2-Channel Pre-Amp Module

Guitar-input is amplified by a gain of 3V/V by U2A. Input impedance is given by R3=1M0. The CMOS input of OPA1678 provides en=4.5nV/root(Hz) at very low input current noise. In fact there was no difference in noise figure with a preceeding SK170 source follower. So I dropped this stage. Omitting the JFET input stage improved power supply rejection significantly. The reason was obviously the non-ideal current source behaviour of the JFET.

Normal Channel 1

The upper part of the circuitry is channel 1, basically an active Si-diode clipping circuit. The first segment of the stereo gain pot controls overdrive gain, i.e. distortion. The second segment of the gain pot reduces post amplifier gain with increasing distortion thus yielding constant loudness over the entire distortion range. The curve is adjusted by selecting the parallell resistor R10.

Pre- and De-Emphasis

To prevent the low notes of a distorted chord from drowning out the higher ones, a bass cut R4,C3 is inserted between input amp and distortion stage. As this would give a flat sound specially at low distortion rates, a complimentary bass boost R14,C7 is added after the distortion stage for overall compensation. The crossover frequency is set to RC=330us corresponding to about 500Hz. Certainly this contributes to a special sound signature.

Hot Channel 2

This is a simplified version of channel 1 with a very high fixed gain, by far exceeding the gain of channel1 in the max position of the pot. Measures have been taken to reduce the audible noise to stunning low levels. The idea is simple: It is well known that the high frequency components of overtone spectra of natural instruments sound decay faster than the low ones. Looking at the decay of a guitar note – at the end a pure sinewave remains. This gave me the idea to implement a level sensitive low pass filter that acts as a fat hi-cut only at very low levels. Properly set it reduces the audible noise substantially without sacrificing treble response of the attack.

The technical implememention is remarkably simple: The anti-parallel si-diodes pair in the feedback path of the distortion stage have their biggest impedance at no signal input representing the max stage voltage gain. With increasing signal level this feedback impedance drops proportionnally thus reducing voltage gain accordingly. A small capacitor in parallel to these diodes does the trick: At low level this forms a low pass filter with lowest corner frequency that quickly shifts up with increasing signal opening the frequency range to the upper end of the scale. And that’s it!

Analogue Switching

Two anti-seriell wired off-the-shelf CMOS transistors act as bidirectional switch. The gate circuitry slows down switching transients to minimize any pop sounds.

Choosing alternative OP-Amps

OPA1678 is the best I actually found for this purpose. But the choice of op-amps is not really critical. CMOS-/JFET-inputs are preferrable for high impedance guitar outputs. Even TL072 will do a good job.