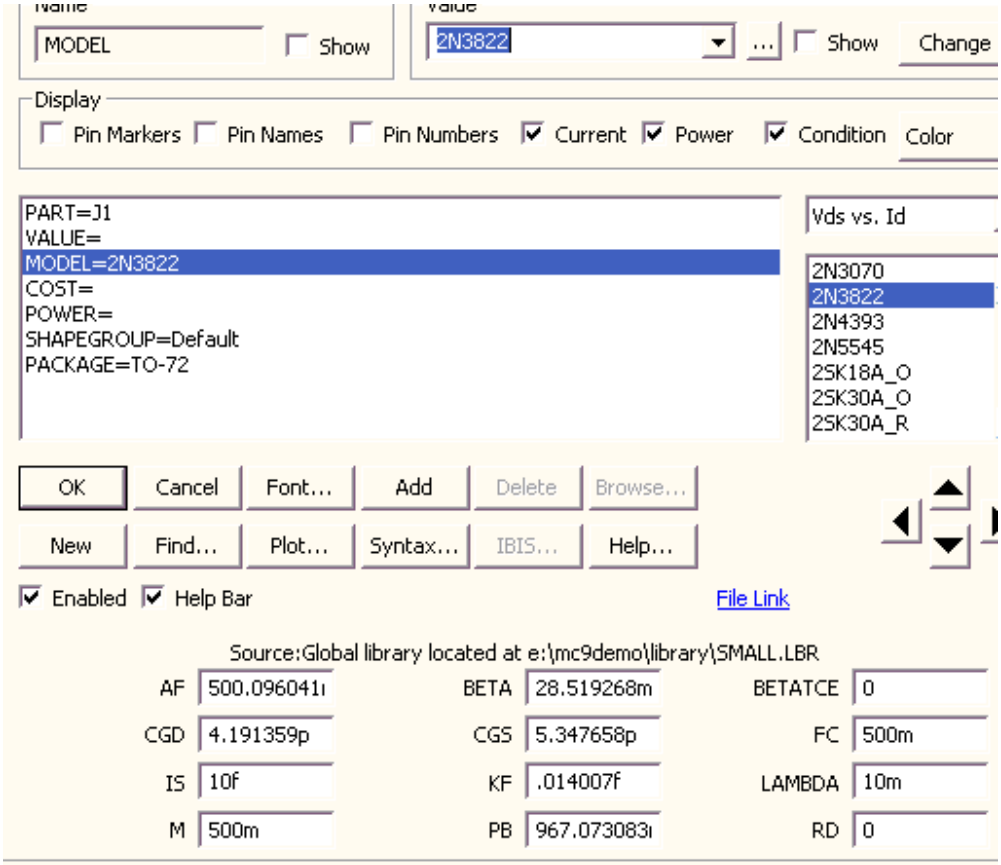
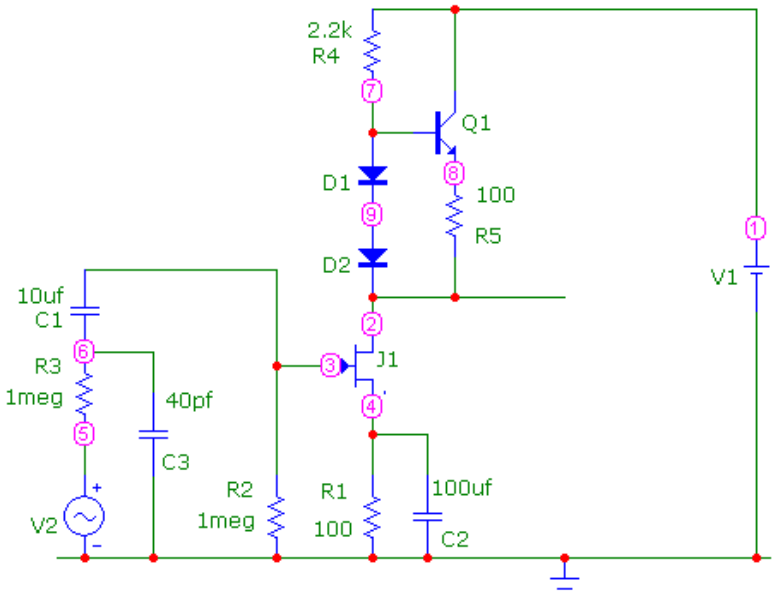
NANOWAVE AUDIO OVER FREE SPACE RECEIVER CIRCUITS.

