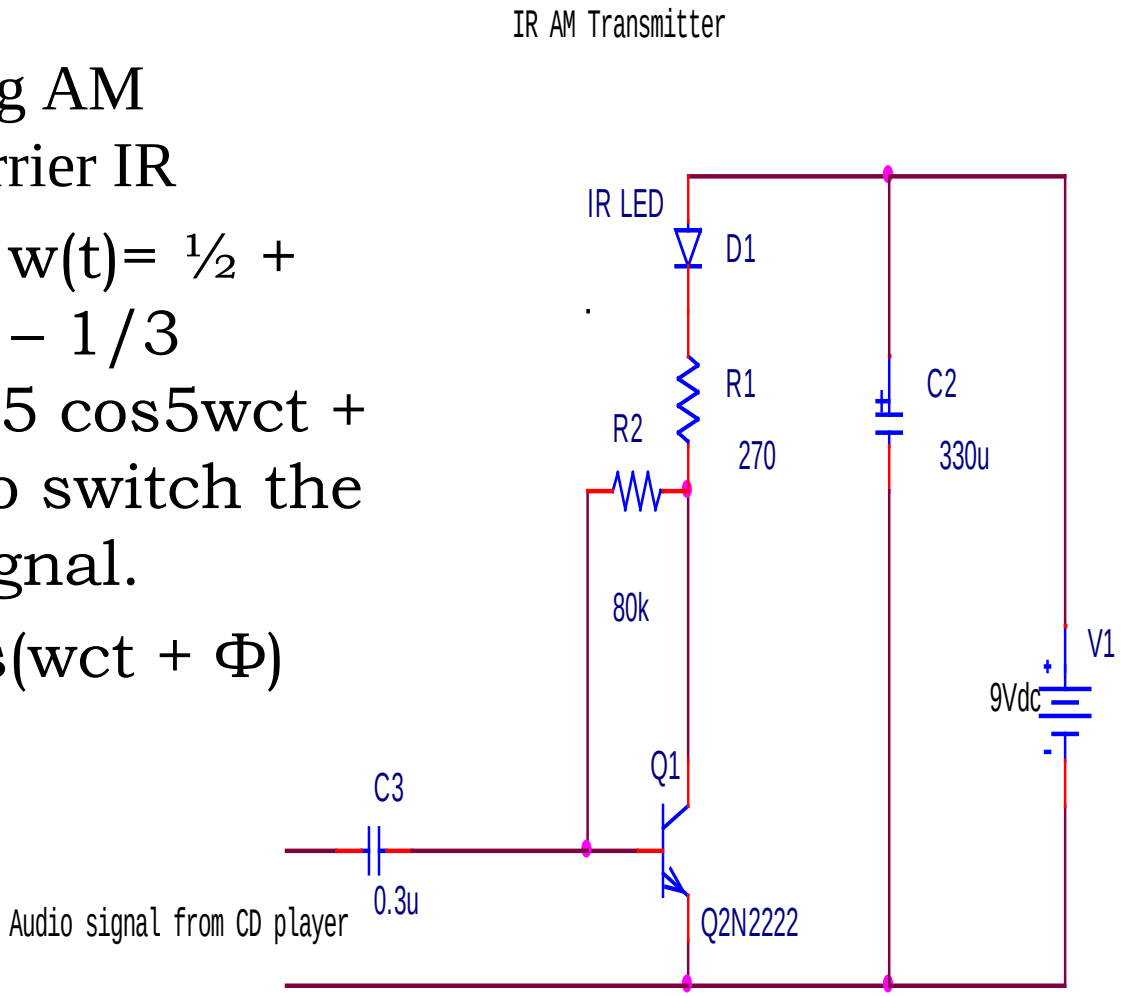
1. The wireless speaker must have a transmitter, receiver and should work over a minimum range of 1m
2. The transmitter must have input impedance greater than 2KΩ and Sensitivity greater than 170mVrms
3. Frequency response f3db at 50Hz and 20KHz
4. Output Power of 2Wrms to the 8Ω speaker

Overview of the System

- The system includes a transmitter, receiver, filter to remove unnecessary signals and voltage and current amplifiers

