Vex IQ Middle School Reverse Engineering 2021-2022

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Subject: Super Nintendo Entertainment System (SNES)

We chose a SNES because, around the time we first knew of the online challenges for this year, Elijah had bought an old unit. The unit was somewhat damaged, and repairs were planned. Seeing the Reverse Engineering challenge, the team approved using it for the challenge and we started at the next practice.

Figure 1 - Disassembling the case

The most common parts being transistors, with a total of ten on the main circuit board alone. On the main board a Central Processing Unit (CPU), Random Access Memory (RAM), two Static RAM (SRAM), and two Picture Processing Unit chips were found. There is also a separate circuit board for sound. The sound circuit board has a total of six chips, two of which were manufactured by Sony, and two transistors. Other parts included casing and a port meant for the controllers to connect to, which was connected to the main circuit board via a ribbon cable.

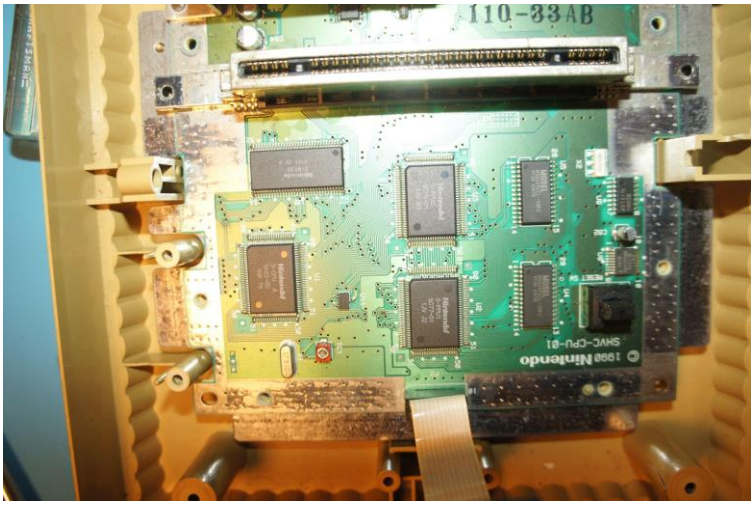

Figure 2 - The main circuit board. Starting in the top left corner going right are RAM, PPU2, Mosel SRAM, CPU, PPU1, and the second Mosel SRAM

There are many parts in the Super Nintendo to fill many roles. The CPU is one of the most important things in the SNES as it processes information and sends instructions to the other components. The CPU was customized by Ricoh, the manufacturer, to move memory around faster.

There are three chips dedicated to two different types of RAM, the RAM and SRAM chips.

The next two chips were designed by Nintendo and are labeled as PPU chips. These chips are used for graphics.

Another important chip is the Sound & Music Processor (SMP) chip on the sound board, which is a sound CPU with 64 KB of SRAM. A Digital Signal Processor (DSP) chip, provides sound effects, mixes channels, adds echo, and can envelope samples. The interesting part of this board is that it uses a faraday cage. A faraday cage is an enclosure used to block electromagnetic fields. According to electronicsmaker.com, “Faraday cages are routinely used in analytical chemistry to reduce noise while making sensitive measurements”. It acts like a car radio when going into a tunnel.

The Checking Integrated Circuit (CIC) checks for another CIC in the game cartridges to help prevent piracy, and make sure games were published and approved by Nintendo before reaching the market.

Figure 3 - Researching for this project

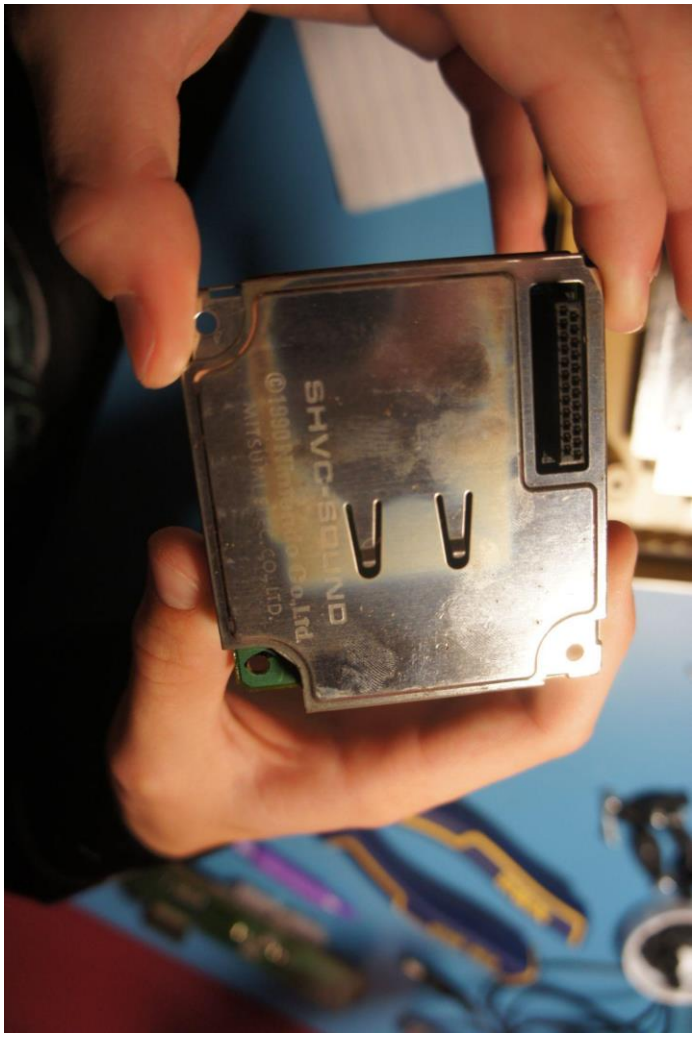

Figure 4 - The “SHVC-SOUND” sound board

To conclude, we learned many things about electronics while doing this project such as the various components of a computer, what a Faraday cage is and how a transistor works.

Complete Parts List

- Casing- top and bottom shell pieces
- Faraday Cage
- Circuit Board:
  - ➔ U1- Ricoh S-CPU
  - ➔ U2- Nintendo S-PPU1
  - ➔ U3- Nintendo S-PPU2
  - ➔ U4- Mosel SRAM
  - ➔ U5- Mosel SRAM
  - ➔ U6- Nintendo S-WRAM
  - ➔ U7- ROHM RGB
  - ➔ U8- Nintendo F411
  - ➔ U9- Texas Instruments HCU04
  - ➔ U10- Texas Instruments 131B
  - ➔ U11- T529D
  - ➔ U12- ROHM 17805
- Sound Board:
  - ➔ IC1- Nintendo S-SMP Sony
  - ➔ IC2- Nintendo S-DSP Sony
  - ➔ IC3- Japan 9138
  - ➔ IC4- LSI Logic LH5P832N
  - ➔ IC5- NEC D6376
  - ➔ IC6- 2904
- Controller Port