

ColecoVision Sound Generation Hardware

The ColecoVision uses the Texas Instruments SN76489A sound generator chip. It contains three programmable tone generators, each with its own programmable attenuator, and a noise source with its own attenuator.

1. Tone Generators

Each tone generator consists of a frequency synthesis section requiring ten bits of information to define half the period of the desired frequency (n). F0 is the most significant bit and F9 is the least significant bit. The information is loaded into a ten stage tone counter, which is decremented at a N/16 rate where N (3.579MHz) is the input clock frequency. When the tone counter decrements to zero, a borrow signal is produced. This borrow signal toggles the frequency flip-flop and also reloads the tone counter. Thus, the period of the desired frequency is twice the value of the period register.

The frequency can be calculated by the following:

$$f = 3.579\text{MHz}/(32n)$$

The output of the frequency flip-flop feeds into a four stage attenuator. The attenuator values, along with their bit position in the data word, are shown below. Multiple attenuation control bits may be true simultaneously. Thus, the maximum attenuation is 28 db.

A0	A1	A2	A3	Weight
0	0	0	1	2 db
0	0	1	0	4 db
0	1	0	0	8 db
1	0	0	0	16 db
1	1	1	1	Off

2. Noise Generator

The noise generator consists of a noise source that is a shift register with an exclusive OR feedback network. The feedback network has provisions to protect the shift register from being locked in the zero state.

Noise Feedback Control

FB	Configuration
0	"Periodic" Noise
1	"White" Noise

Noise Generator Frequency Control

NF0	NF1	Shift Rate
0	0	N/512
0	1	N/1024
1	0	N/2048
1	1	Tone gen #3 output

3. Control Registers

The SN76489A has eight internal registers which are used to control the three tone generators and the noise source. During all data transfers to the SN76489A, the first byte contains a three bit field which determines the destination control register. The register address codes are shown here.

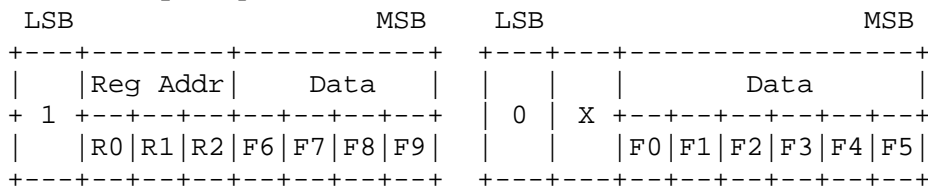
Register Address Field

R0	R1	R2	Destination Control Register
0	0	0	Tone 1 Frequency
0	0	1	Tone 1 Attenuation
0	1	0	Tone 2 Frequency
0	1	1	Tone 2 Attenuation
1	0	0	Tone 3 Frequency
1	0	1	Tone 3 Attenuation
1	1	0	Noise Control
1	1	1	Noise Attenuation

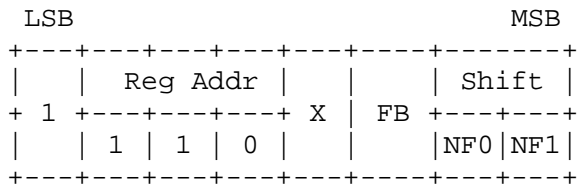
4. Data Formats

The formats required to transfer data are shown below.

Frequency



Noise Control



Attenuator



```
+---+-----+-----+
|   |Reg Addr|   Data   |
+ 1 +---+---+---+---+---+
|   |R0|R1|R2|A0|A1|A2|A3|
+---+---+---+---+---+---+
```

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