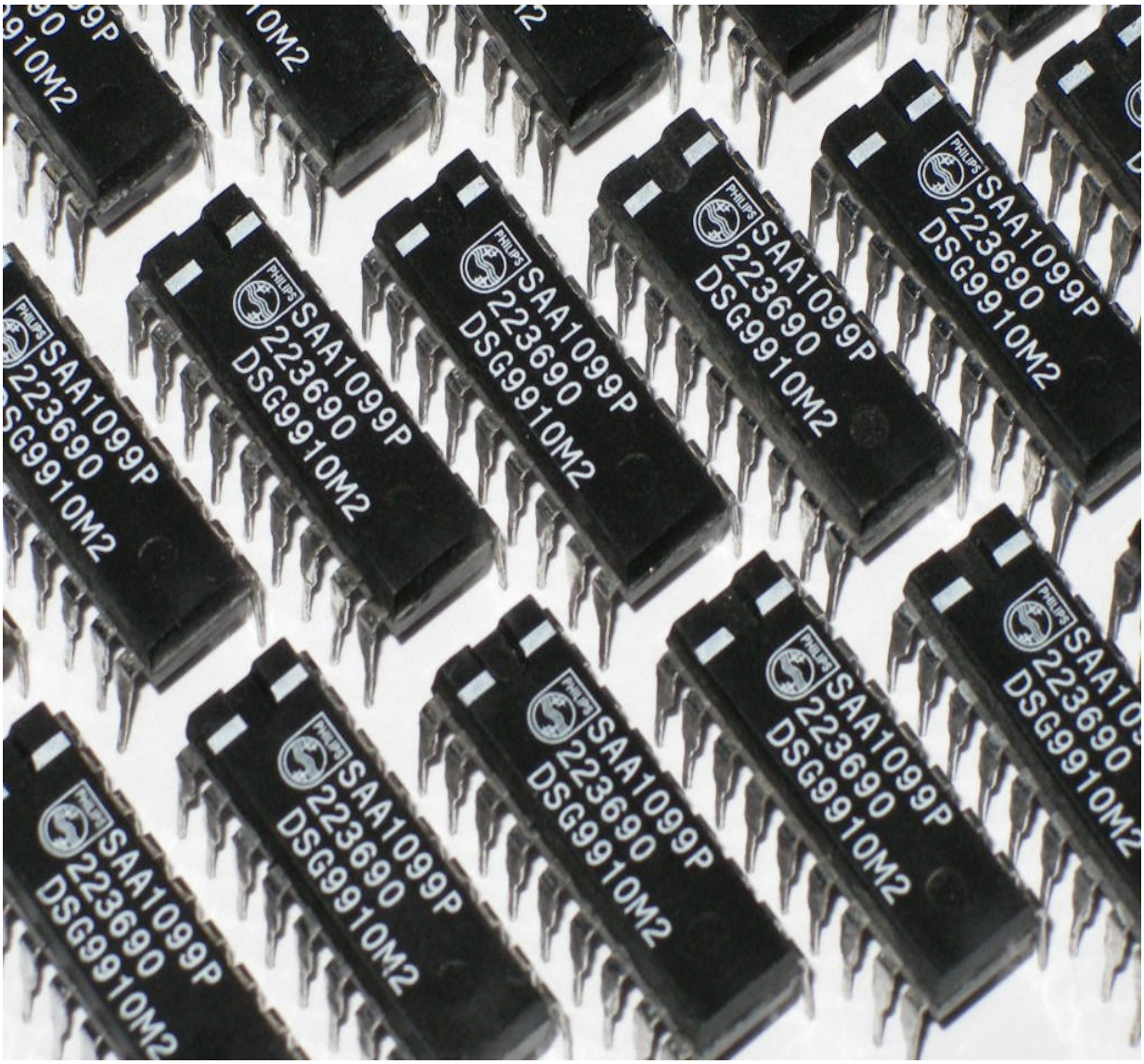
SAA 1099

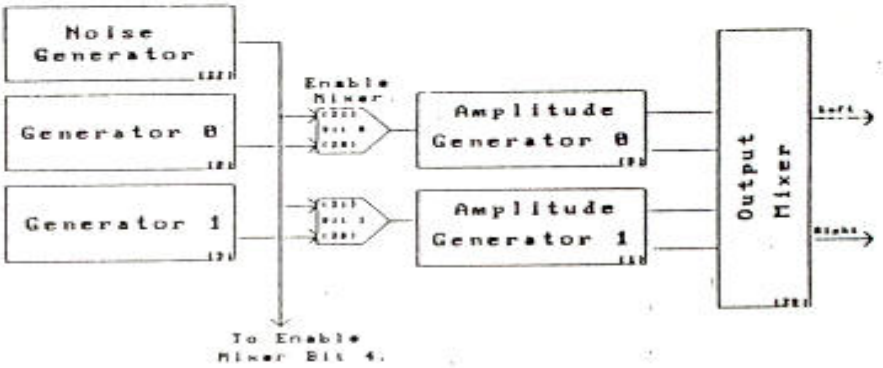
Documentation from SAM COUPE technical manual
(Page 23-26)



PHILIPS SAA1099 SOUND CHIP

- INTRODUCTION -

The sound chip has six tone registers or oscillators and two noise generators. These can all be panned individually from left to right across the stereo field using one of the 256 possible positions, (ie. 16 volumes per channel, thus 16 x 16 combinations gives 256 positions). The position in the stereo field, relating to that particular oscillator, is controlled by its amplitude register. The overall sound can be enabled or disabled using output mixer (28). To hear sound, this register should be '1', to kill the sound, it should be 0.

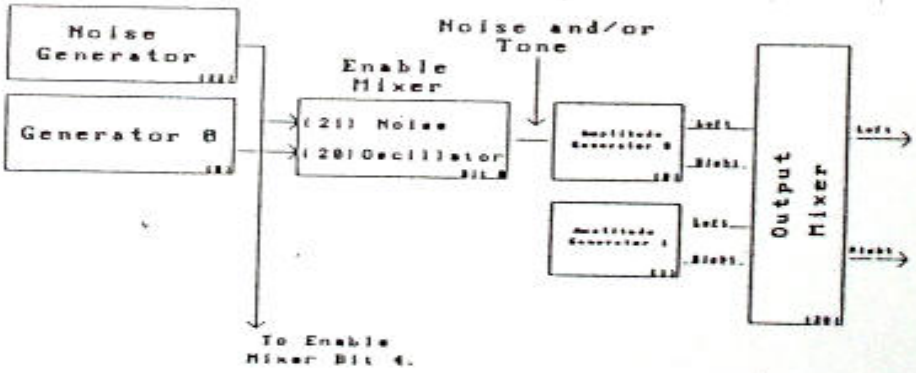


The six oscillators are split, three per noise generator. This enables the two envelope registers to be used independently.

- NOISE & SOUND -

Mixer registers 20 and 21 mix the noise with each of the oscillators. Register 20 controls whether an oscillator's sound is passed or stopped, whilst register 21 controls the noise.

Example:



Using this mixer allows either noise or tone or both or nothing to be passed to a single amplitude register and so to a precise position in the stereo field.

- PITCH -

The pitch of each complete oscillator is controlled by two parameters. These are eight possible octaves per generator and 256 possible tones per octave. By carefully choosing octave and tone register data, a smooth transition is possible from the lowest frequency on this sound of 31Hz to the highest frequency of 7.81KHz.

- MUSIC -

Chromatic scales are possible using the table below. Please note also, that the tone numbers are also valid for the other octaves of the same note although tuning may be difficult towards the lower octaves.

- THE CHROMATIC SCALE -

NB: All numbers given in decimal.