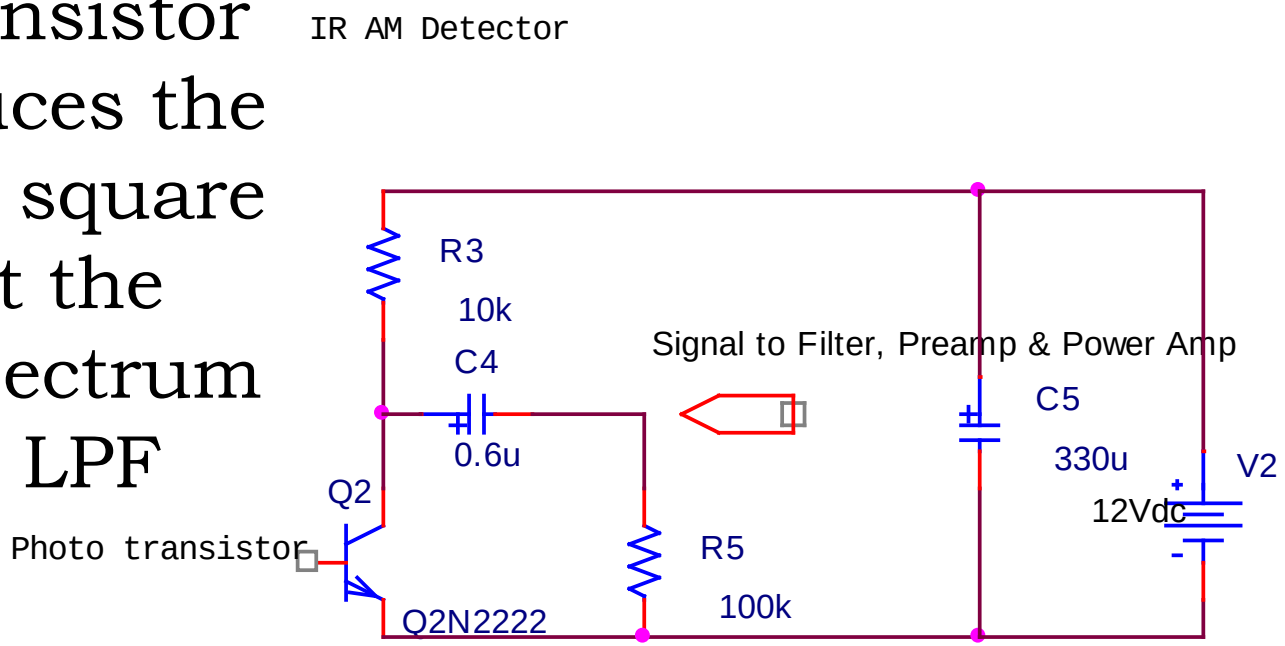
Design of Transmitter

- Use of switching AM modulation, Carrier IR
- Square wave w(t)= ½ + 2/Π (coswct – 1/3 cos3wct + 1/5 cos5wct + ….) is used to switch the base band signal.
- y(t) = m(t)Cos(wct + Φ) AM Signal

