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**Discrete Diamond Non-Feedback I/V Stage  
for TDA1541(A) DAC**

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The results of the previous usage of the AD844 without feedback were subjectively excellent but the question that remained was could the things be done inside the same concept to achieve better objective (harmonic distortion) performance and if yes, will it improve also subjective performance. The extensive simulations I have been running during some time pointed out the circuit shown on the figure 1 as one of those that can be the way to go. Interesting fact is that the AD844's internal circuit (as is) also could achieve superb distortion performance used as a common base stage, but it needs a higher bias current. Some other variation on this theme can perform well too, and some can perform even better. So, the bias used in the AD844 is below what we need here but in fact with complementary diamond transistors there is no need to run enormous currents, something like 3.5-4mA is quite enough; it won't help much here to go higher than this.

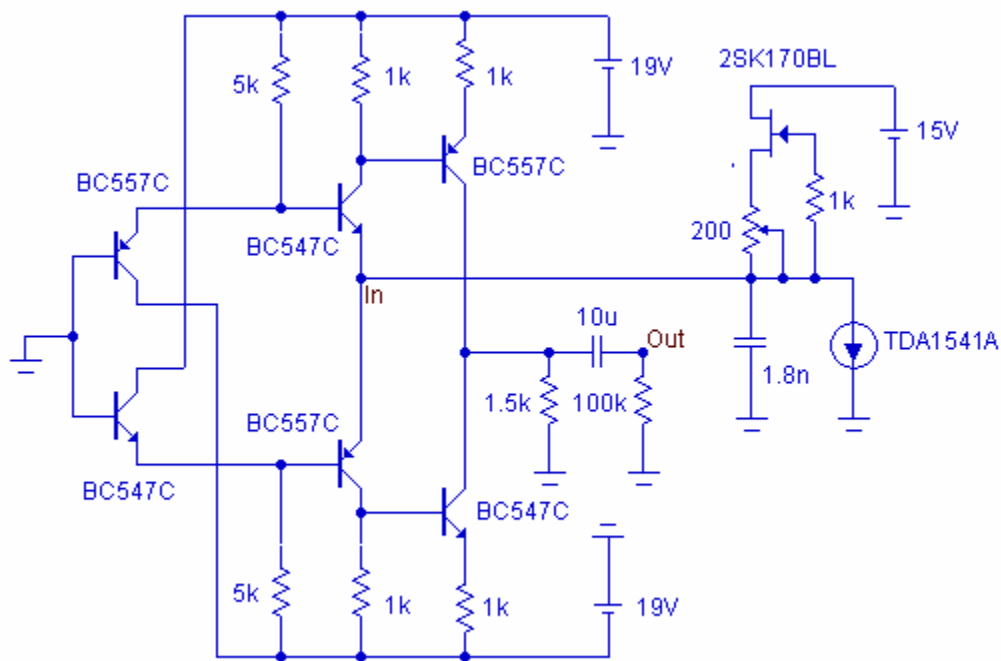


Figure 1

One could add diode (or transistor in diode connection) or transistor + diode (a la LM6181) per side to achieve conventional current mirrors with the emitter degeneration (later being the Wilson type), but the circuit works well as such with that the bias through the diamond's "collector" is somewhat lower than through the "emitter".

With TDA1541A used like a source measured THD at 0dBFS and 1kHz is 0.012%. The measurement was actually done using 1.2k I/V resistor but it will not change much if you use 1.5k as shown to achieve the standard output of about 2VRMS. (I somehow fell in love with DS1802 potentiometer and did this to match its requirements.)

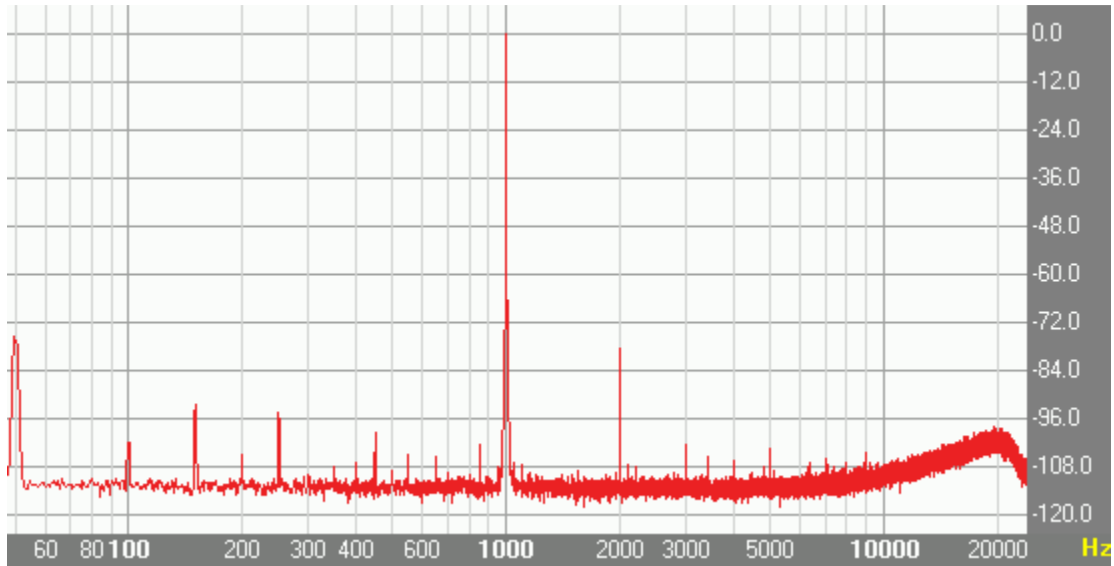


Figure 2: Harmonic distortion measured at 0dBFS, total value is 0.012%.

