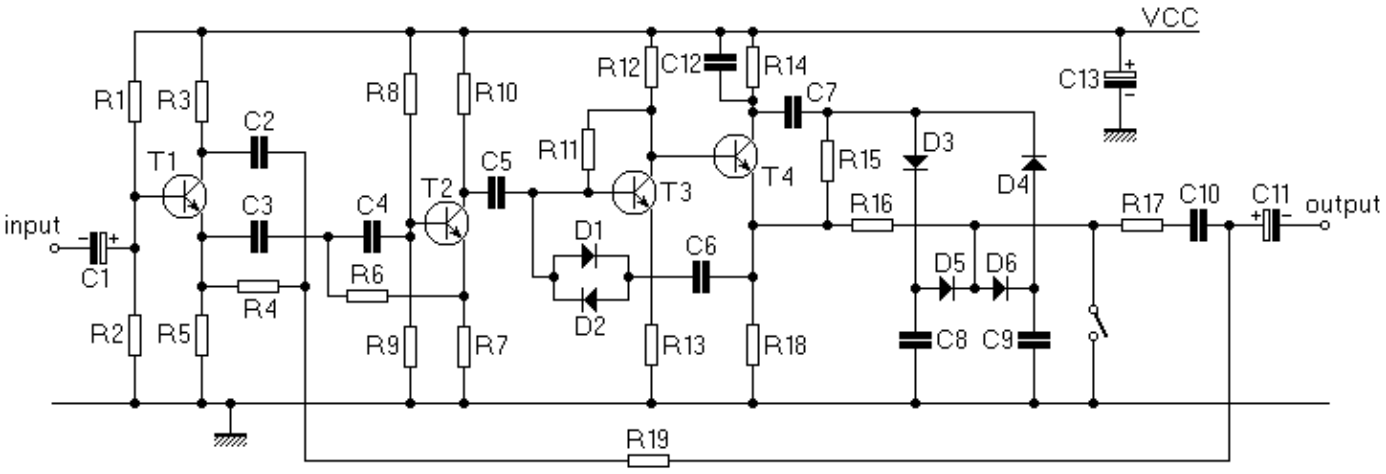
Philips' Dynamic Noise Limiter

This circuit was developed by Philips in the late sixties or early seventies to improve the subjective signal-to-noise ratio of cassette reproduction. Unlike the various Dolby systems, which require encoding and decoding, the DNL works on playback only and therefore can be used with any source material. Indeed, it can improve the sound of not only tape playback but any source where broadband noise (hiss) is troublesome - noisy FM and AM radio signals are examples.

Philips made the circuit available on a royalty-free basis. The circuit diagram here is based on two published versions; *Wireless World* (December 1971 pp 585 to 586) and *Elektor* (January 1984 pp 1-36 to 1-41). There are some differences between the two circuits - mainly component values and part numbers. To accommodate the two designs using one diagram I have listed the component values in a separate table. (**WARNING - DO NOT MIX THE TWO DESIGNS - USE ONLY THE COMPONENT VALUES FROM ONE COLUMN OF THE TABLE**). The major difference between the two circuits is the limiter made up from D1, D2 and C6 which are absent from the *Elektor* design. The addition of C12 in the *Elektor* design reduces the high-frequency gain of T4, possibly to improve stability.

I have built the *Wireless World* version and it works well. I used BC108 transistors (the BC148 versions have identical electrical specs but are in 'Lockfit' packages). I also used 1N4148 diodes instead of the BA217s which are hard-to-get (obsolete); almost any other type of small-signal silicon diode should be suitable (but don't mix types).

The principle of operation is straightforward - it is only during quiet passages that tape noise becomes intrusive, by reducing the gain for the higher frequencies during these periods an improvement in signal-to-noise ratio is achieved. This has only a minor effect on the higher frequency components of the signal since these are effectively masked by the noise anyway. The effect is progressive with the high-frequency attenuation increasing as the signal level falls. A 0 dBm (775 mV) signal passes through the circuit virtually unaffected (with the frequency response being almost flat); however, as the input falls to (say) 2 mV the attenuation rises to 10 dB at 7.5 kHz and 20 dB at 10 kHz. The effective roll-off is then about 18 dB/octave.



Because the amount of high-frequency attenuation depends on the input signal level, it is important that the input level is correct. The driving circuit should generate 'line level' at the input - i.e. the loudest portions need to be at 775 mV (RMS). The best way to check this is with a sinusoidal source and a 'scope. For tape use, record a few minutes of a 1 kHz sine wave at 100% modulation and check the level at the input of the DNL, a potential divider (total resistance of around 25 kΩ) can be used to reduce the input amplitude to the correct level.

Closing the switch disables the noise limiting effect giving a flat response (and thus allowing the DNL to be left permanently in circuit).

Component List

Component	Wireless World	Elektor	Comment
R1	68k	270k	
R2	56k	150k	
R3	680	1.5k	
R4	1k	5.6k	
R5	680	1.5k	
R6	8.2k	15k	
R7	1k	2.2k	
R8	330k	680k	
R9	100k	180k	
R10	1.8k	3.9k	
R11	330k	330k	
R12	22k	22k	
R13	680	680	
R14	4.7k	5.6k	
R15	330k	120k	
R16	22k	22k	
R17	120k	220k	
R18	680	680	
R19	4.7k	6.8k	On WW version: variable 0 to 4.7k preset
C1	4.7µF	4.7µF	
C2	22nF	4.7nF	
C3	3.3nF	1.8nF	
C4	470pF	270pF	
C5	1.8nF	1.5nF	
C6	22nF	not fitted	forms limiter with D1 & D2 in WW version
C7	330pF	680pF	
C8	4.7nF	22nF	
C9	4.7nF	22nF	
C10	10nF	4.7nF	
C11	4.7µF	4.7µF (16V)	

C12	not fitted	2.2nF	
C13	not fitted	10µF (16V)	Not shown on WW circuit but should be used
T1	BC148B/BC108B	BC547B	
T2	BC148B/BC108B	BC547B	
T3	BC148C/BC108C	BC547B	
T4	BC148B/BC108B	BC547B	
D1-D2	2 x BA217	not fitted	forms limiter with C6 in WW version
D3-D6	4 x BA217	4 x 1N4148	
VCC	+14V	+12V	

I haven't included anything like a detailed description of the circuit operation as yet - please let me know if you feel this would be useful.

Electronics Index **Feedback Form**