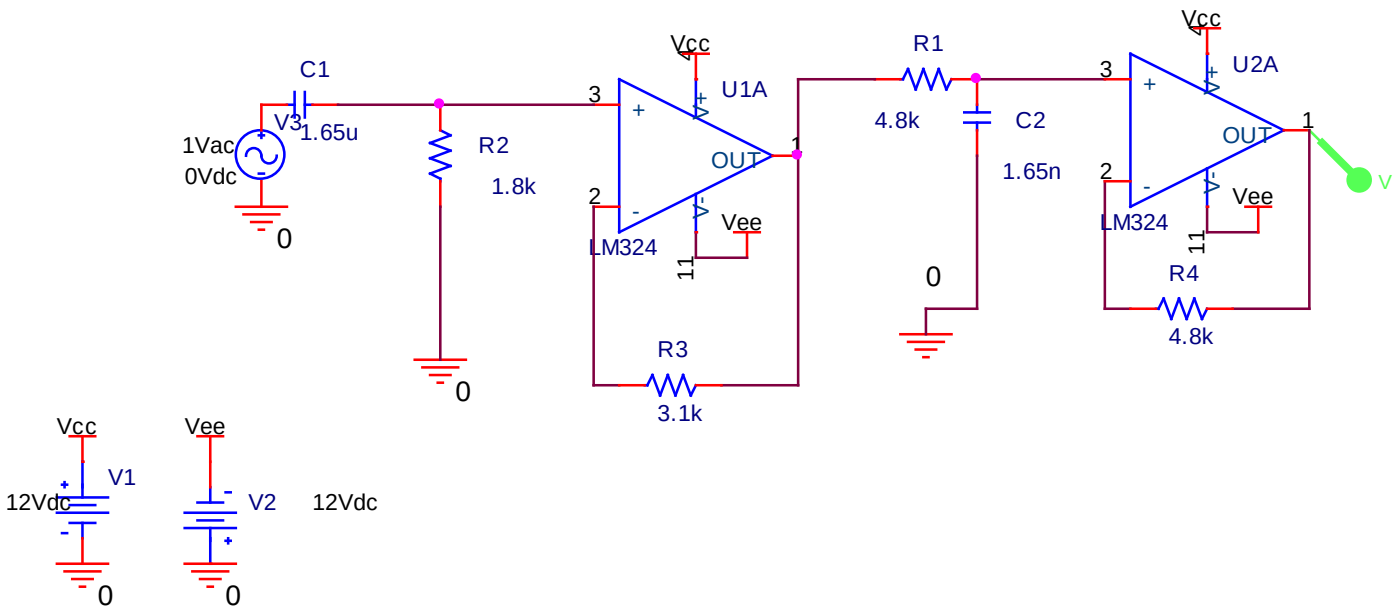


Design of Receiver

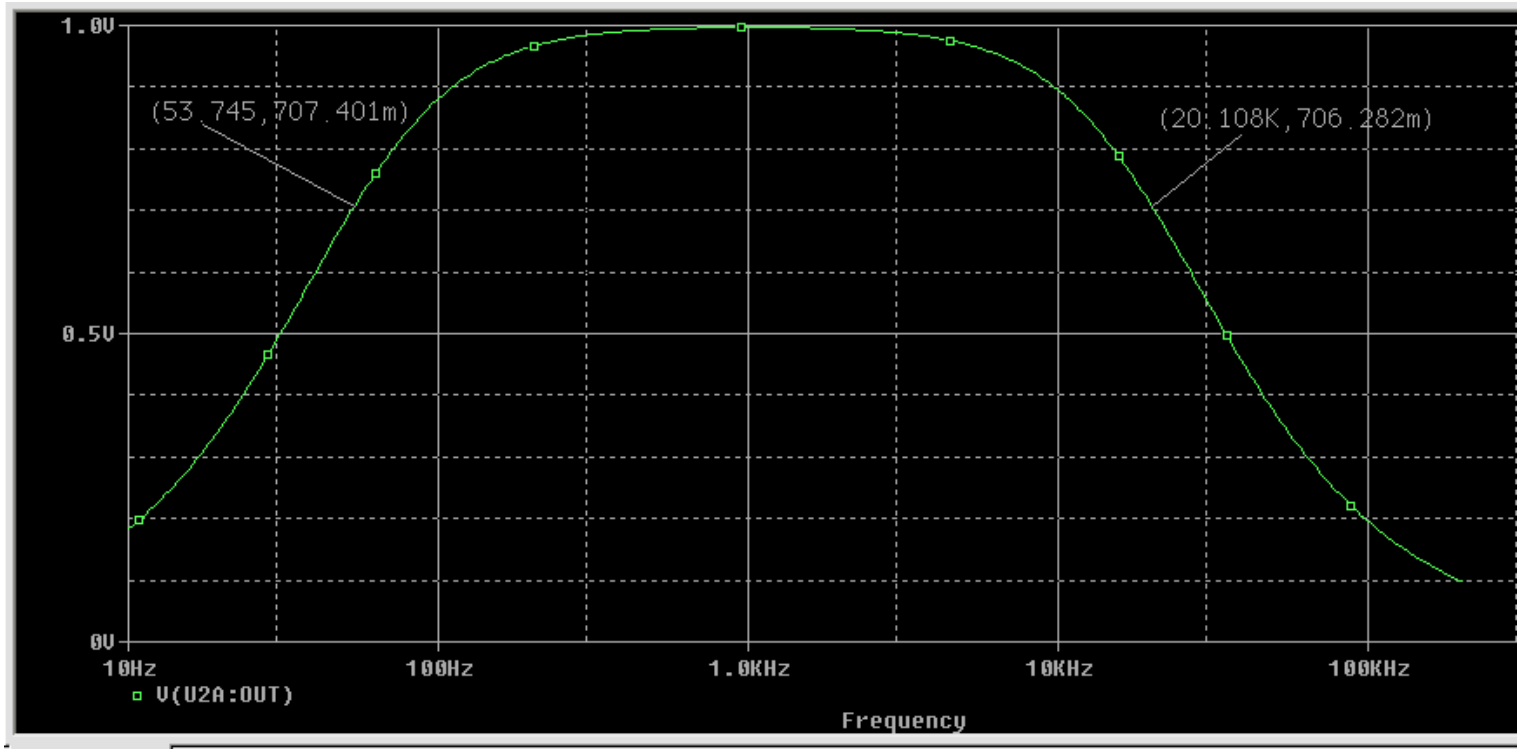
- Demodulation is carried out using a phototransistor that produces the equivalent square wave to get the original spectrum by using a LPF