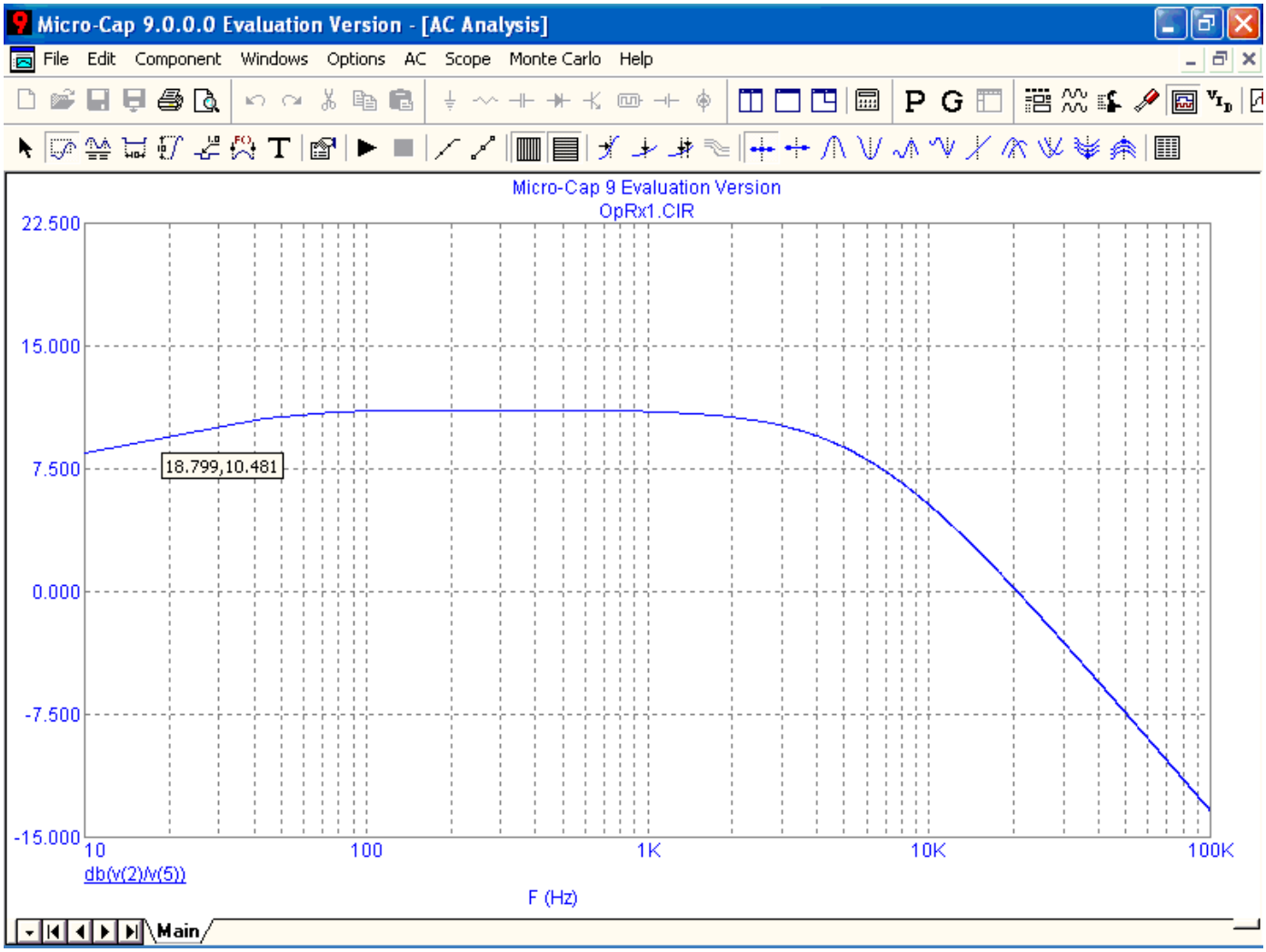
Firstly, here are the Microcap model parameters for the 2N3822:



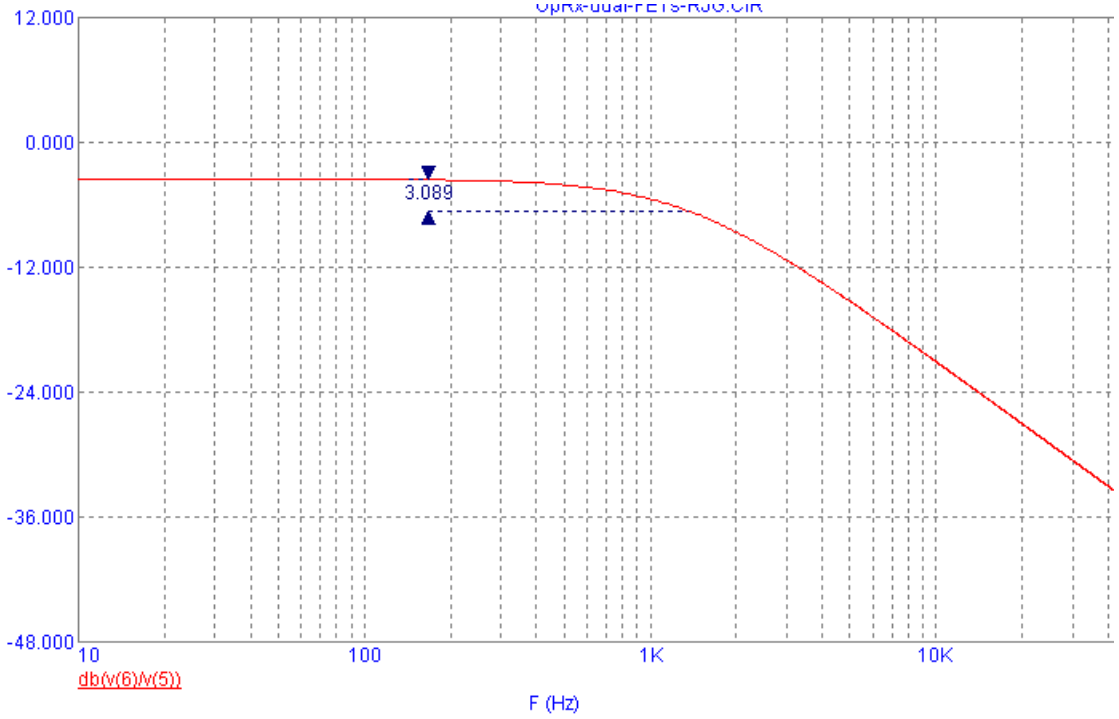
The circuit model for the original optical receiver is shown below, and note that the “gain” is defined as the ratio ($V_{(node\ 2)} \div V_2$):-



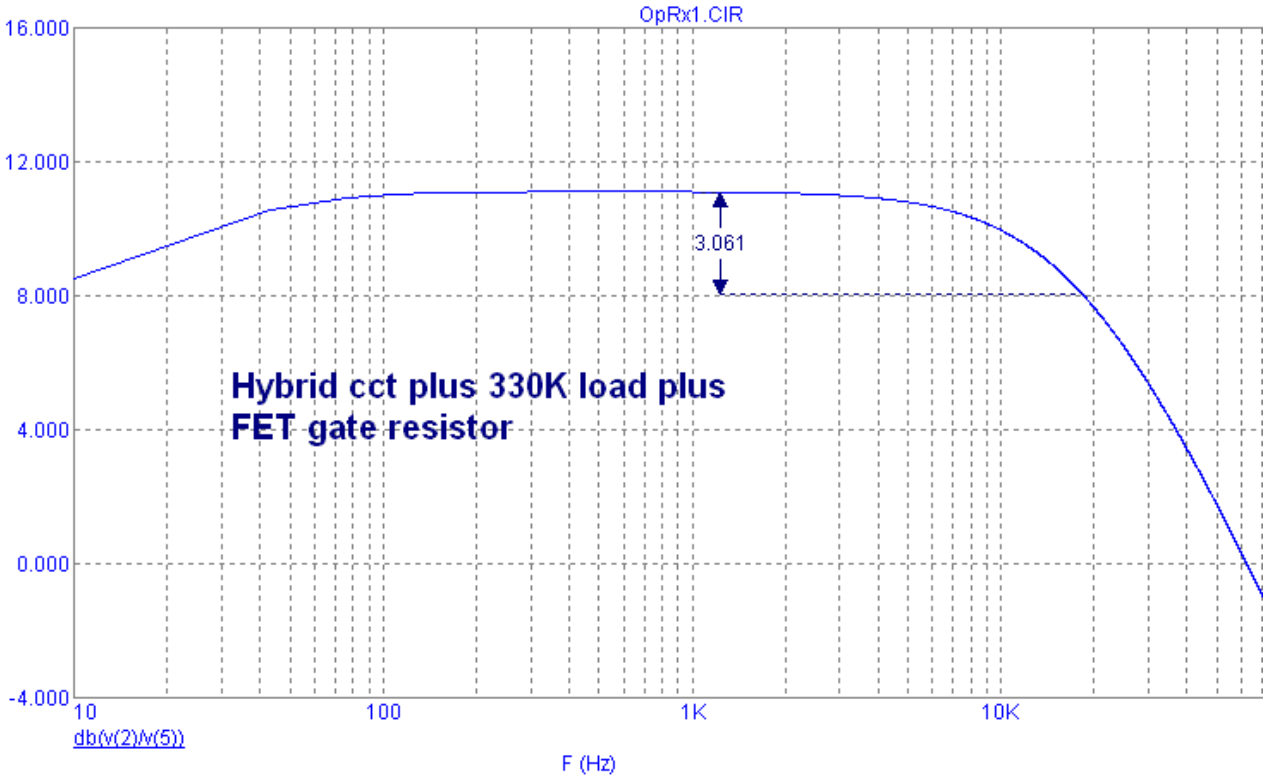
Now, the frequency response of the circuit is given, assuming the Thevenin-Norton transformation for the photodiode holds valid:



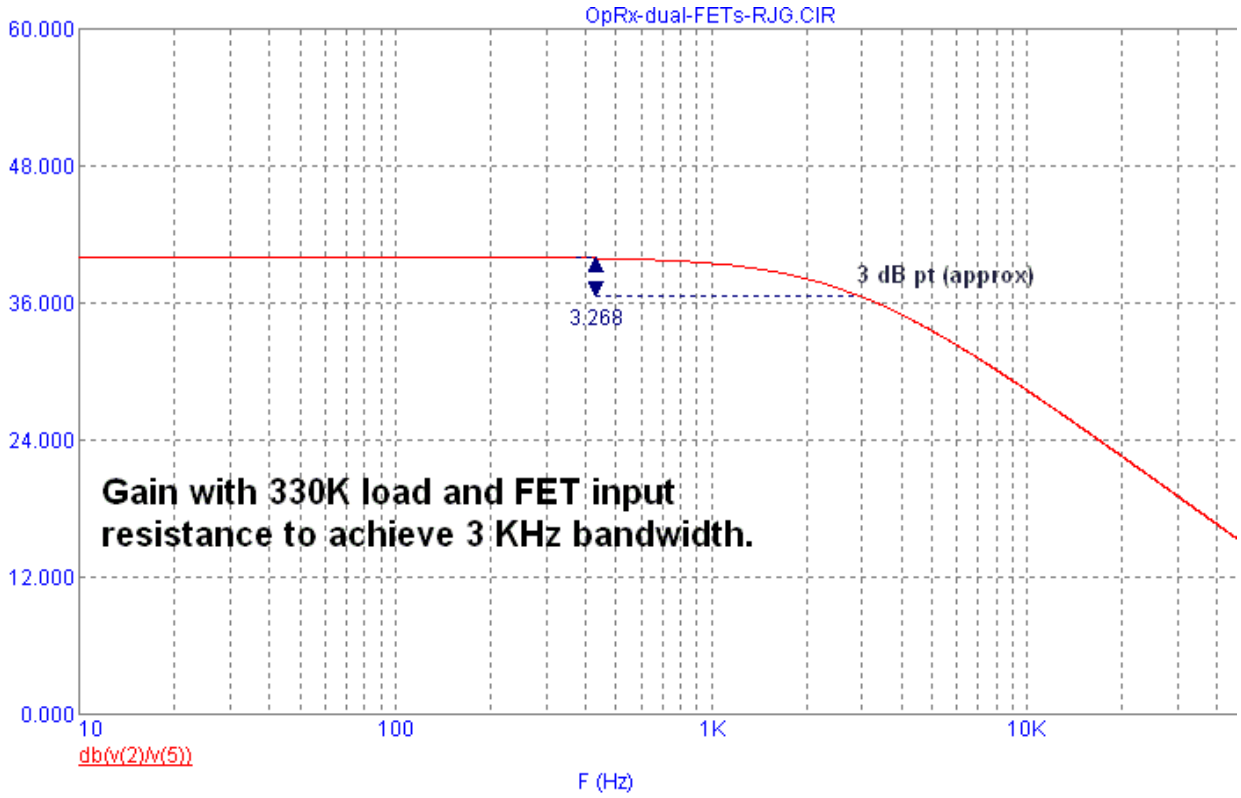
Now, the frequency response of the photodiode and its load (before the amplifier) is shown below:



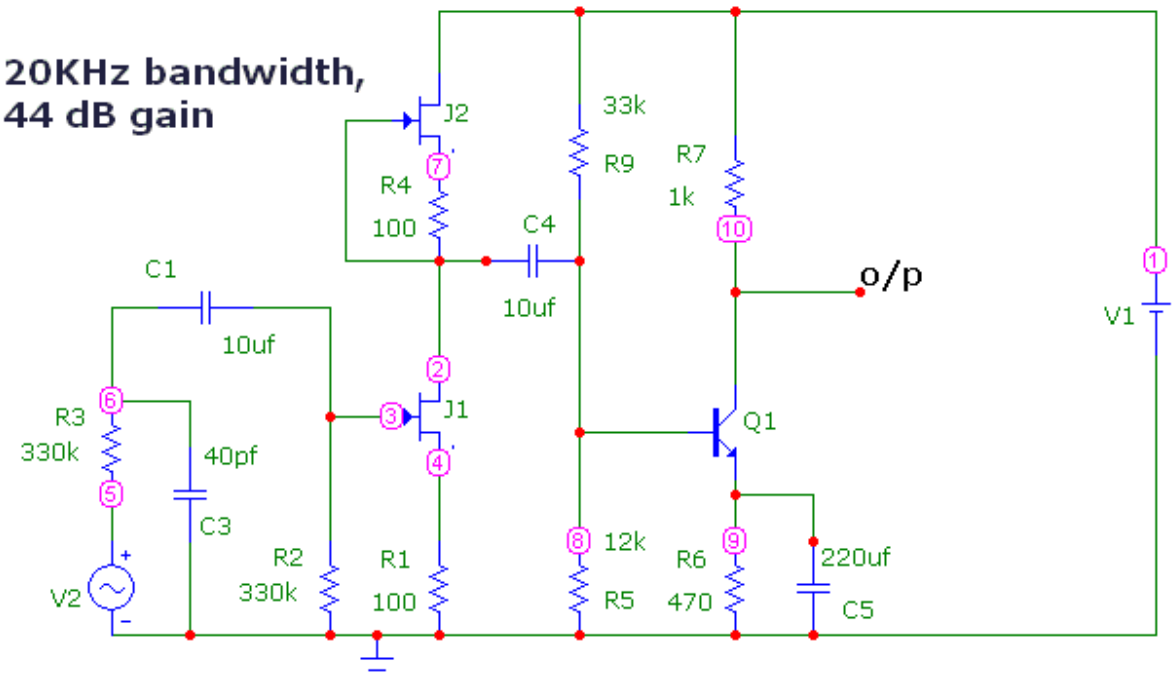
This shows that the load resistance is too large at 1 Megohm to even give audio bandwidth before the FET amplifier. Therefore, reducing the load resistance and FET gate bias resistance both to 330K gives the following frequency response:



The dual FET (M0RJG) circuit was then similiarly modified with 330K load plus FET gate bias resistor to give the following frequency response:



