

An Audio Compressor/Peak Limiter Circuit - Part II

The object of this experiment is to connect the detector circuit assembled last week to the VCA assembled two weeks ago to form a compressor/limiter. The circuit is specified to have an attack time of $\tau_a = 1$ ms and a release time of $\tau_r = 1$ s. The design equations for incorporating these specifications into the design are given in

<http://users.ece.gatech.edu/~mleach/papers/limiter.pdf>

In addition, the threshold of gain reduction is to be 1 V. That is, the circuit is to reduce gain for any signal that causes the output voltage to have a peak value greater than 1 V.

- The first step is to add P_1 and R_{15} to the detector circuit designed last week. Calculate the value of these so that P_1 can be adjusted to produce a dc offset voltage at the output of A_4 over the range $V_{TO} \pm 1$ V, where V_{TO} is the threshold voltage for your JFET. The ± 1 V is not an absolute number. The object is to be able to easily adjust P_1 so that the dc offset is slightly more positive than V_{TO} . The design equation is

$$V_{TH} = V^+ \frac{R_7}{R_8}$$

- With $C_2 = 10 \mu\text{F}$, calculate the value of R_{13} for the release time constant $\tau_r = 1$ s. The design equation is

$$\tau_r = R_{13}C_2$$

Use the closest 5% value resistor and use $R_{16} = R_{13}$.

- Using the value of R_9 from last week, use the equation

$$R_9 \parallel R_{10} = \frac{2R_{13}I_{DSS}R_1 \parallel R_2}{V_{TO}^2 (\tau_r/\tau_a - 1)}$$

to calculate the required value of R_{10} .

- With the output of A_4 not connected to the JFET, power up the circuit with $v_I = 0$. Adjust P_1 so that the dc output of A_4 is approximately V_{TO} .
- Connect the output of A_4 to the JFET gate through R_{17} . Apply an input voltage of 0.5 V peak to the circuit. Measure v_O and adjust P_1 so that the circuit gain is 1 dB lower than unity. Increase the input voltage and observe the gain of the circuit automatically reducing so as to maintain a peak output voltage of 1 V as v_I increases to a maximum value of 10 V peak.
- Once the circuit is operational, measure the peak value of v_O versus the peak value of v_I for $0 \leq |v_I| \leq 10$ V at a frequency of $f = 1$ kHz. Plot the graph of v_O versus v_I in your report.

After your circuit is operational, do not disassemble it. It will be further evaluated next week, and an audio source will be made available so that you can see how it operates with an audio signal. The object of this experiment is to make the circuit operational.