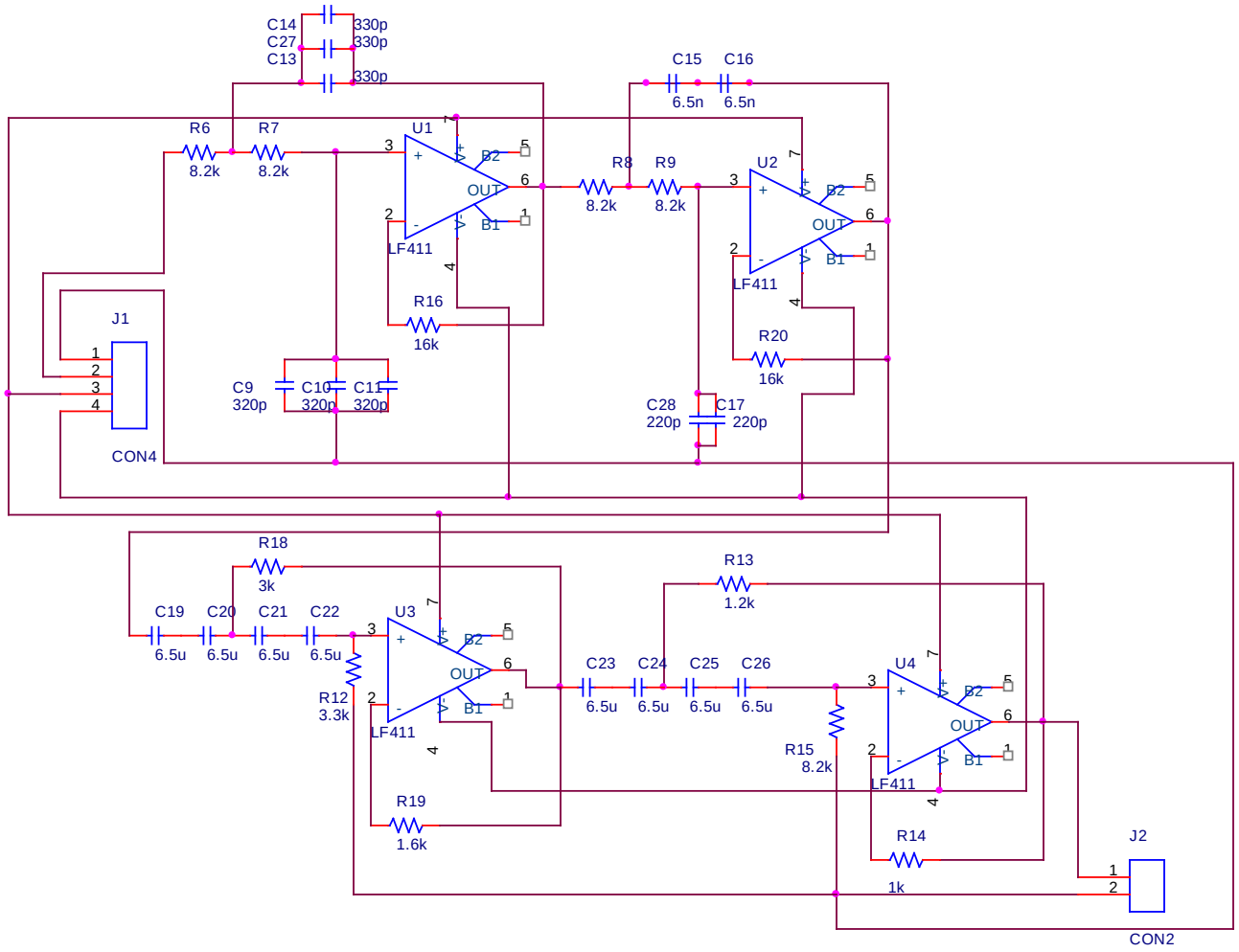
Design of Single Pole BPF



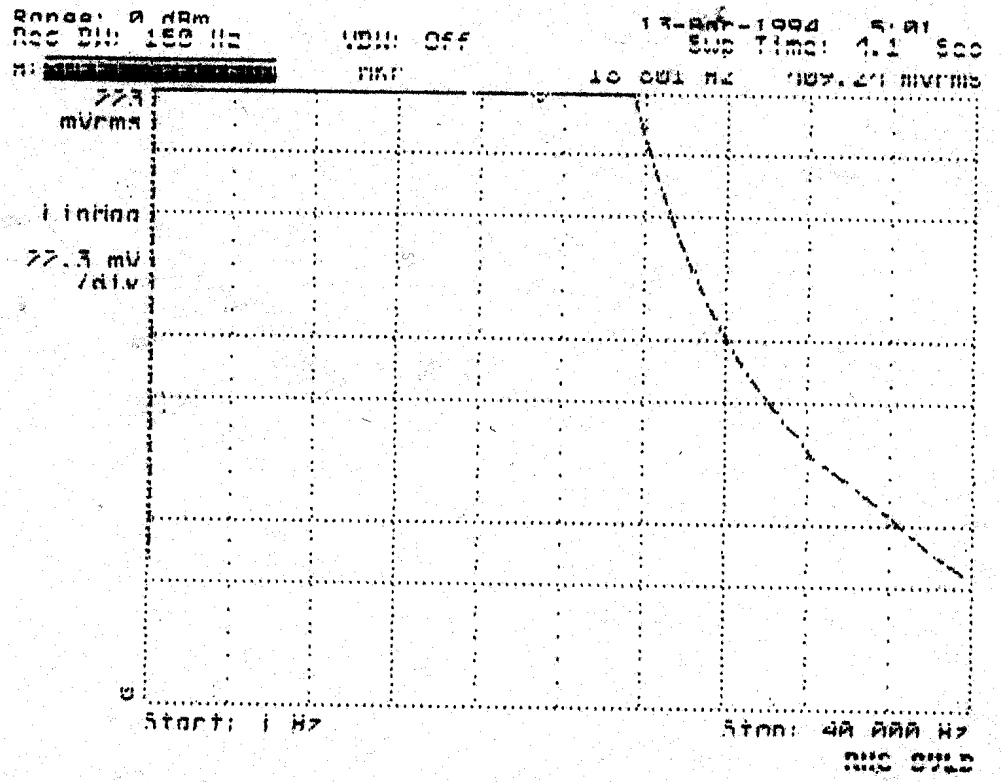
Frequency Response of the BPF



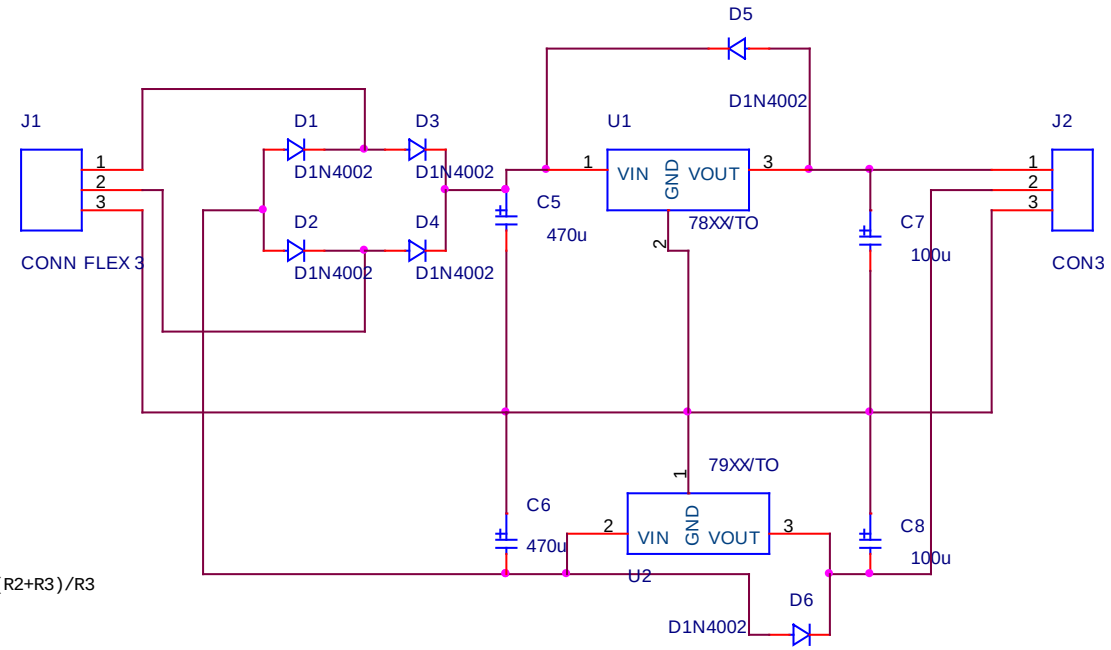
4 Pole Butter worth BPF

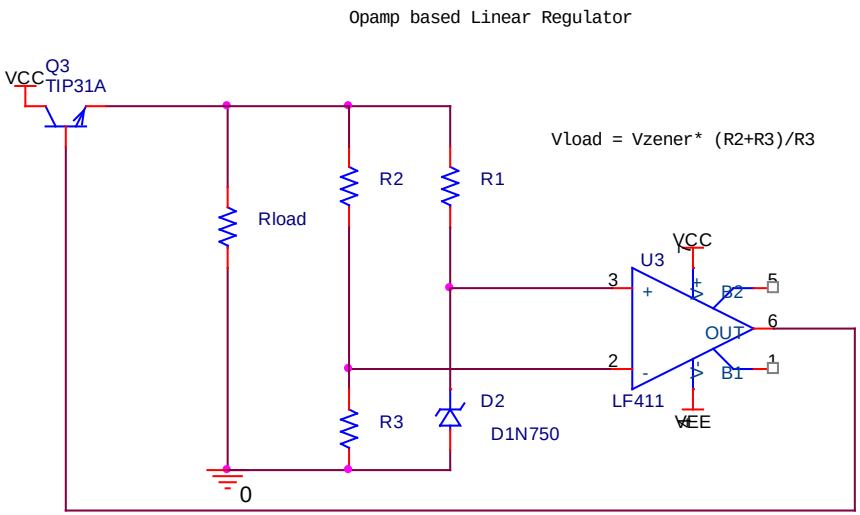


Frequency Response of Butter worth filter using Spectrum Analyzer



Design of Power Supply





Design of Voltage and Current Amplifiers

- Should have very high input impedance and low output impedance to prevent loading when cascaded with other stages
- Must exhibit high slew rate i.e should be fast enough to prevent distortion of signals and exhibit minimum offset and Total harmonic distortion.
- TL082 BIFET OpAmp is the ideal candidate for the audio application. The FET input stage affords very high input impedence (>1012Ω), it has a high slew rate of 13V/us and the BJT stage allows for a maximum power dissipation of 680mw.

