Computer Hard Drive Exploration

TEXAS INSTRUMENTS

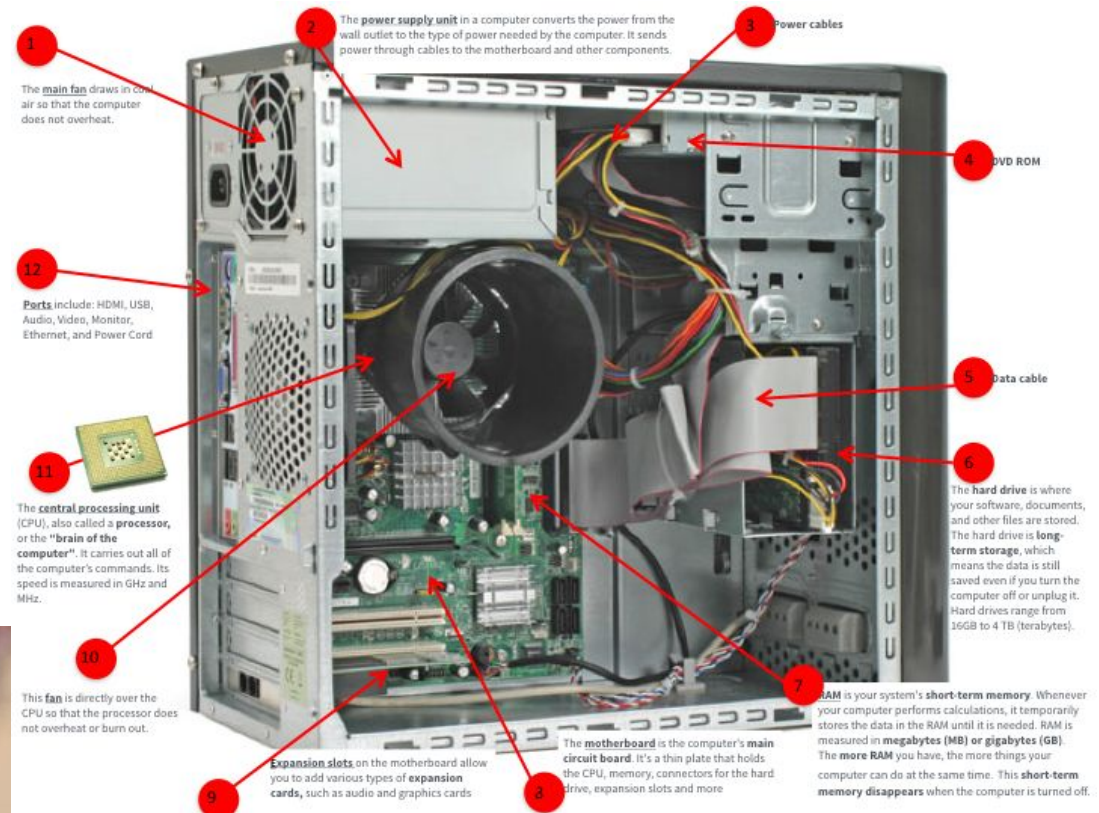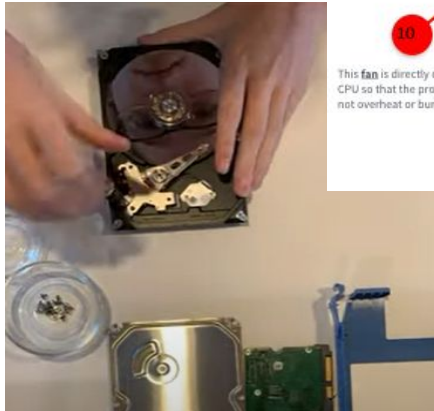REC FOUNDATION
ROBOTICS EDUCATION & COMPETITION FOUNDATION

Introduction

We selected a computer hard drive to deconstruct because of our Covid limitations. Our Vex Administrator had some spare computer hard drives available that were going to be recycled and we needed multiple to allow for social distancing. We sent each person in the team home with one to take apart. We thought it would be neat to see what was really inside of a computer and were amazed how small a hard drive is in relation to how much data is stored on one.

Hard Drive Components

The hard drive itself is just a small part of a desktop computer, there are many other components that ensure functionality. But the Hard Drive is where all the long term storage of data is kept.

On the next few pages you will see each of the components of the hard drive and an explanation of what they do within the unit.

2 The **power supply unit** in a computer converts the power from the wall outlet to the type of power needed by the computer. It sends power through cables to the motherboard and other components.

3 Power cables

4 DVD ROM

1 The **main fan** draws in cool air so that the computer does not overheat.

12 **Ports** include: HDMI, USB, Audio, Video, Monitor, Ethernet, and Power Cord

5 Data cable

6 The **hard drive** is where your software, documents, and other files are stored. The hard drive is **long-term storage**, which means the data is still saved even if you turn the computer off or unplug it. Hard drives range from 16GB to 4 TB (terabytes).

11 The **central processing unit** (CPU), also called a **processor,** or the **"brain of the computer"**. It carries out all of the computer's commands. Its speed is measured in GHz and MHz.

