

Low Voltage Compressor / Limiter

The circuits within this application note feature THAT218x to provide the essential function of voltage-controlled amplifier (VCA) and THAT 2252 as an rms-level detector (RMS). Since writing this note, THAT has introduced a new dual VCA, as well as several Analog Engines®. Analog Engines combine a VCA and an RMS with optional opamps in one part. With minor modifications, these newer ICs are generally applicable to the designs shown herein, and may offer advantages in performance, cost, power consumption, etc., depending on the design requirements. We encourage readers to consider the following alternatives in addition to the 218x and 2252:

- Analog Engine (VCA, RMS, opamps): 4301
- Analog Engine with low supply voltage and power consumption (VCA, RMS, opamps): 4320
- Analog Engine with low cost, supply voltage, and power consumption (VCA, RMS): 4315
- Analog Engine with low cost and power consumption (VCA, RMS): 4305
- Dual (VCA only): 2162

For more information about making these substitutions, please contact THAT Corporation's technical support group at apps_support@thatcorp.com.

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Low Voltage Compressor / Limiter

The following circuit is a standard compressor / limiter adapted to run off +5 volts and -4 volts. A Linear Technology LT1054 is used to generate the -4 volt rail as shown in Figure 2.

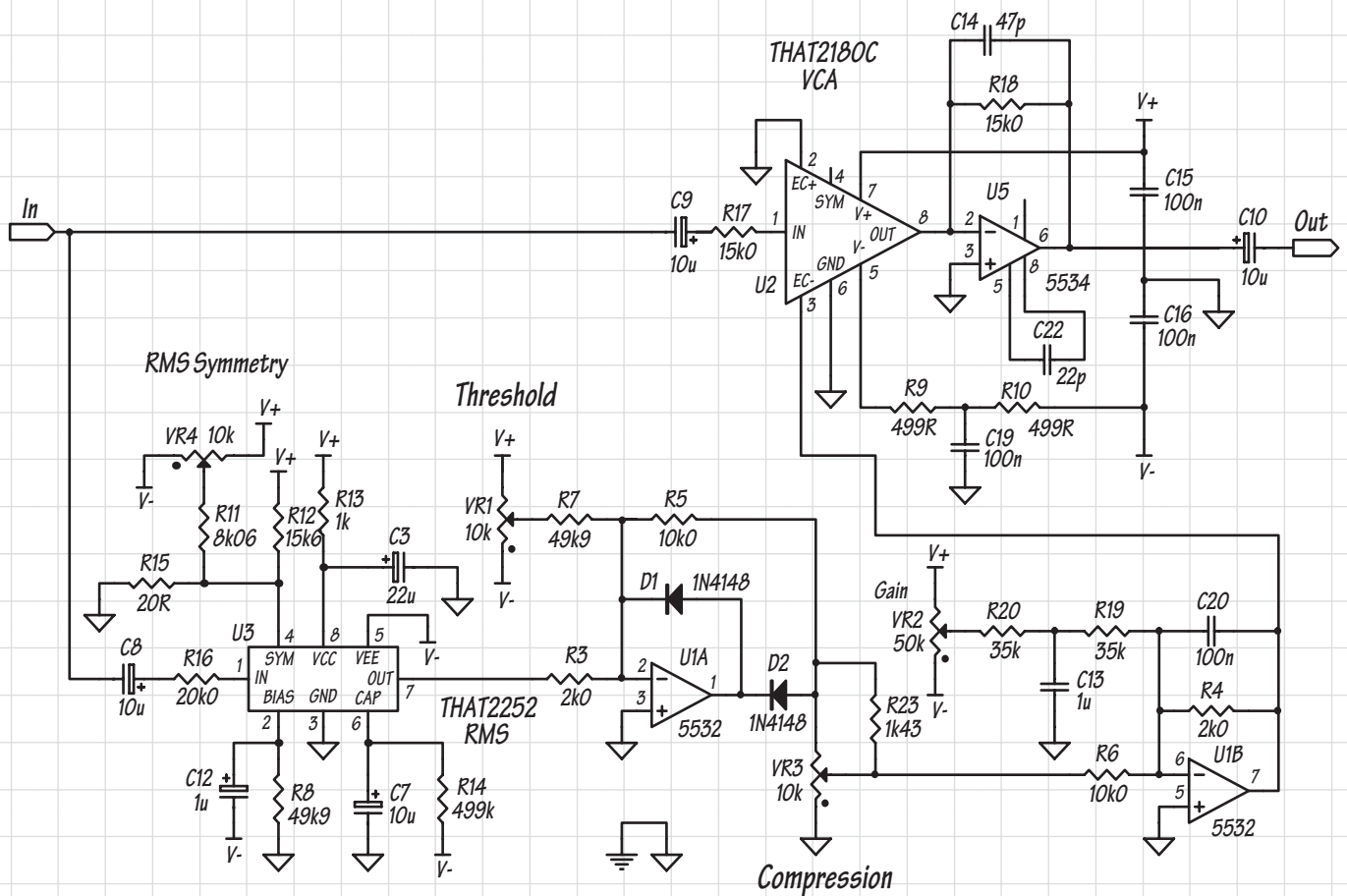


Figure 1: Low-voltage compressor / limiter

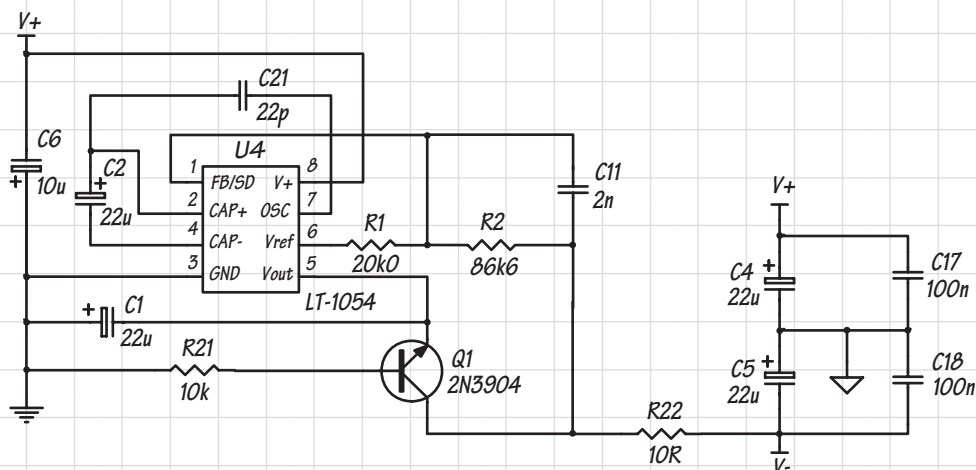


Figure 2: Regulator circuit

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U4 is a switched capacitor voltage inverter that inverts the +5 volt supply. It then regulates that -5 volts down to -4 volts. Q1 is necessary to keep U4's substrate properly biased. The filter formed by R22 and C5 isolates switching spikes from the compressor circuitry. Note: The ground connections around U1 should be kept very short and connected to the compressor's signal ground at only one point.