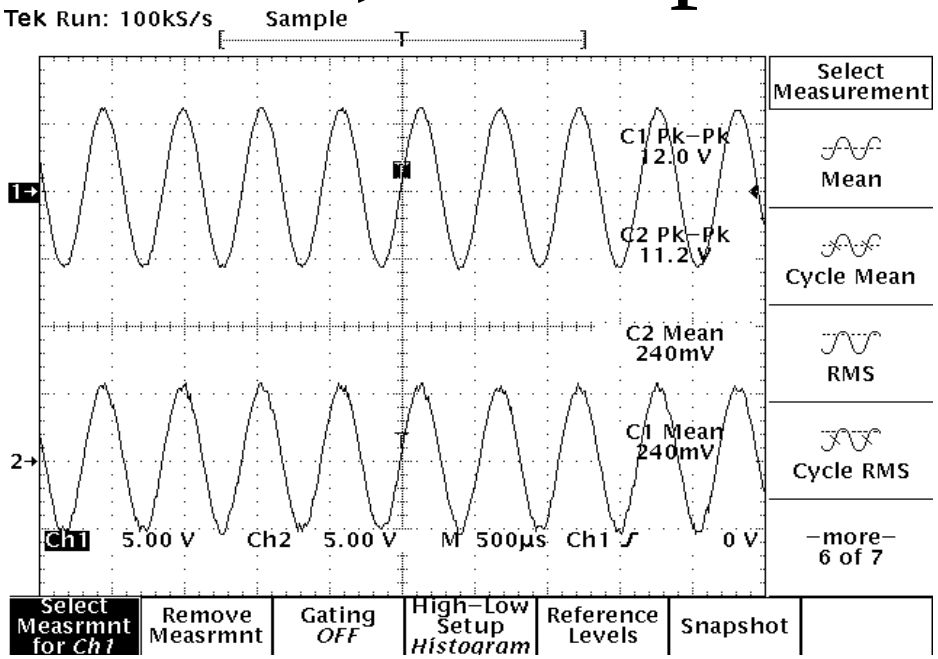
Voltage and Current Amplifier

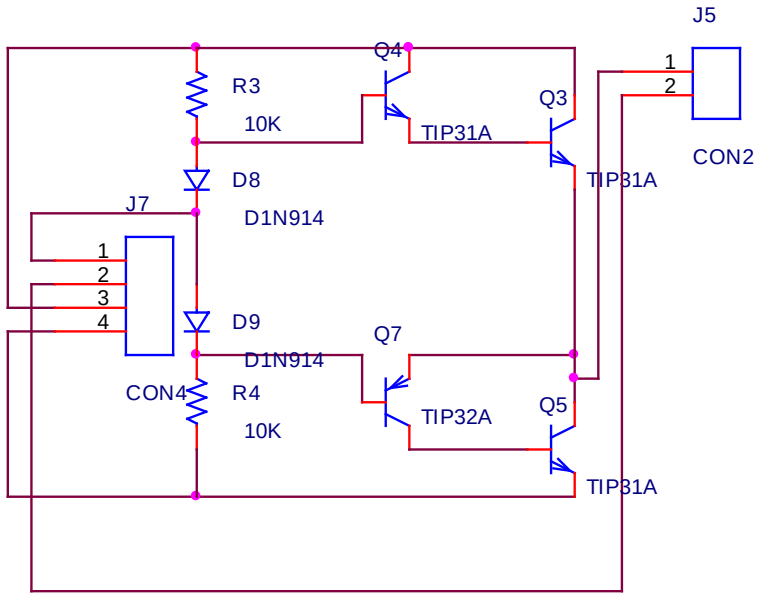
- Therefore the Dual BIFET TL082 was used for the active filter and the inverting voltage amplifier designed with a maximum gain of 100. (Gain = Rf/Ri =10KΩ/100Ω).
- The Current booster stage is a Class AB Push-Pull amplifier using TIP31A and TIP32A Power transistors. The TIP power transistor is designed to handle a maximum collector current of 3Amp and 40Watts.

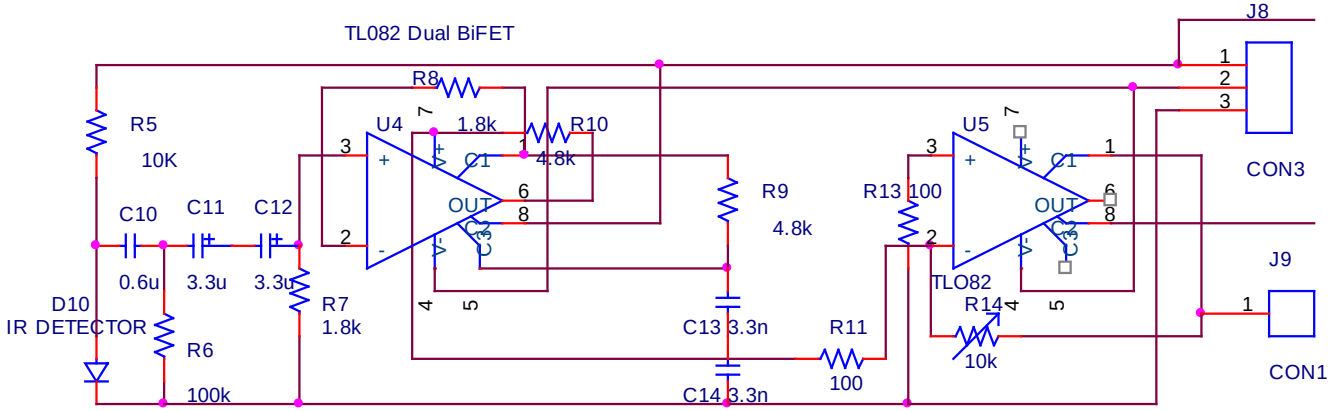
Class AB Output Stage

- A darlington configuration enables us to effectively design the output stage with very high gain of the order of 1600 (hfe of a TIP being 40 when used in darlington configuration effective hfe = 40*40). The high gain ensures negligible base current when compared to the bias current required by the diodes.
- The biasing diodes eliminate crossover distortion.