10 This **fan** is directly over the CPU so that the processor does not overheat or burn out.

7 RAM is your system's **short-term memory**. Whenever your computer performs calculations, it temporarily stores the data in the RAM until it is needed. RAM is measured in **megabytes (MB) or gigabytes (GB)**. The **more RAM** you have, the more things your computer can do at the same time. This **short-term memory disappears** when the computer is turned off.

9 **Expansion slots** on the motherboard allow you to add various types of **expansion cards,** such as audio and graphics cards

8 The **motherboard** is the computer's **main circuit board**. It's a thin plate that holds the CPU, memory, connectors for the hard drive, expansion slots and more
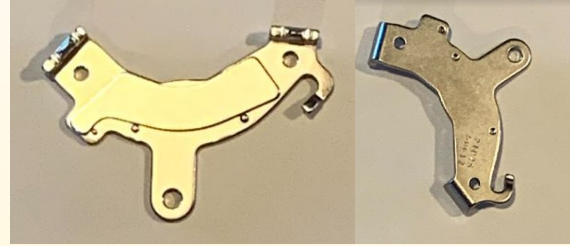
The **Metal Cover** is the piece that protects the other components inside.

The **Base Casting Assembly** keeps all of the components in their place and allows them all to function free of dust and debris.

The **Actuator** has a very strong magnet on one side. It connects to the other actuator plate to secure the actuator arm.

The **Small Spindle** allows the smooth rotation and movement of the Read-Write Head.

The **Actuator Arm** controls the recording and is the component that is moving the surface media to read and write data.

The **Read-Write Head** is responsible for reading and writing the data from the disk; it is connected to the actuator arm.

REVERSE
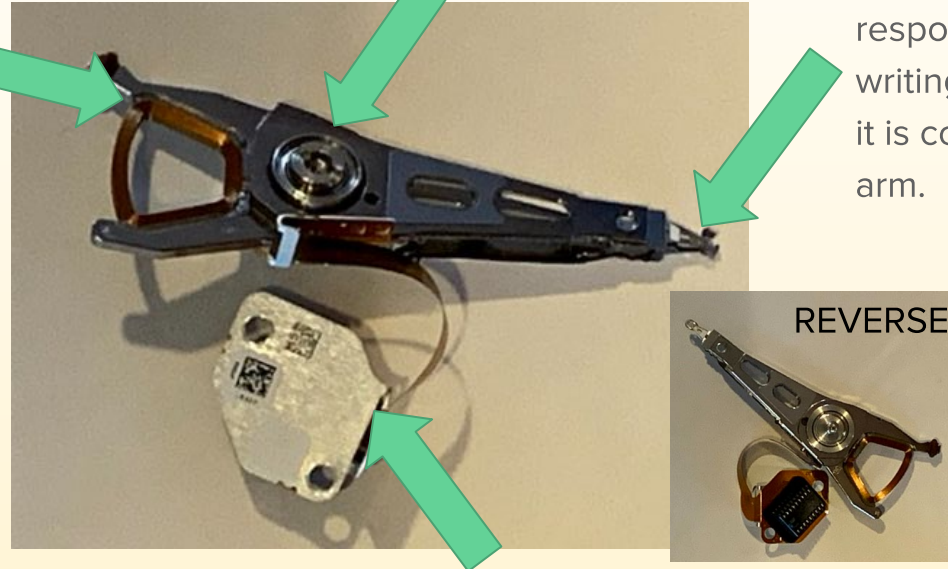
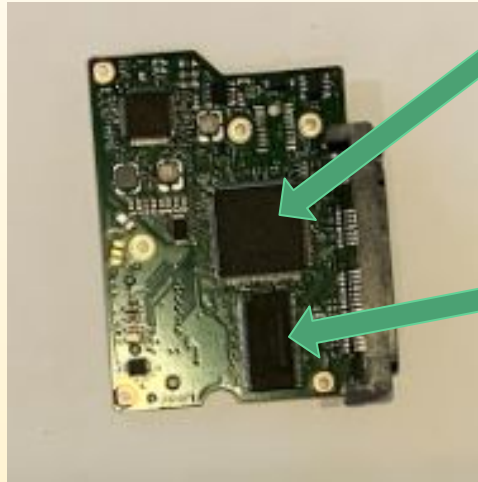The **Ribbon Cable/Flexible Connector** is used for the internal wiring, while the **Electronic Controller** makes the connection to to the circuit board.

Central Spindle holds a rotating platter in place. Spindle speed, which is measured in rotations per minute, is used to measure the disk drive performance.