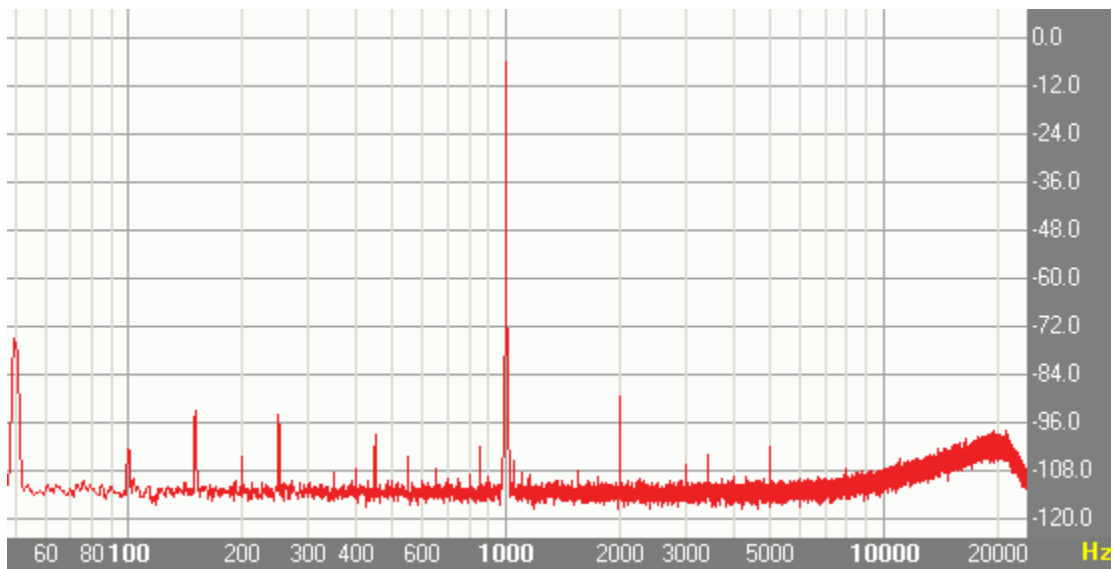


Figure 3: With the -6dBFS (50%) signal the distortion drops to 0.007%.

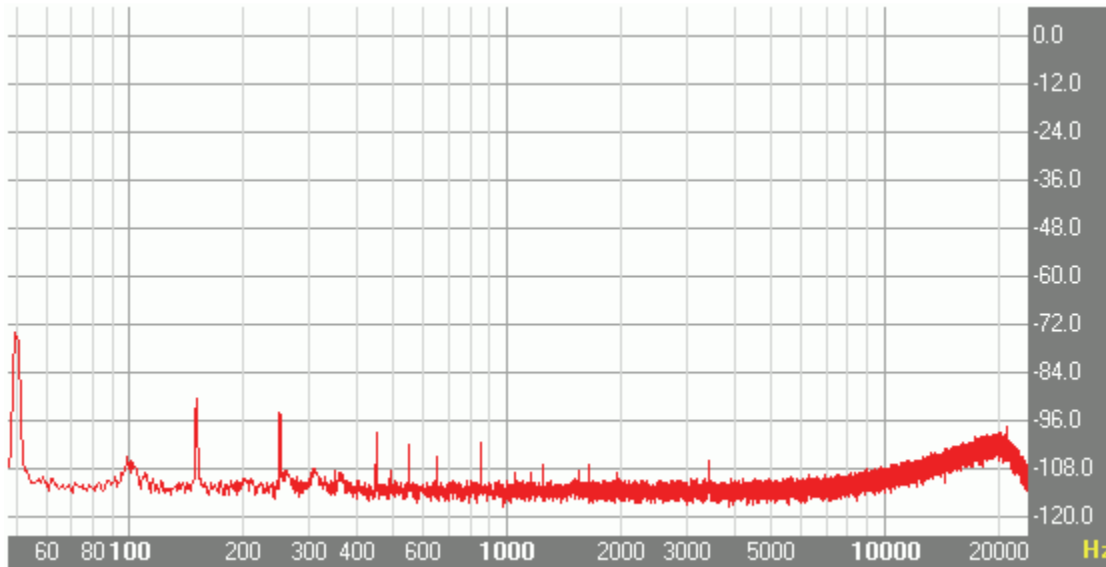


Figure 4: For the reference, this graph shows the noise of the measurement setup.

As shown, other than the good sound, the decent specifications also can be achieved using common base stages in the I/V converters. The circuit you see above can be further improved by... hmm, I'll tell you once. Build what you see above (with mentioned changes if you want) but bear in mind that it will not be easy to beat the AD844. The layout and supply have to be done carefully and it worth to check if the output buffer will improve something or not. Ultimately this circuit has less grain and can achieve a better resolution but this does not mean that you will notice the grain or lack of the resolution listening to the common base AD844 I/V, you will not. Other than known shortcomings the monolithic solutions also have some advantages which are not only practical by nature.