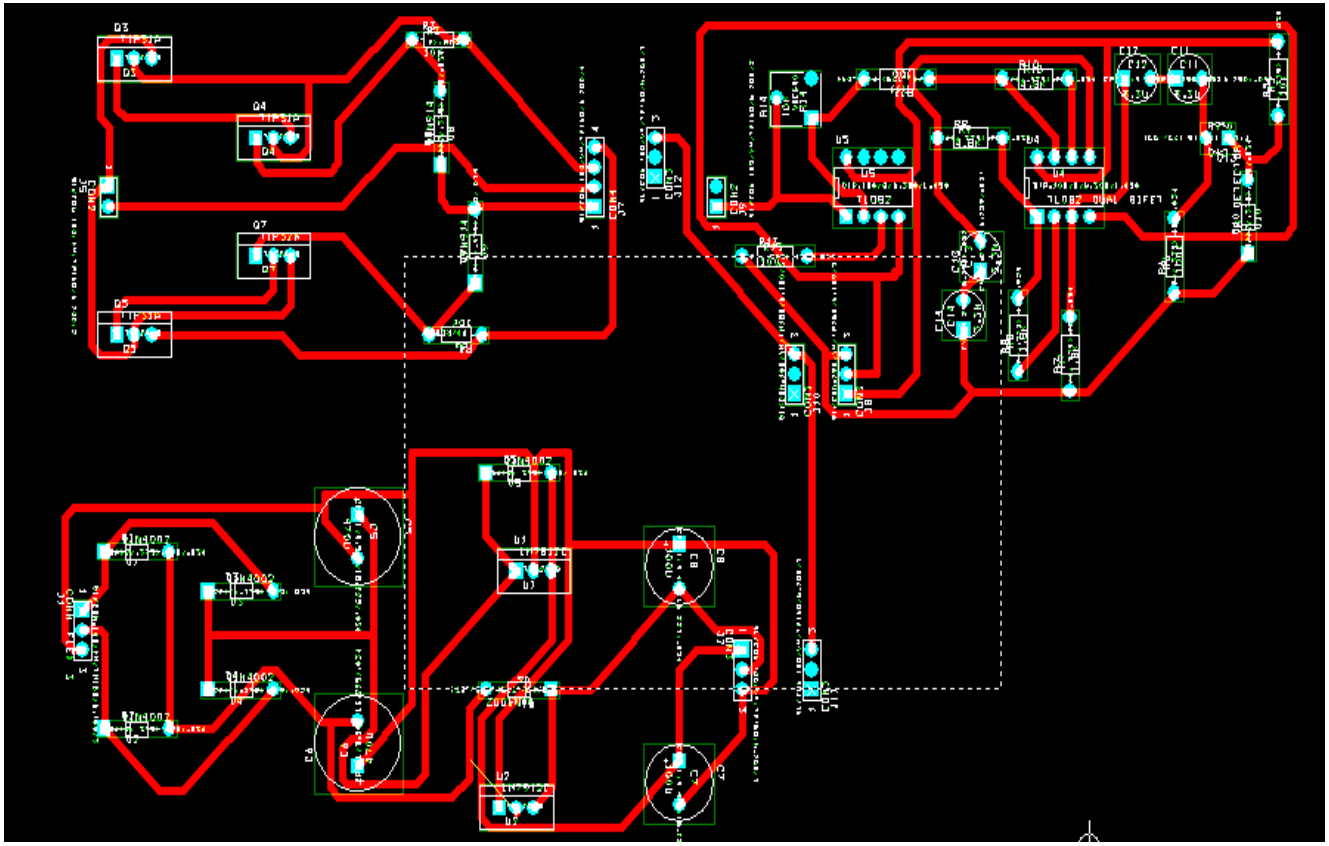
Filter, V amplifier & I amplifier

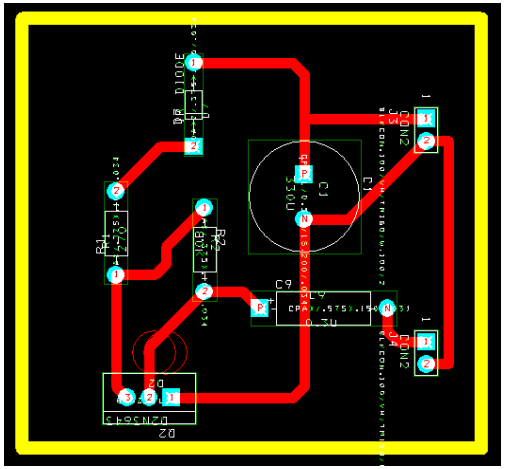






Layout of Wireless Speaker





My Wireless Speaker