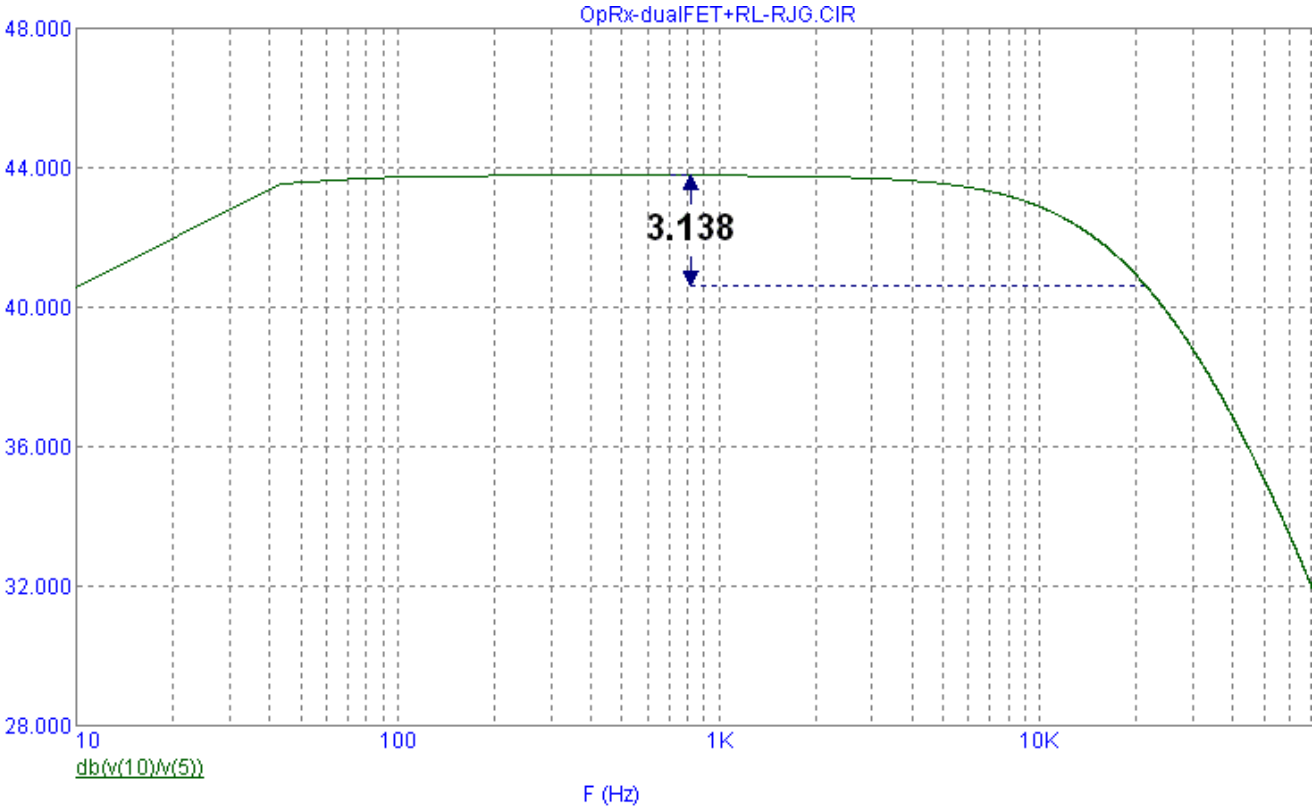
As can be seen above, the bandwidth is just sufficient at 3 KHz and the gain is higher than for the FET-bipolar cascode circuit. A better circuit involving the dual FET approach with better bandwidth than any of the above circuits is shown below:

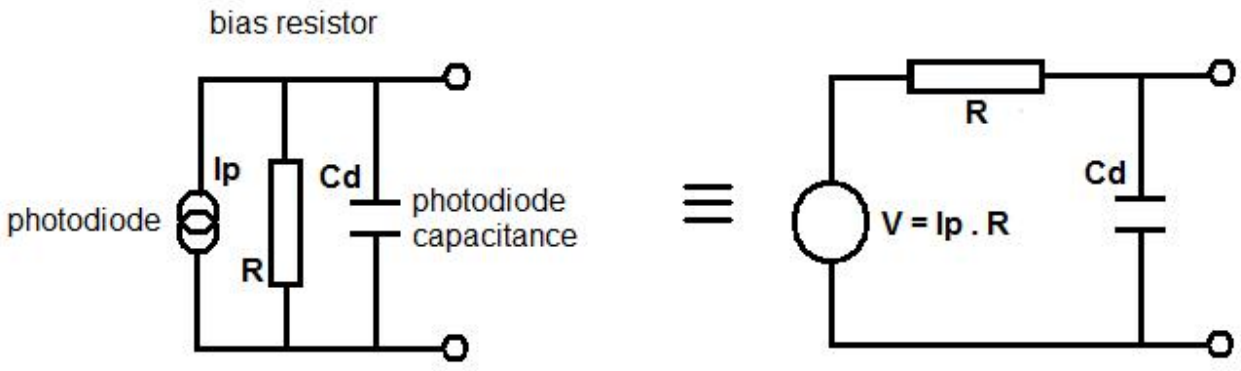


The high impedance FET load for the first stage is loaded in a controlled manner by the input stage of the second amplifier. Also note that the source resistance of the first stage FET amplifier is no longer bypassed: the bootstrapping effect is applied to its gate-source

capacitance to improve the frequency response. The loading of the J2 drain load ensures control of the gain so that the Miller capacitance effect, from the drain of J1 to its gate, is reduced. J1 and J2 are 2N3822 or similar, and Q1 is a 2N2222 or similar.

The frequency response of this combination is shown below:



The low frequency band edge can be reduced if necessary by reducing the coupling capacitances and/or the 220uF emitter bypass capacitance.

Finally, note the voltage-current (Thevenin-Norton) transformation as below: