Electronics Online Challenge 2020

Dvico TViX Xroid A1

Team Number: #1155A

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Table of Contents

Final Summary Report

Around 2010, Taesub, the dad of one of our team members and an electrical and software engineer, was working on the software for a video player/storage device. For testing purposes, Taesub brought home a prototype of TVIX-HD Xroid A1 designed by DVICO, a Korean electronics company. The team member mentioned that he was always curious as to how it worked. This caused us to become interested in the TVIX, and since it was not in use, we chose it for our project.

Unfortunately, we weren't able to meet up this year, so one of our team members, Hyunsung, was assigned to the disassembly and pictures. To assure his safety, he wore safety glasses, took extra precautions when working, and was supervised by his dad, Taesub. First, he removed all of the screws and external components to expose the motherboard. He then had some trouble because he didn't recognize the jack hex screw as a screw, but figured it out with the help of teammates through Zoom and successfully removed the motherboard from the casing. He then took pictures of specific parts to use for our analysis. The grooves made in chips were not visible under regular lighting so he used a flashlight to shine a light at an angle to highlight the words.

For our research, we looked up various labels on the different components then consulted our mentor or Taesub when we got stuck. We found that Samsung had made the various memories and the CPU, while other companies such as Holtek, Cirrus Electronic, Semtech, and many others mainly in the US or Taiwan, made various other components. In addition, one of the chips we originally thought was unidentified turned out to be a DC to DC connector made by TI Electronics.

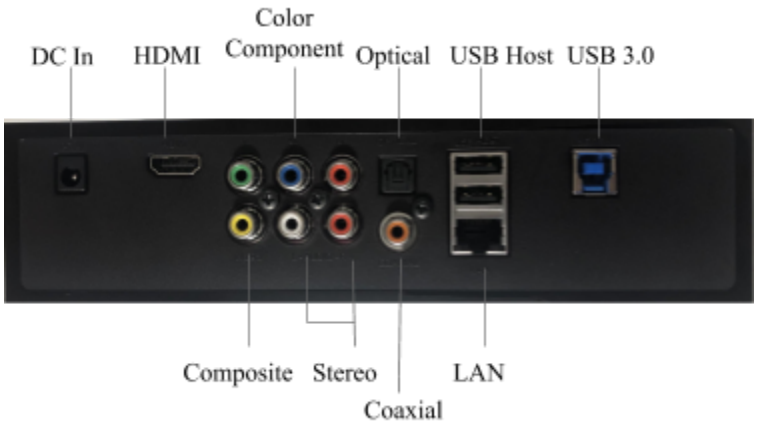
We learned many things about electrical components and were surprised multiple times at the complexity of things. We learned about how memory was used in different ways, how the CPU works, what each of the inputs and outputs do, and so much more. This experience made us want to actually build one ourselves starting with the very basics of making a schematic and going on to build something like what we saw during this experiment. We hope that this opportunity will come someday, but in the meantime, we can build some robots for VEX Robotics competitions.

Device Overview

Figure 1.0 Top/Front View

The top of the device contains the buttons for controlling the device, and the front contains the screen and the LED on/off indicator.

Figure 1.1 Back View

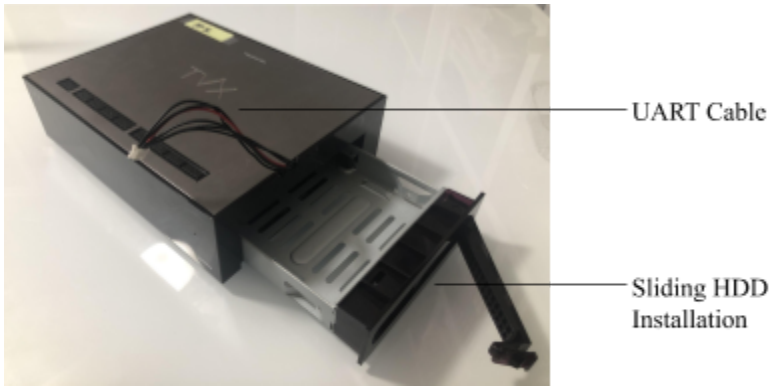


The back of the device contains various ports for power, ethernet, audio, and output.

Figure 1.2 Side View (Left)

The left of the device contains the fan and a few more inputs.

Figure 1.3 Side View (Right)



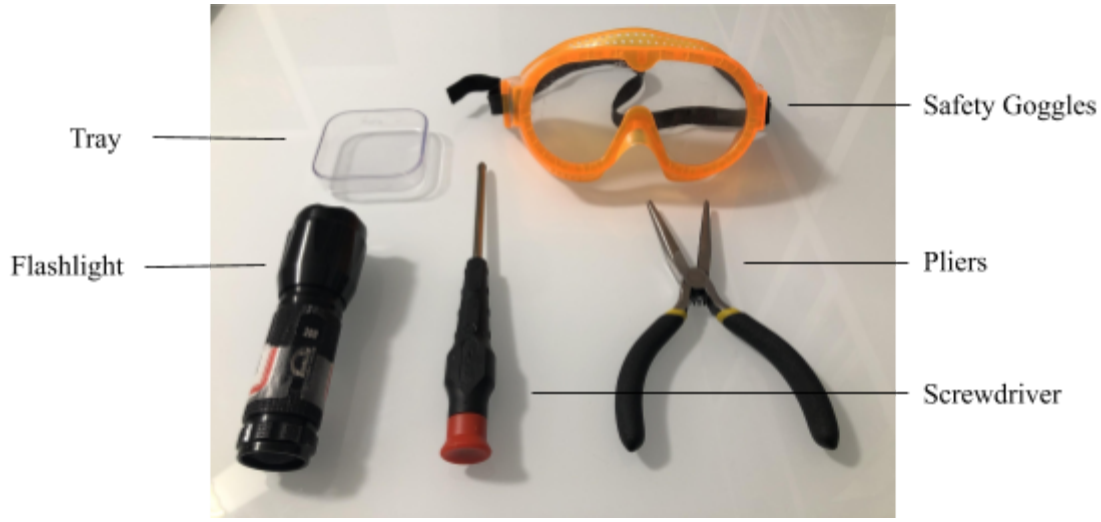
The right side of the device contains the hard disc tray and the debugging cable that connects to a computer.

Figure 1.4 Bottom

The bottom contains the serial number, the model name (DVICO TViX Xroid A1 Sample), and the rubber feet to prevent scratches and improve grip.

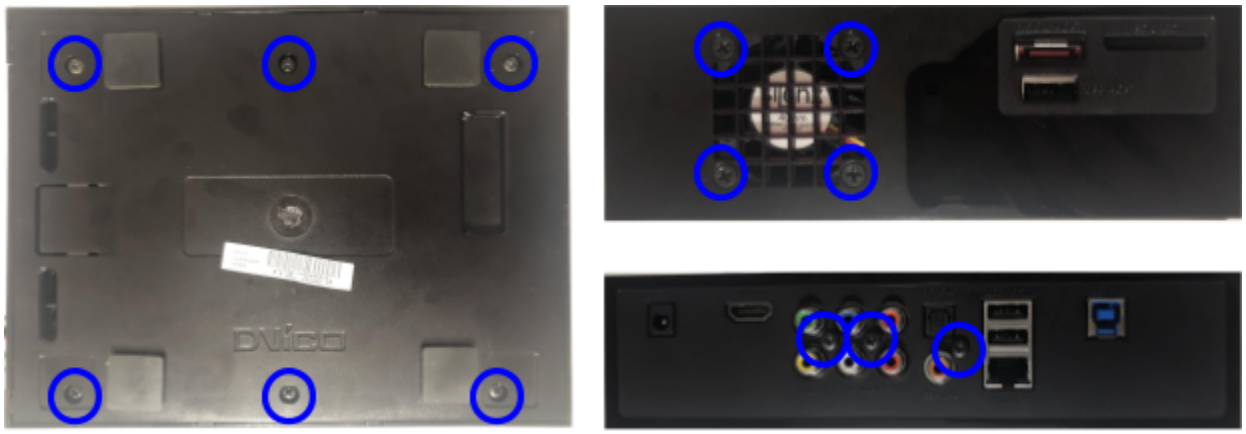
Disassembly

Figure 2.0 Tools



The safety goggles were on at all times during the disassembly process, and the other tools were used in various steps in the disassembly.

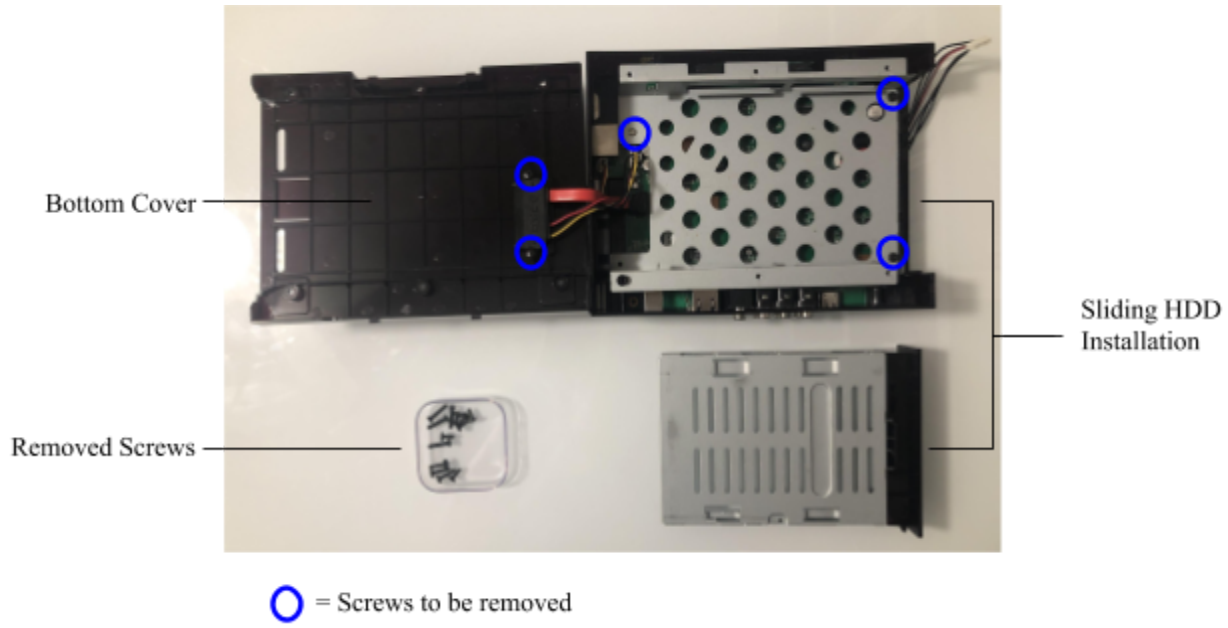
Figure 2.1 Screws



= Screws to be removed

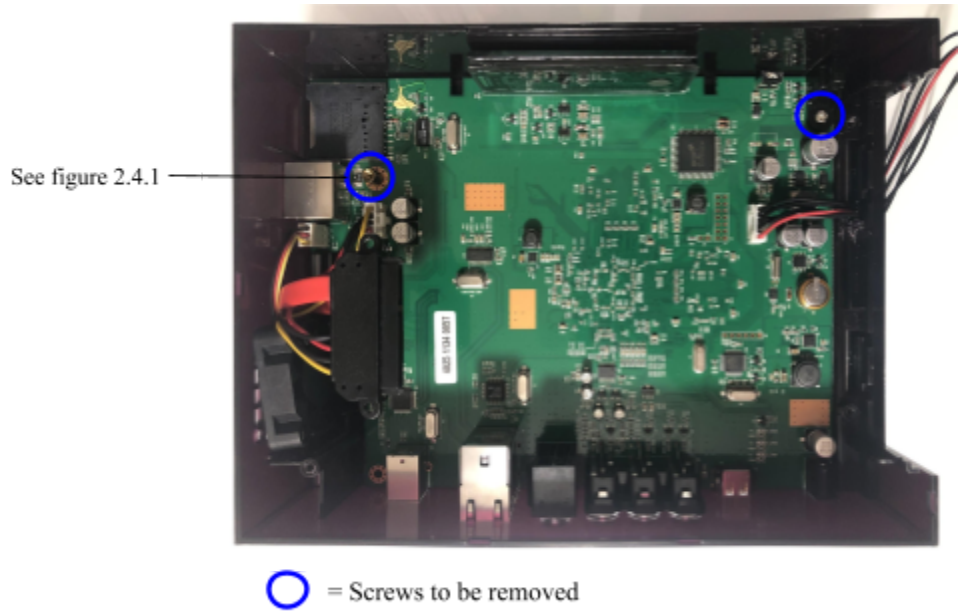
We first removed all the screws that we had access to using a screwdriver and put them in the tray for safekeeping.

Figure 2.2 Opened Device



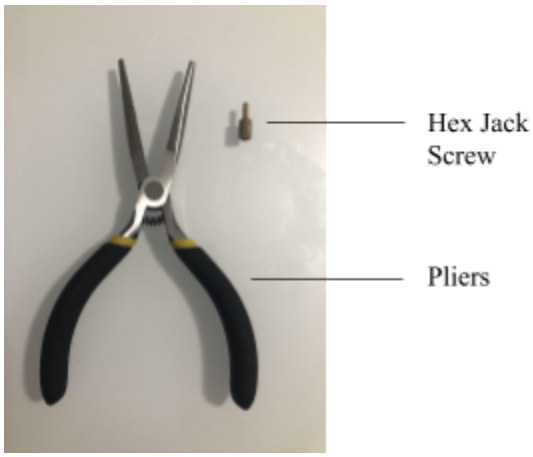
After the bottom cover was removed, we found the hard disk tray and some more screws.

Figure 2.3 Motherboard Removal



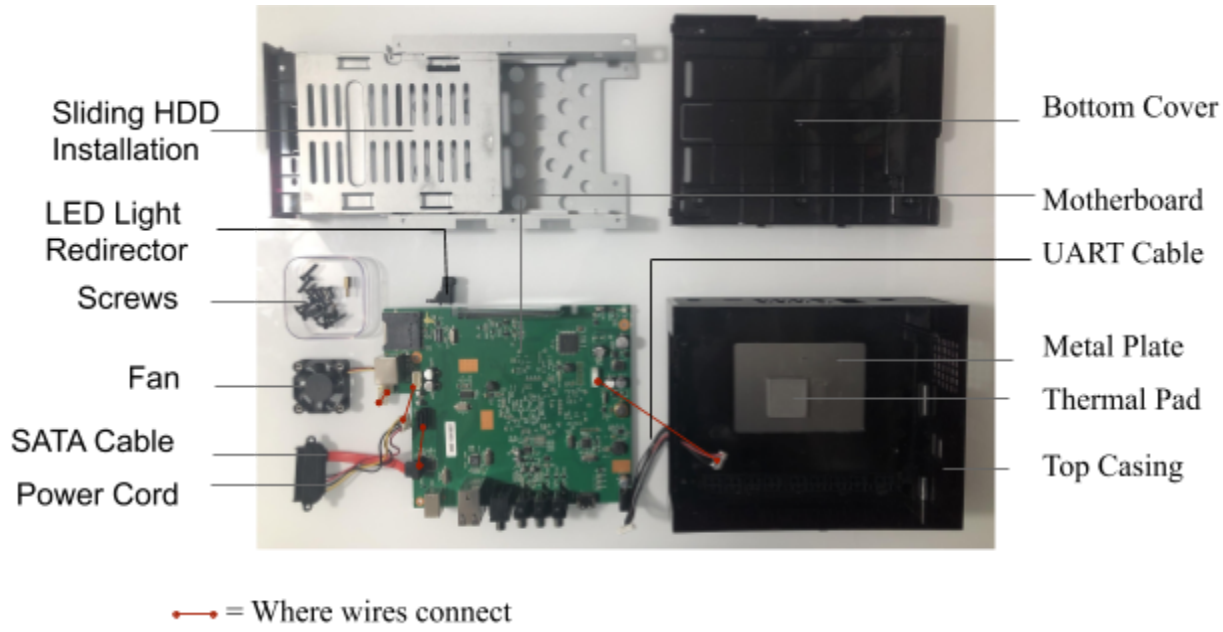
Screws, screws, and more screws. This brings back VEX memories…

Figure 2.3.1 Hex Jack Screw



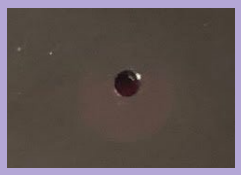
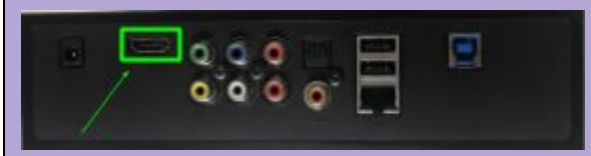
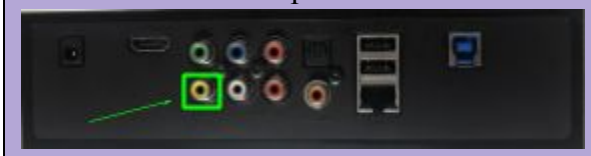
Used pliers to unscrew the hex jack screw.

Figure 2.4 Overview

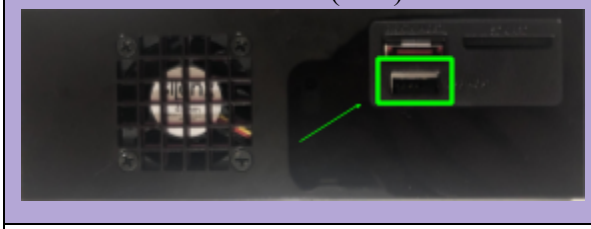


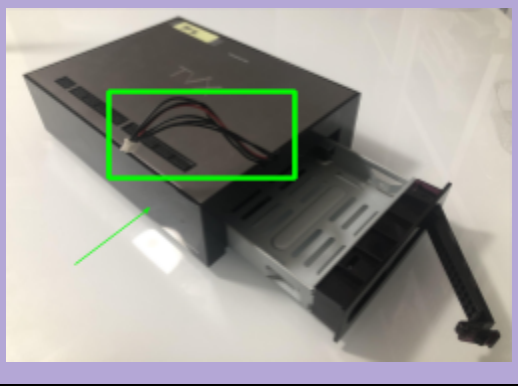
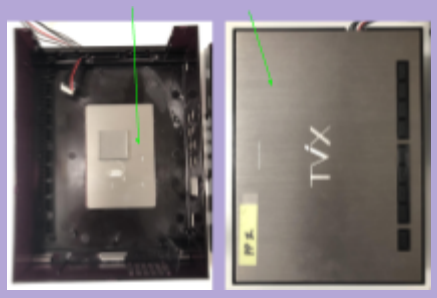
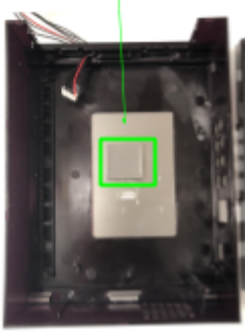
All separate components layed out.

Table 1.0 External and Internal Components

Component Image	Quantity	Function
Buttons 	9	The buttons located on the top of the device are used to control the device in place of a remote controller.
Information Display 	1	This screen shows various information such as playing/paused, time, video title, and video length. It is currently blank because it is off.
LED On/Off Indicator 	1	The LED indicator located on the front is used to show whether the device is powered on or not.
DC In 	1	The DC (direct current) port is used to plug in the DC cable which allows power to run through the device.
HDMI 	1	The HDMI (high definition media input) port is used to send video output to another device such as a television.
Color Components 	3	These are the three video outputs for RGB colors.
Composite 	1	The composite port is used to transfer video signal through a single wire and does not support HD (high definition) video.

Stereo 	2	This is the output for stereo sound (sound from multiple directions).
Optical 	1	The optical port is used to deliver digital audio output to another device such as a television or monitor.
USB 3.0 	1	The USB 3.0 B port on the rear is used for super speed applications such as external peripherals.
RJ 45 LAN 	1	The RJ45 LAN (Registered Jack-45 Ethernet) port is used for a wired internet connection as opposed to a wireless one.
USB Host (Back) 	2	The 2 USB hosts are additional ports to allow for more media input.
Coaxial Jack 	1	The coaxial jack is used to send digital audio signals between devices.
E-SATA Host 	1	The E-SATA Host on the side of the device is used to provide a connection to external storage devices.

Fan  	1	The 40mm fan running at 6000 rpm is used to keep the internal components cool.
SD Card Input 	1	The SD card reader is used to allow media aside from that on the hard drive to be displayed.
USB Host (Left) 	1	The USB Host on the left of the device is used to input media through flash drives and other drives which operate through USB.
Screws 	20	The screws were used in various places to secure the device.

UART Cable 	1	This is a cable used for debugging purposes and is not present in the final product.
Sliding HDD Installation 	1	This is the container that holds the 3TB hard drive.
Metal Plate 	1	The metal plate is connected to the thermal pad on the inside to redirect heat.
Thermal Pad 	1	The thermal pad redirects heat from the CPU to the metal plate.

Casing 	1	The casing contains all of the internal components, has buttons and the screen, and supports the aesthetic of the device.
Label 	1	The label contains the serial number, bar code, and name of the product.
Rubber Feet 	4	The feet act as a buffer between the bottom and the ground to prevent scratches, shock, and other general damage.
Light Redirector 	1	This redirects the light from an LED on the motherboard to the LED on/off indicator.

Motherboard

Figure 3.0 Integrated Chips on Motherboard (Top)

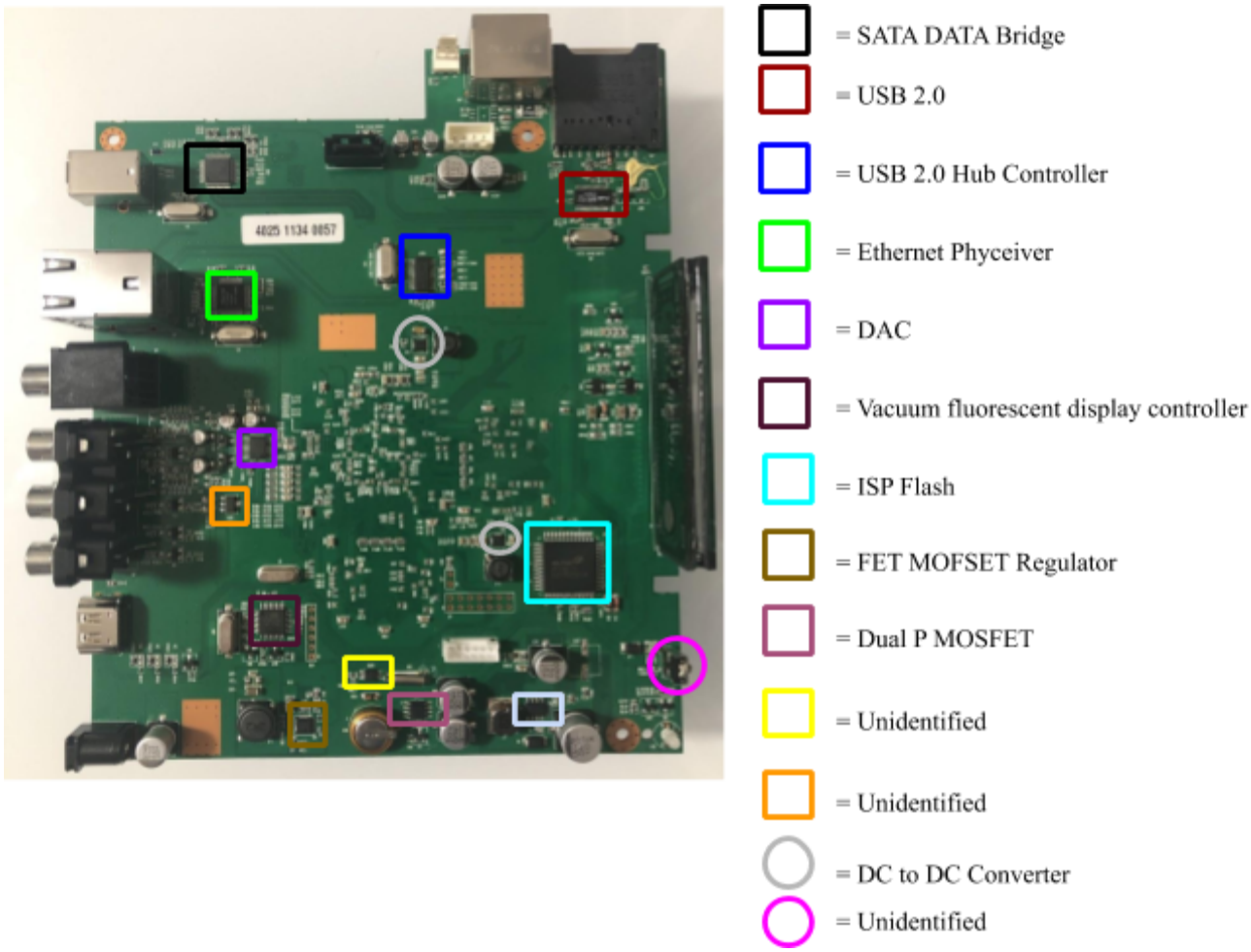


Figure 3.1 Integrated Chips on Motherboard (Bottom)

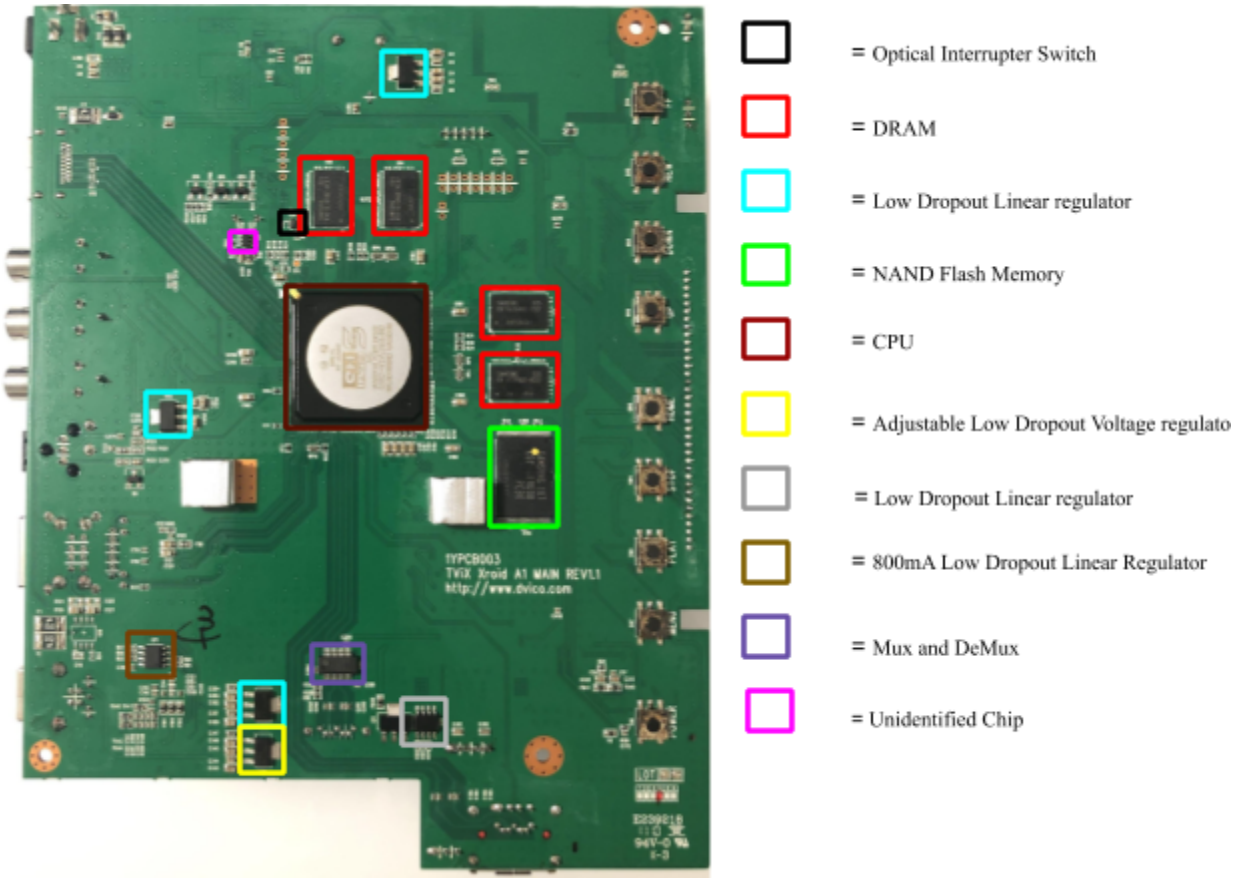
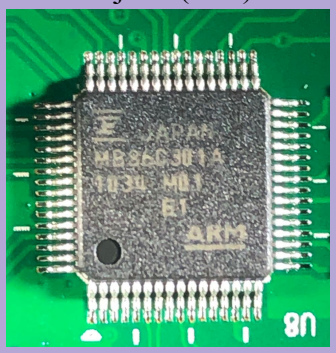
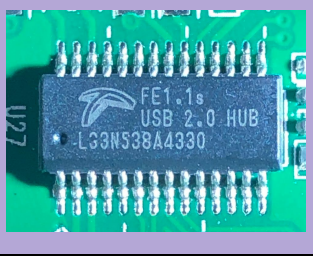
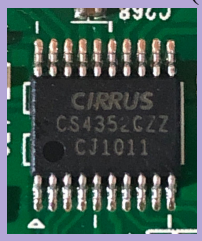
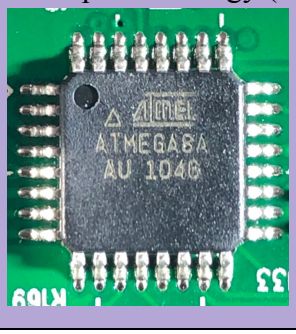
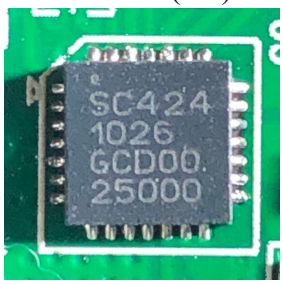
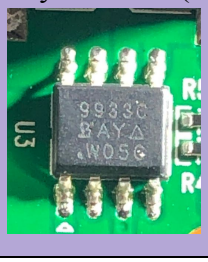
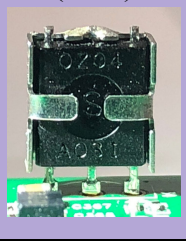
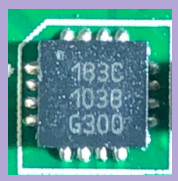
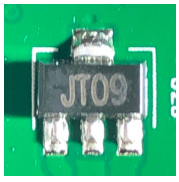


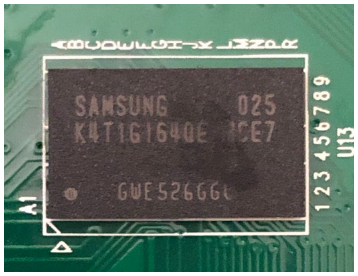
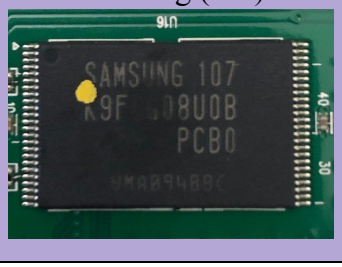
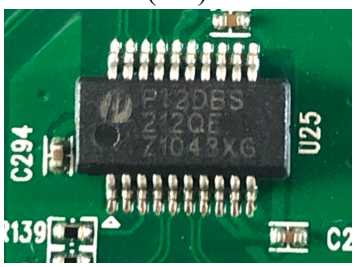
Table 2.0 Integrated Chips on Motherboard

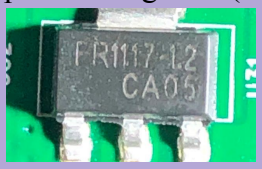
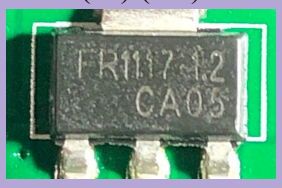
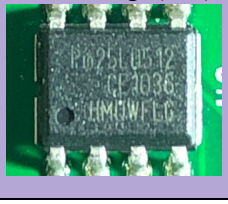
Component Image and Manufacture	Quantity	Function/Description	Information and Part Number
SATA DATA BRIDGE (TOP) Fujitsu (JAP) 	1	This USB 3.0 bridge reduces transfer of data from video by 10 fold over USB 2.0.	DATASHEET MB86C30A

USB 2.0 SD Card Reader (TOP) Moai Electronics (TW) 	1	This chip fills the gaps of data transfer for video and pictures.	DATASHEET MA8121C
USB 2.0 HUB CONTROLLER (TOP) Qixin Electronics (CN) 	1	This chip is used to increase the number of data buses of the USB 2.0.	DATASHEET FE1.1S
ETHERNET PHYCEIVER (TOP) Realtek Semiconductors (TW) 	1	This Single Chip 10/100M Fast Ethernet Phyceiver sends and receives data from the ethernet.	DATASHEET RTL8201CP
DAC (TOP) Cirrus Electronics (US) 	1	The DAC converts digital data to analog audio signals to be sent to an amplifier.	DATASHEET CS4352(C)ZZ

VFD (Vacuum fluorescent display) CONTROLLER (TOP) Holtek (TW) 	1	This chip controls the VFD lights on the display.	DATASHEET B037G0523
ISP FLASH (TOP) Microchip Technology (US) 	1	This chip allows for itself to be programmed while installed into the system.	DATASHEET ATMEGA(8)A
FET MOSFET REGULATOR (TOP) Semtech (US) 	1	This Integrated FET regulator has a MOFSET for the regulator to regulate analog data.	DATASHEET SC424
DUAL P MOSFET (TOP) Vishay Siliconix(US) 	1	This chip has 2 gates to separate analog data but will only turn on when below 20V.	DATASHEET 9933C

DC TO DC Converter (TOP) Texas Instruments (US) 	1	This inverting switching regulator converts fluctuating DC current to a constant DC current.	DATASHEET 34063
UNIDENTIFIED CHIP (TOP) 	1	No concluded description	0204A031
UNIDENTIFIED CHIP (TOP) 	1	No concluded description	ANW SOABM
UNIDENTIFIED CHIP (TOP) 	2	No concluded description	183C
UNIDENTIFIED CHIP (TOP) 	1	No concluded description	JT09

CPU (BOTTOM) Sigma Designs (TW) 	1	This secure media processor CPU calls upon direct programs to complete tasks like watch videos.	DATASHEET SMP8657A3A
DRAM (BOTTOM) Samsung (KR) 	4	This DRAM chip by Samsung holds memory and cycles about 667 million times second.	DATASHEET K4T1G14QE-HCE7
NAND Flash Memory (BOTTOM) Samsung (KR) 	1	This NAND Flash Memory chip stores data in gates like an internal SD card.	DATASHEET K9F4G08U0B
Mux and DeMuxer (BOTTOM) Pericom Semiconductors (US) 	1	This chip allows for multiple inputs and a single output (MUX) and the opposite (DEMUX).	DATASHEET P12DBS

Adjustable Low Dropout Voltage regulator.(Bottom) Fitipower Integrated (TW) 	1	This LDO allows a large amount of adjustable voltage to pass through.	DATASHEET FR1117 E950
Low Dropout Linear regulator(Bottom) Fitipower Integrated Circuits (TW) 	1	This LDO creates a constant decrease of voltage.	DATASHEET FR1117 E950
800mA Low Dropout Linear Regulator (Bottom) National semiconductors (TI) (US) 	1	This LDO has a max voltage of 800mA.	DATASHEET FR1117 1.2
Optical Interrupter Switch (Bottom) Mouser Electronics (US) 	1	The Optical Switch is a light sensitive switch.	DATASHEET H21
512 Kbit SPI Bus Serial EEPROM (BOTTOM) Microchip (US) 	1	The EEPROM is memory that is accessed from the SPI Bus.	DATASHEET Pm25L0512

Quad Operational Amplifier (Bottom) Diodes (US) 	1	The amplifiers are able to capture the AC signals and amplify	DATASHEET 2904
UNIDENTIFIED CHIP (BOTTOM) 	1	No concluded description	C9F13

Figure 3.2 Important Motherboard Components (Top)

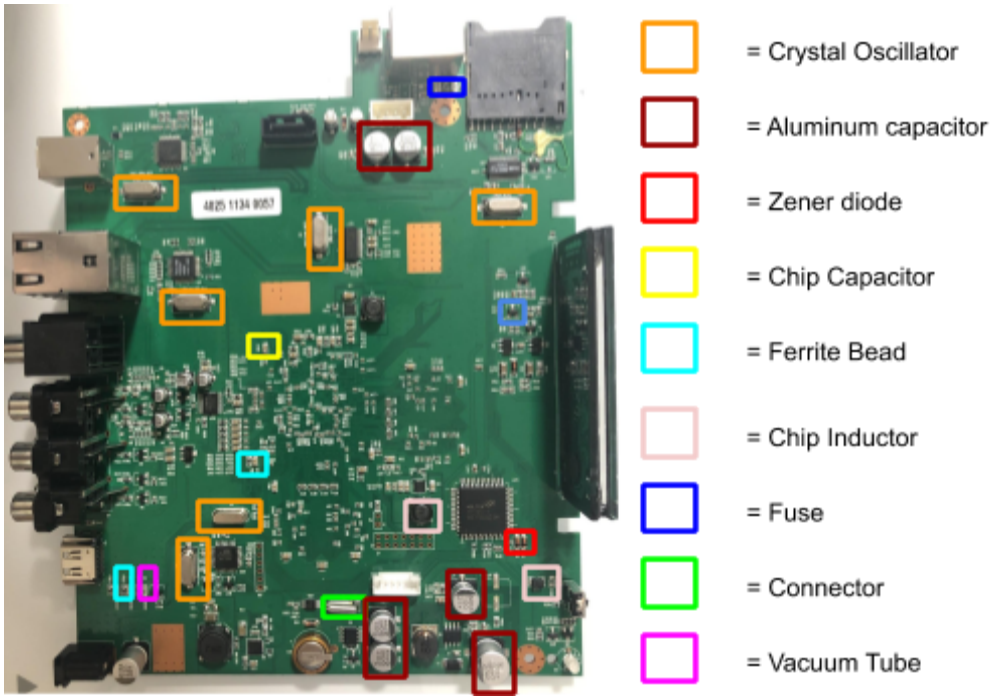


Figure 3.3 Important Motherboard Components (Bottom)

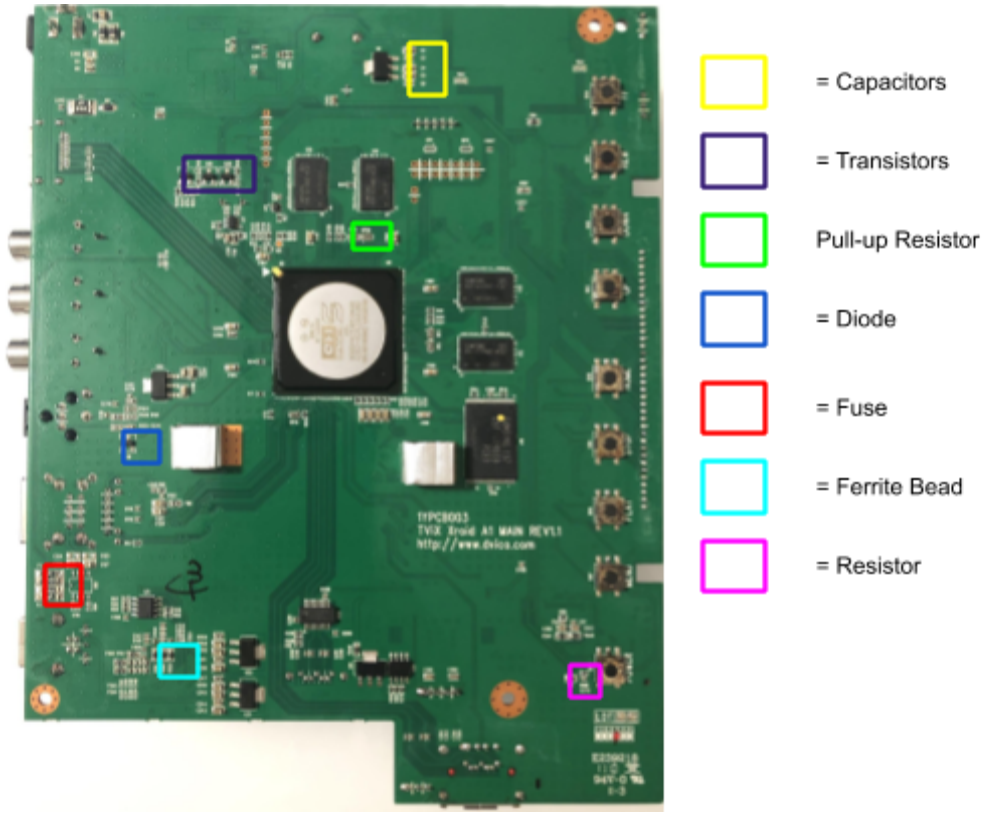
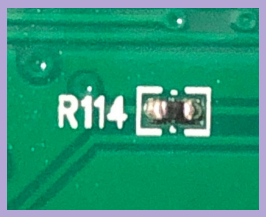
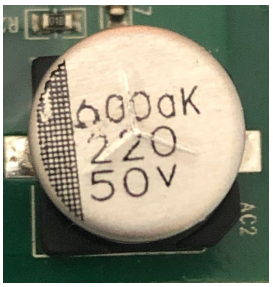
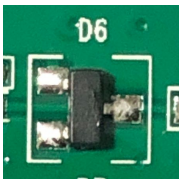


Table 3.0 Important Motherboard Components

Component Image And Part Number	Quantity	Function (what it does)
Resistor 	222	The resistor is present to provide electrical resistance mainly by reducing current flow and dividing voltages.
Aluminum Capacitor 	6	The aluminum capacitor is used for storing a large amount of current that is stored for later use.
Chip Capacitor 	410	The chip capacitor is a passive chip used to store electrical energy and is mounted directly onto the PCB (printed circuit board).
Diode 	9	A diode is a semiconductor that acts as a switch and allows for current to flow in one direction.
Crystal Oscillator 	9	A crystal oscillator is a device which uses vibrations from a crystal to create an electric pulse.

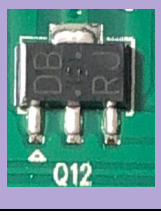
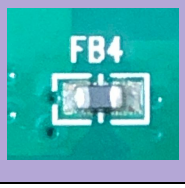
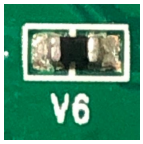
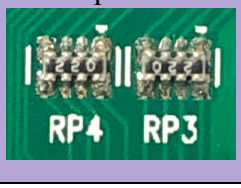
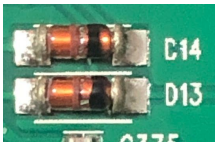
Inductor 	4	An inductor is used as a passive electrical component which stores energy as magnetic energy.
Transistor 	20	A transistor is a semiconductor which is used to control the flow of electricity.
Fuse 	4	A fuse is a safety for the circuit that will melt and break the circuit if too much current is sent through it.
Ferrite Bead 	53	A ferrite bead is a component that is used to suppress high frequency electronic noise to suppress current flow.
Vacuum Tube 	37	A vacuum tube is a device that controls the flow of electrons in a vacuum.
Pull-up Resistor 	16	Usually used with switches and transistors, pull-up resistors are made to ensure a known state for a signal.
Zener diode 	4	A zener diode allows current to flow in both directions as opposed to one but only when enough voltage is applied.

Figure 3.4 Miscellaneous Motherboard Components (Top)

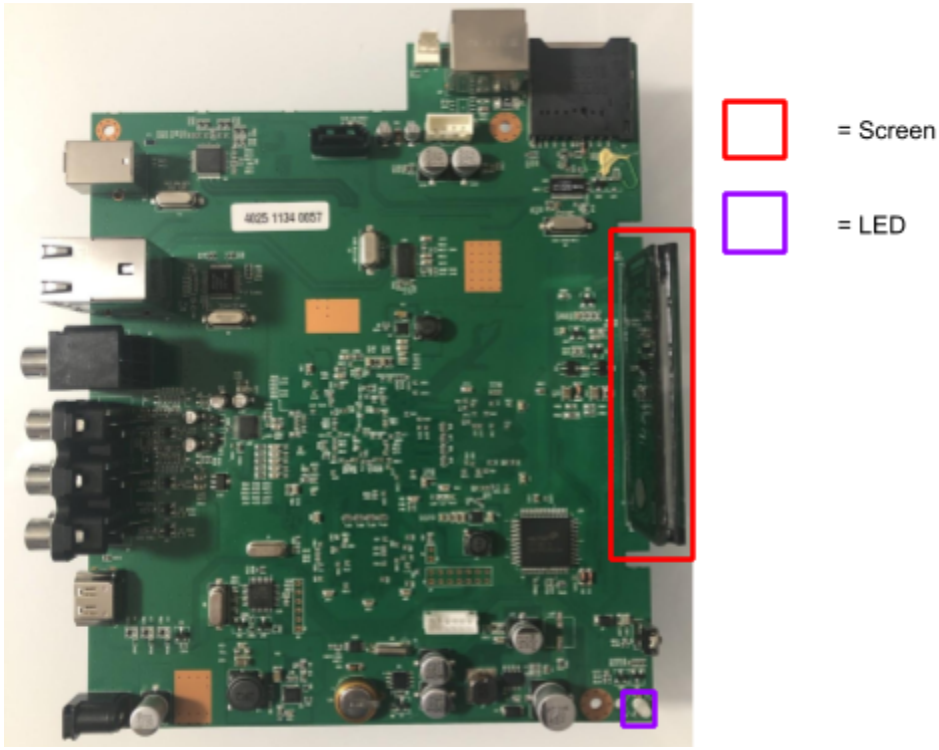


Figure 3.5 Miscellaneous Motherboard Components (Bottom)

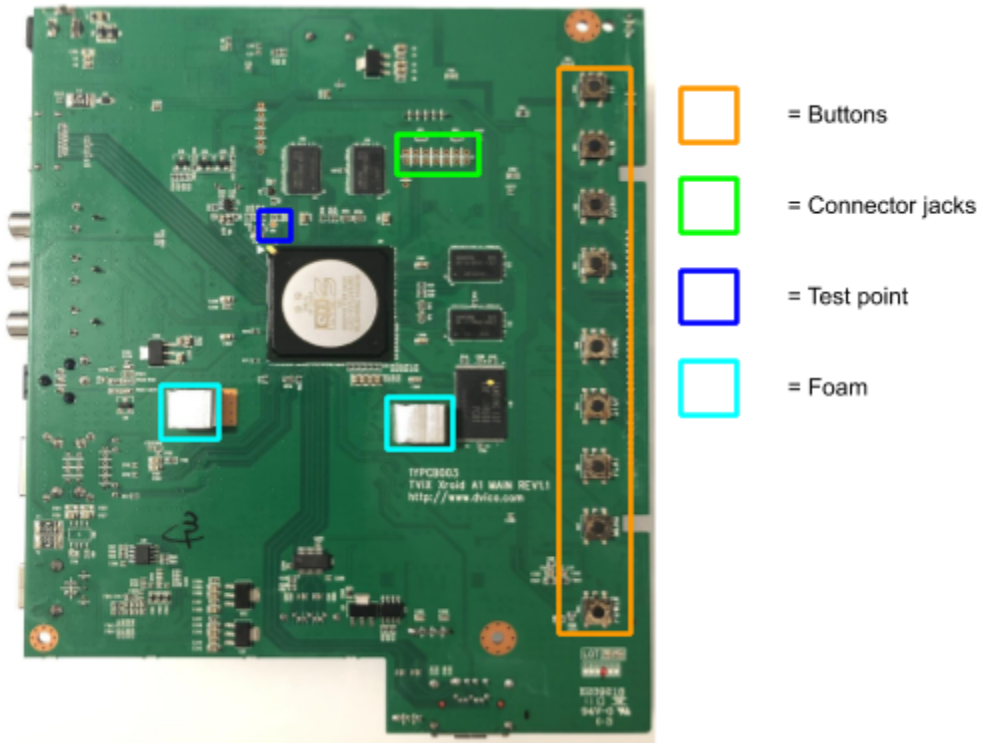
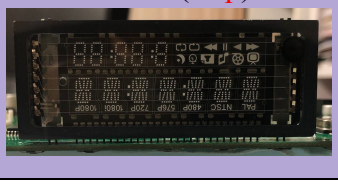
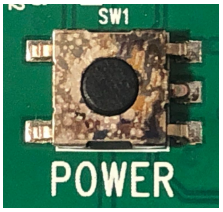
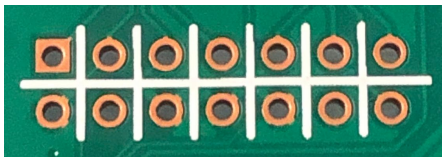
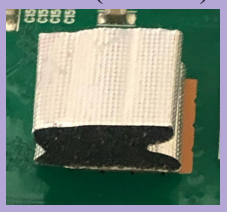
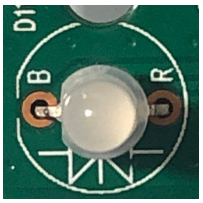
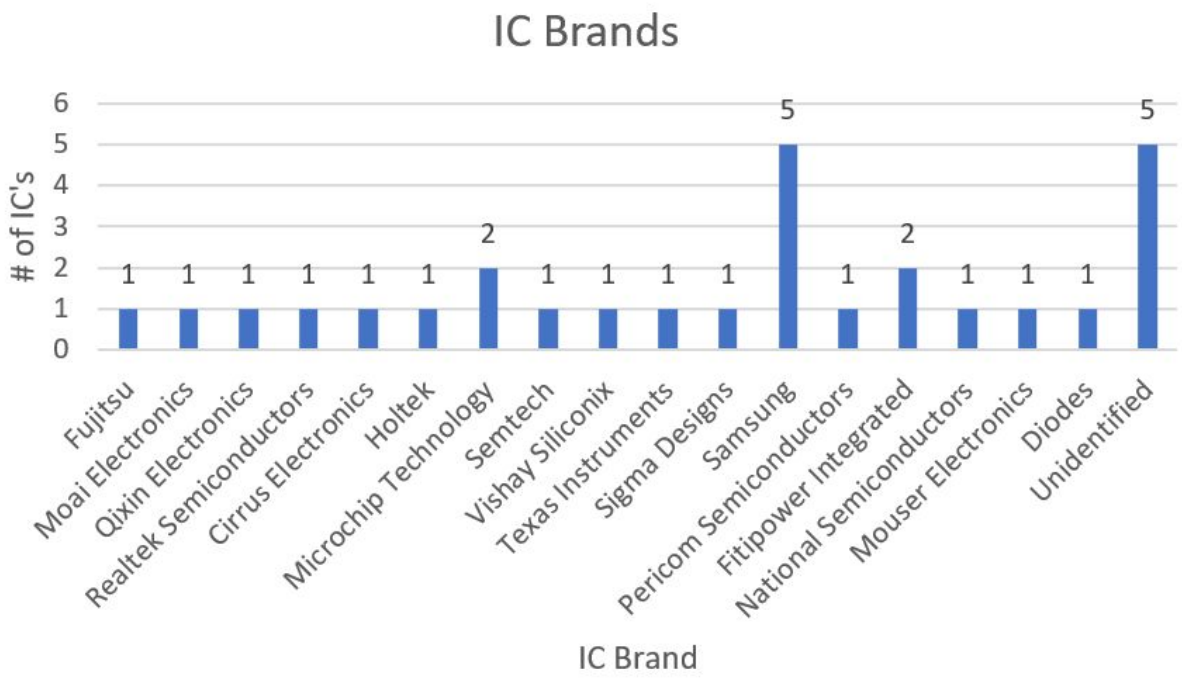
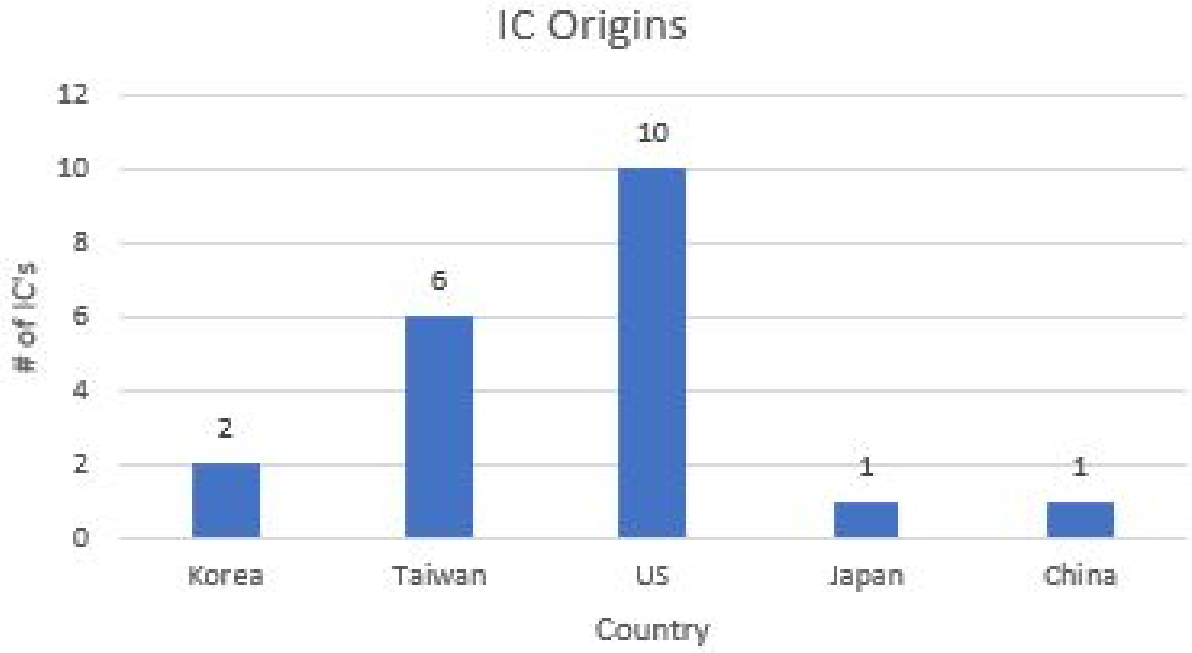
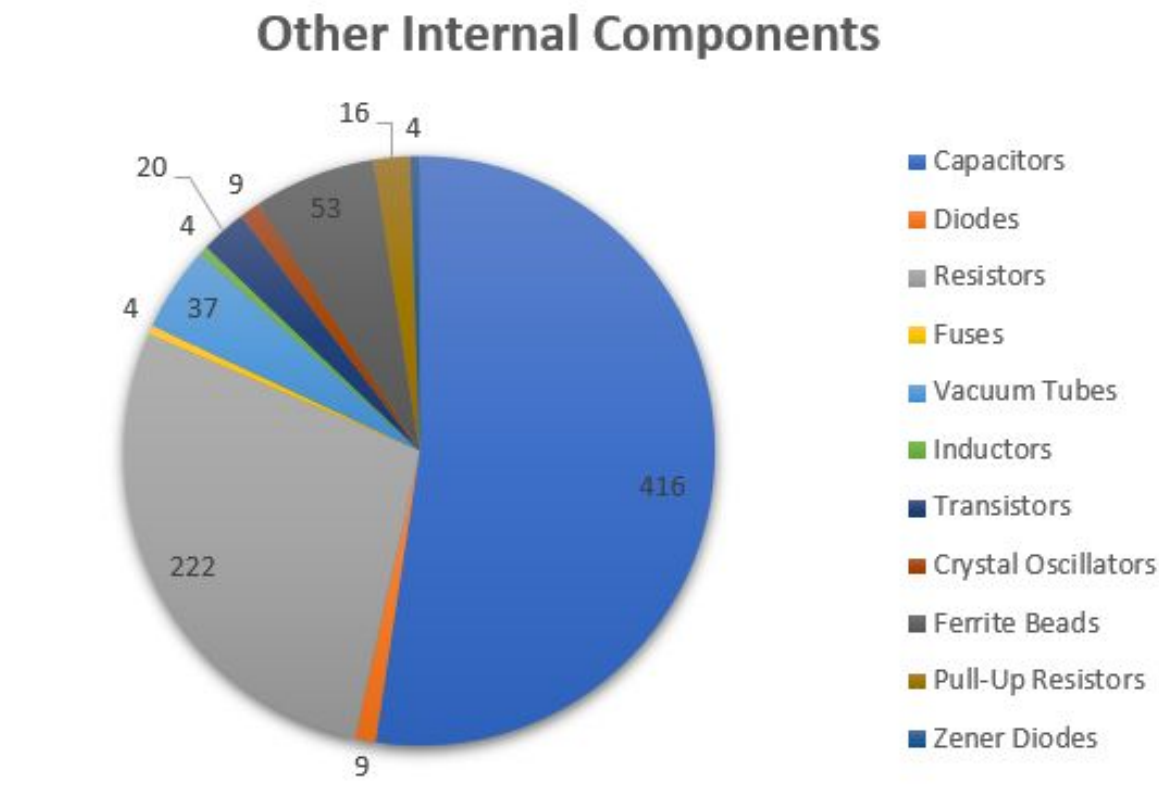


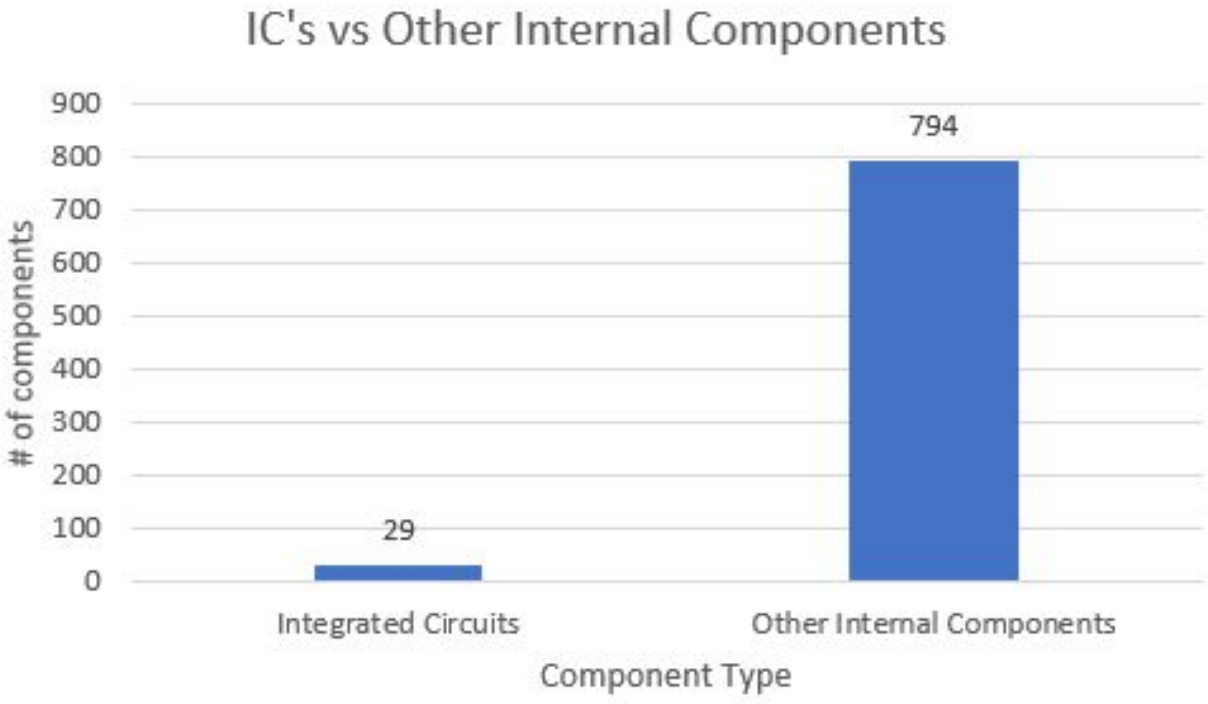
Table 4.0 Miscellaneous Motherboard Components

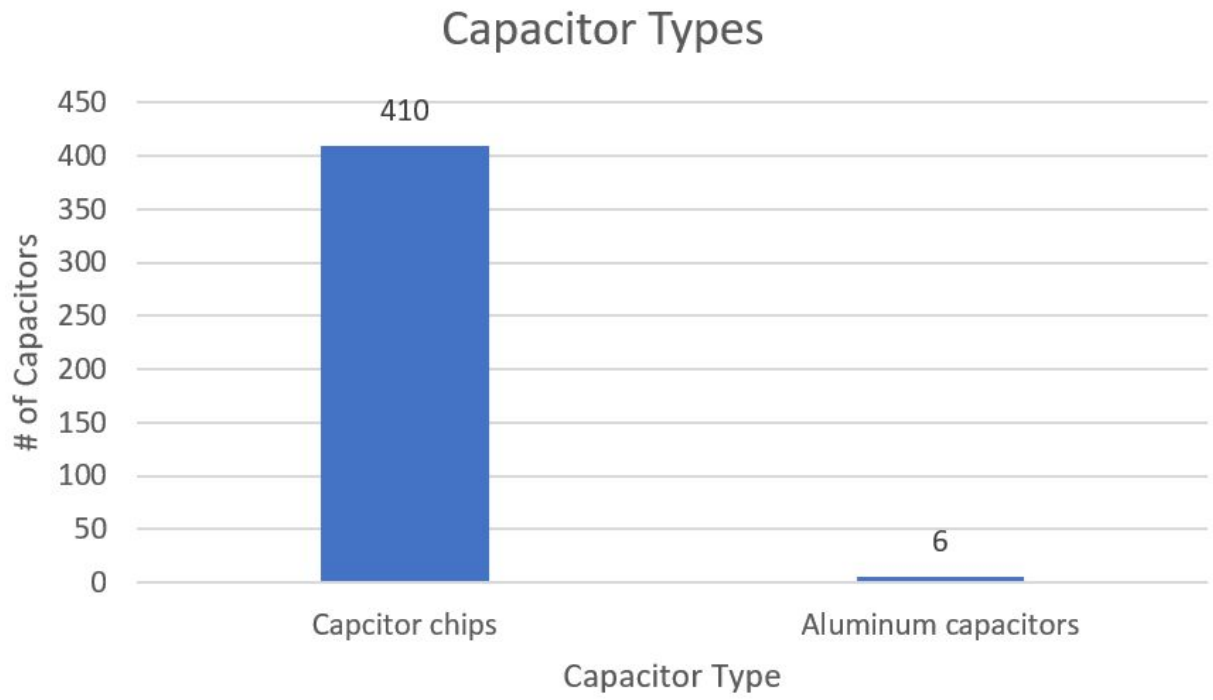
Component Image And Part Number	Quantity	Function (what it does)
Screen (Top) 	1	The screen is an LCD display used to show the current playing and media and other user input.
Buttons (Bottom) 	9	The buttons on the motherboard are connected to those on the outside of the device and allow for user input.
Test point (Bottom) 	1	The test point is a spot on the motherboard where you can input test signals or monitor the circuitry.
Connector Jack (Bottom) 	2	Connector Jacks are used for adding more components to the motherboard/device for debugging purposes using JTAG (Joint Test Action Group).
Foam (Bottom) 	2	The foam protects the motherboard from touching the metal casing which would cause an electrical short circuit.
LED (Top) 	1	The LED is used to show whether the device is on or not.

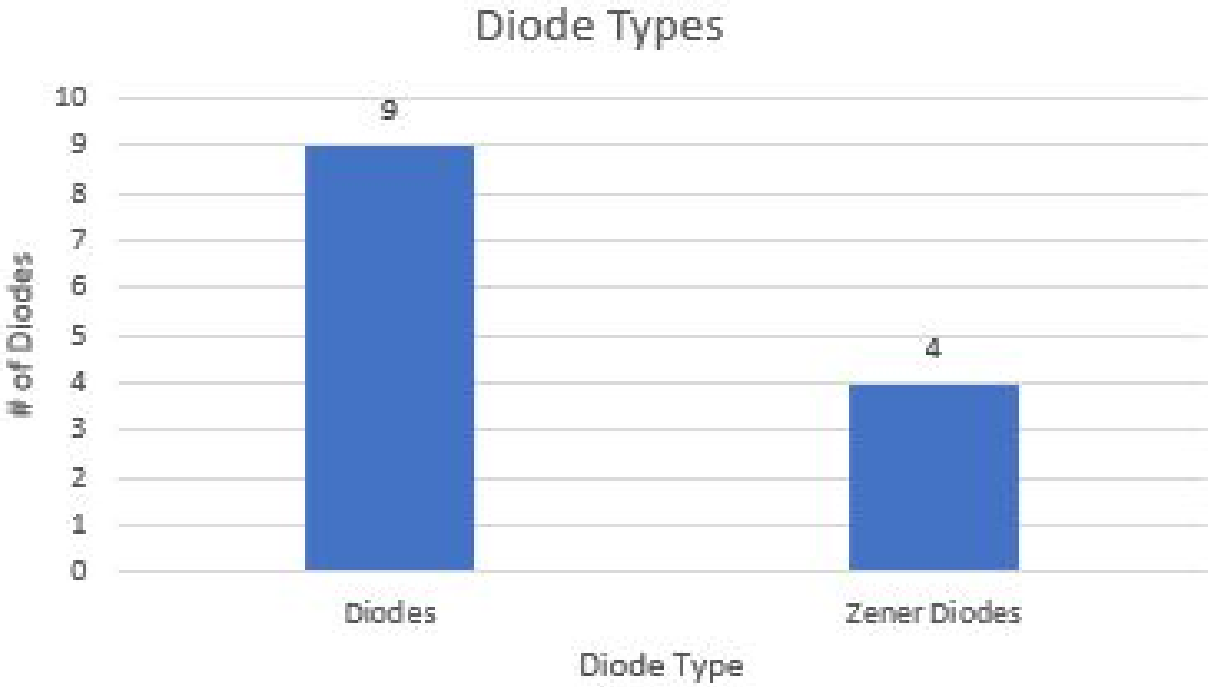

IC Brands
# of IC's
IC Brand
Fujitsu
Moai Electronics
Qixin Electronics
Realtek Semiconductors
Cirrus Electronics
Holtek
Microchip Technology
Semtech
Vishay Siliconix
Texas Instruments
Sigma Designs
Samsung
Pericom Semiconductors
Fitipower Integrated
National Semiconductors
Mouser Electronics
Diodes
Unidentified


IC Origins
# of IC's
Country
Korea
Taiwan
US
Japan
China


Other Internal Components
16
4
20
9
4
53
4
37
416
222
9
Capacitors
Diodes
Resistors
Fuses
Vacuum Tubes
Inductors
Transistors
Crystal Oscillators
Ferrite Beads
Pull-Up Resistors
Zener Diodes


IC's vs Other Internal Components
900
800
700
600
500
400
300
200
100
0
# of components
794
29
Integrated Circuits
Other Internal Components
Component Type


Capacitor Types
450
400
350
300
250
200
150
100
50
0
# of Capacitors
410
6
Capcitor chips
Aluminum capacitors
Capacitor Type


Diode Types
10
9
8
7
6
5
4
3
2
1
0
# of Diodes
9
4
Diodes
Zener Diodes
Diode Type

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