Note	Tone Number (decimal)	Octave Number	Required Frequency (Hz)	Actual Frequency (Hz)
Middle C	33	03	261.626	261.506
C#	60	03	277.183	277.162
D	85	03	293.665	293.427
D#	109	03	311.127	310.945
E	132	03	329.628	329.815
F	153	03	349.228	349.162
F#	173	03	369.994	369.822
G	192	03	391.995	391.850
G#	210	03	415.305	415.282
A	227	03	440.000	440.141
A#	243	03	466.164	466.418
B	5	04	493.883	494.071
C	33	04	523.251	523.013

- OCTAVE REGISTERS -

Register 16 is an octave register altering the octave of tone registers 8 and 9. This is made possible by only using three bits per tone register to select the required octave.

Thus 2x2x2 gives us eight possible octaves as previously mentioned. So, to access the octave register for tone register 8, we must supply a number (0-7) to the lower 3 bits of register 16. If we needed to access the octave for tone register 9, we would then need to supply a number between 16 and 64 making sure that the first four bits D0-D3 contain zero, or the octave number for tone register 8 if in use.

Example:

Required Octave 5
For Tone Register 8
only.

Number output to Register 16= 5.

Required Octave 6
For Tone Register 9
only.

Number output to Register 16= 96

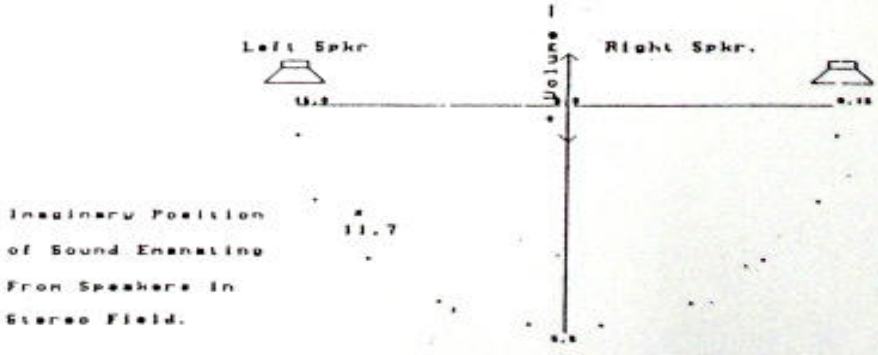
- AMPLITUDE REGISTERS -

Any data sent to a particular amplitude register can precisely control the position of a sound in the stereo field.

This is made possible by using the same technique as for the octave register. The only differences being that this time 4 bits are used to convey the volume of each channel, and the two 'halves' of the binary number refer to two channels (left and right) instead of two separate tone registers.

Volume 11 required
on left channel.
Volume 7 required
on right channel for
amplitude register 2

This would place the sound towards the left side of the stereo field.



- NOISE GENERATORS -

We have two noise generators again controlled by one register. The operation is very similar to that of the octave registers, but this time only 2 bits are used per noise generator. This gives 4 possible noise clock frequencies. Three of these options are preset - namely 0=31.25KHz, 1=15.6KHz and 2=7.8KHz. The fourth option (External) is controlled by the frequency of Generator 0 in the case of Noise generator 0 or Generator 3 in the case of Noise Generator 1. Using these generators, we are able to vary the 'pitch' of the noise and/or tone. If only continuously controllable noise is required, the relative tone mixer bit is disabled, but the relative noise mixer bit enabled. This technique is called using a tone generator to "Modulate" the frequency of the noise.

- ENVELOPE REGISTERS -

The envelope controllers can be found on registers 24 and 25.

Bit 0-Controls whether the envelope that is set up is mirrored in the left or right channel. (This can be useful to generate a sense of movement without writing to the amplitude registers).

Bits 3,2,1-Set envelope shape. These three bits select an envelope shape from the table found in Fig 3. in the Philips sound chip data sheet.

Bit 4-Controls resolution of envelope if repeated very quickly. 16 levels of resolution controlling envelope modulation are available for repetition up to 977Hz and 8 levels for repetition rates above 977Hz.

Bit 5-This bit controls whether the envelope registers are controlled by generators 1 or 4. If this bit is reset(0), then the internal clock is used to control the shape of the envelope. If this bit is set(1), then the external clock is used(A0) to control the envelope.

Bit 6-is not used.

Bit 7-is used to enable or disable the operation of the envelope controller. Note that this bit should be set (1), the enable envelope control.