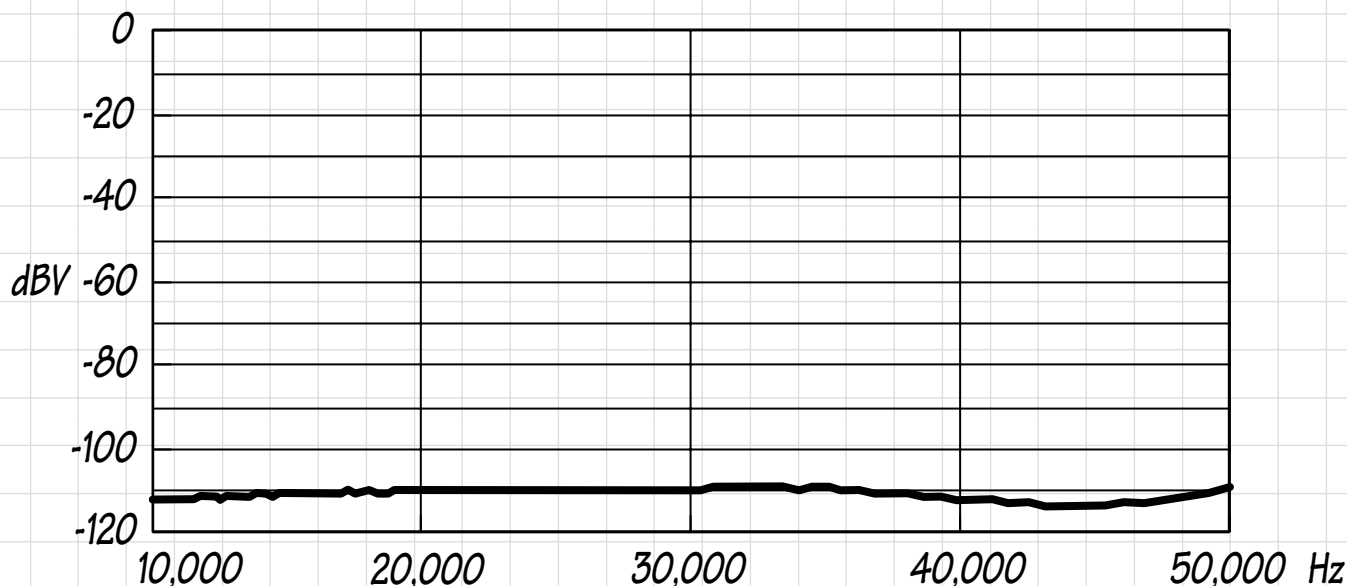


Figure 3: Noise vs Frequency

The remainder of the circuit is a standard compressor / limiter with some minor enhancements. The filter in the VCA biasing, formed by R9, R10, and C19, minimizes noise on the output. In the "gain adjust" portion of the side-chain, the filter formed by R19, R20, and C13 keeps distortion low. For further information on compressor / limiters, see THAT Corporation's Application Note 100A, "Basic Compressor / Limiter Design".

Figures 3 through 5 show the results obtainable with this circuit. Figure 3 shows output noise as a function of bandwidth. The total noise was -98 dBV, a figure which could be reduced further by increasing the value of C14 with some sacrifice in bandwidth.

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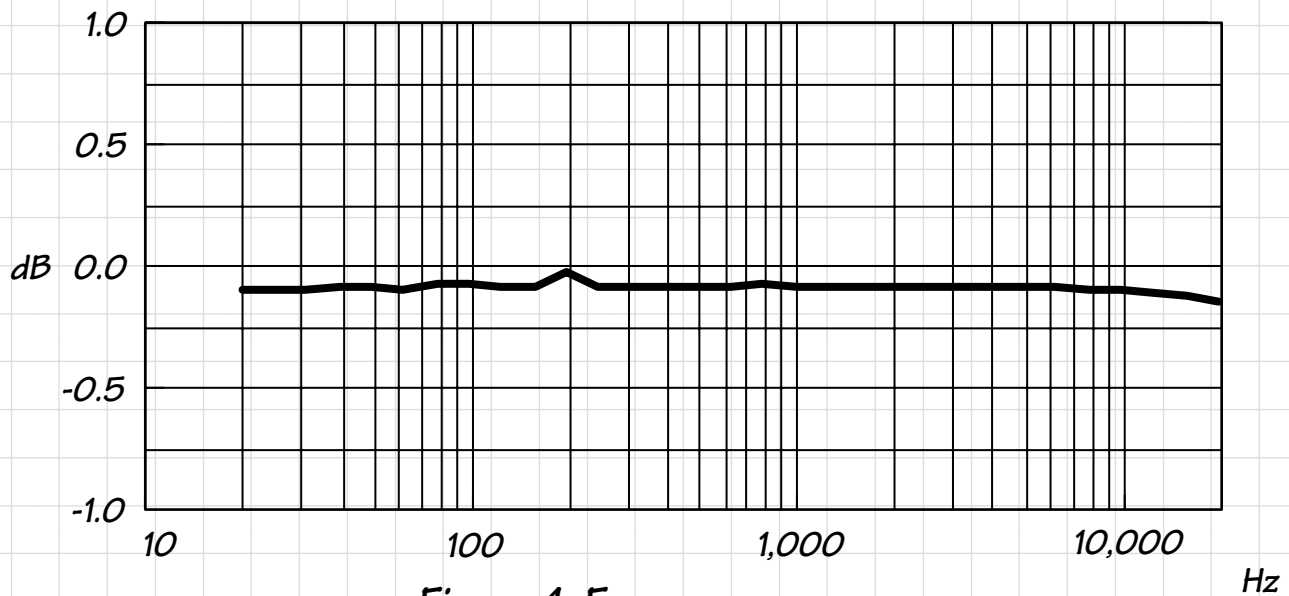


Figure 4: Frequency response

As can be seen from Figure 4, frequency response varies less than 0.25 dB from 20 Hz to 20 kHz.

Figure 5 plots THD+N versus frequency at various gain settings. As can be seen from the graph, this parameter is dominated by noise at lower gain settings.

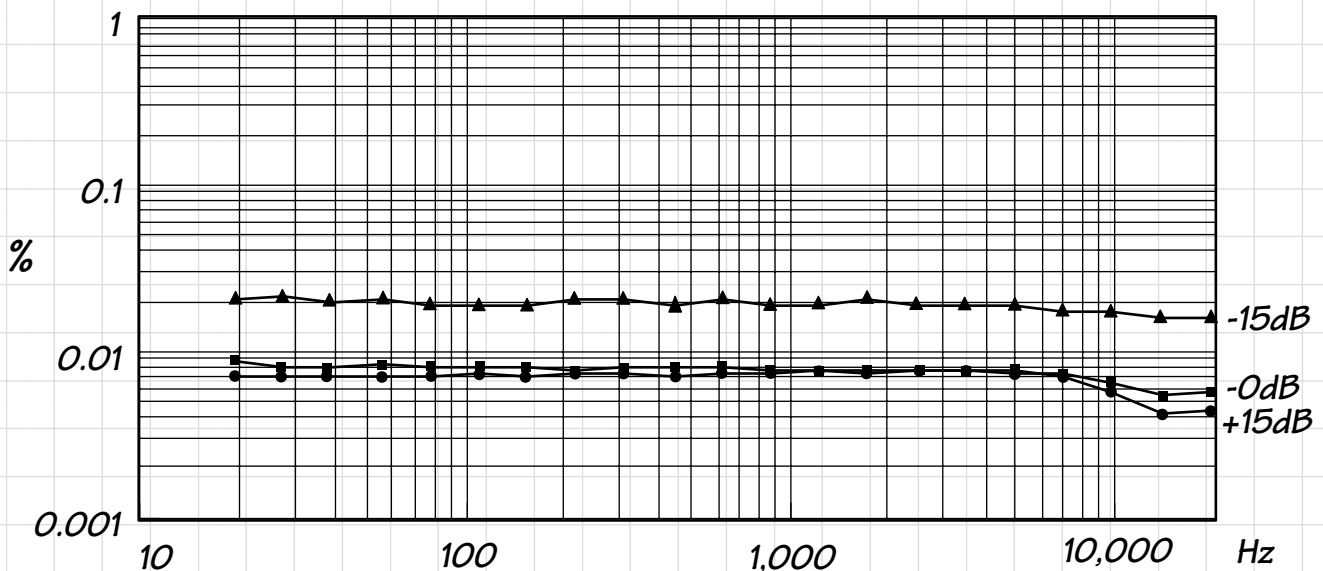


Figure 5: THD+N at various gain settings

THD+Noise at -15 dB, 0 dB, and +15 dB gain