This **Magnetic Platter** is the piece that stores all the data on your device in long term storage. This unit had 500GB of storage.
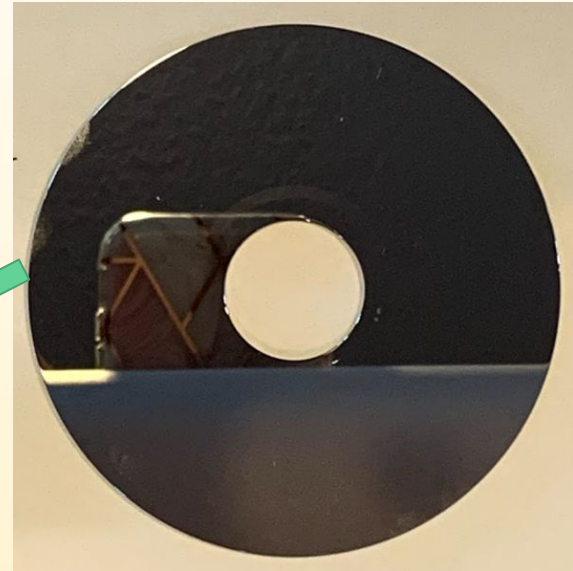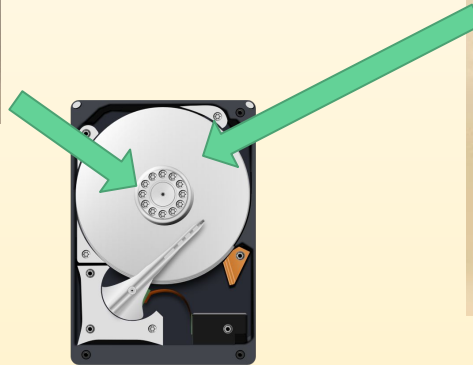
Printed Circuit Board (PCB) "tells" the hard drive how to operate. It processes signals from the computer and outputs information to the central processing unit (CPU).

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Integrated Circuits (ICs) TQFP-176

Manufacturer :	LSI Corporation (Avago)
Package/Case :	TQFP-176
Product Categories :	Integrated Circuits (ICs)
Datasheet:	B5502D0 PDF
RoHs Status:	Lead free/RoHS Compliant
In-stock:	278

W9412G6KH-5   Datasheet ⬇

Digi-Key Part Number	W9412G6KH-5-ND
Manufacturer	Winbond Electronics
Manufacturer Product Number	W9412G6KH-5
Supplier	Winbond Electronics
Description	IC DRAM 128M PARALLEL 66TSOP II
Manufacturer Standard Lead Time	10 Weeks
Detailed Description	SDRAM - DDR Memory IC 128Mb (8M x 16) Parallel 200MHz 50ns 66-TSOP II

Our Circuit Board <u>did</u> contain a Texas Instruments Component : Integrated Circuit

This tiny circuit is the brains behind electronic devices. An IC is a collection of electronic components: resistors, transistors, capacitors all stuffed into a tiny chip.
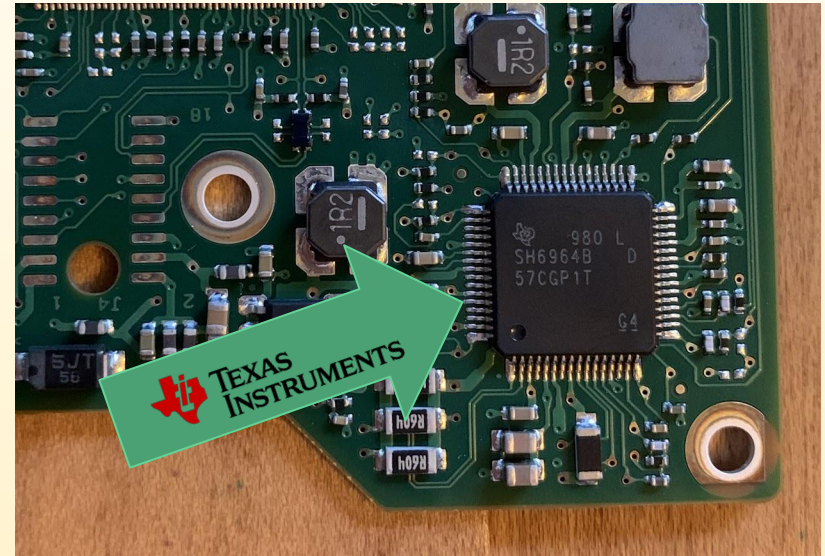

Products > Integrated Circuits (ICs) > SH6964B
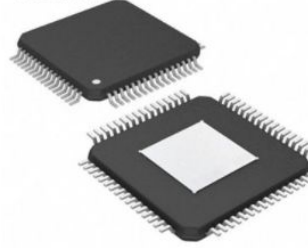
SH6964B HOT

Integrated Circuits (ICs) TQFP/64

Manufacturer :	Texas Instruments, Inc
Package/Case :	TQFP/64
Product Categories :	Integrated Circuits (ICs)
Datasheet:	SH6964B PDF
RoHs Status:	Lead free/RoHS Compliant
In-stock:	506

What we learned about how a Hard Drive works:

The hard drive contains a spinning platter with thin magnetic coding. A "head" moves over the platter, writing 0's and 1's as tiny areas or magnetic north and south on the platter. To read the data back, the "head" goes to the same spot, notices the north and south spots flying by, and so deduces the stored 0's and 1's. This is binary code or bits used to represents text, computer processor instructions, or any other data.
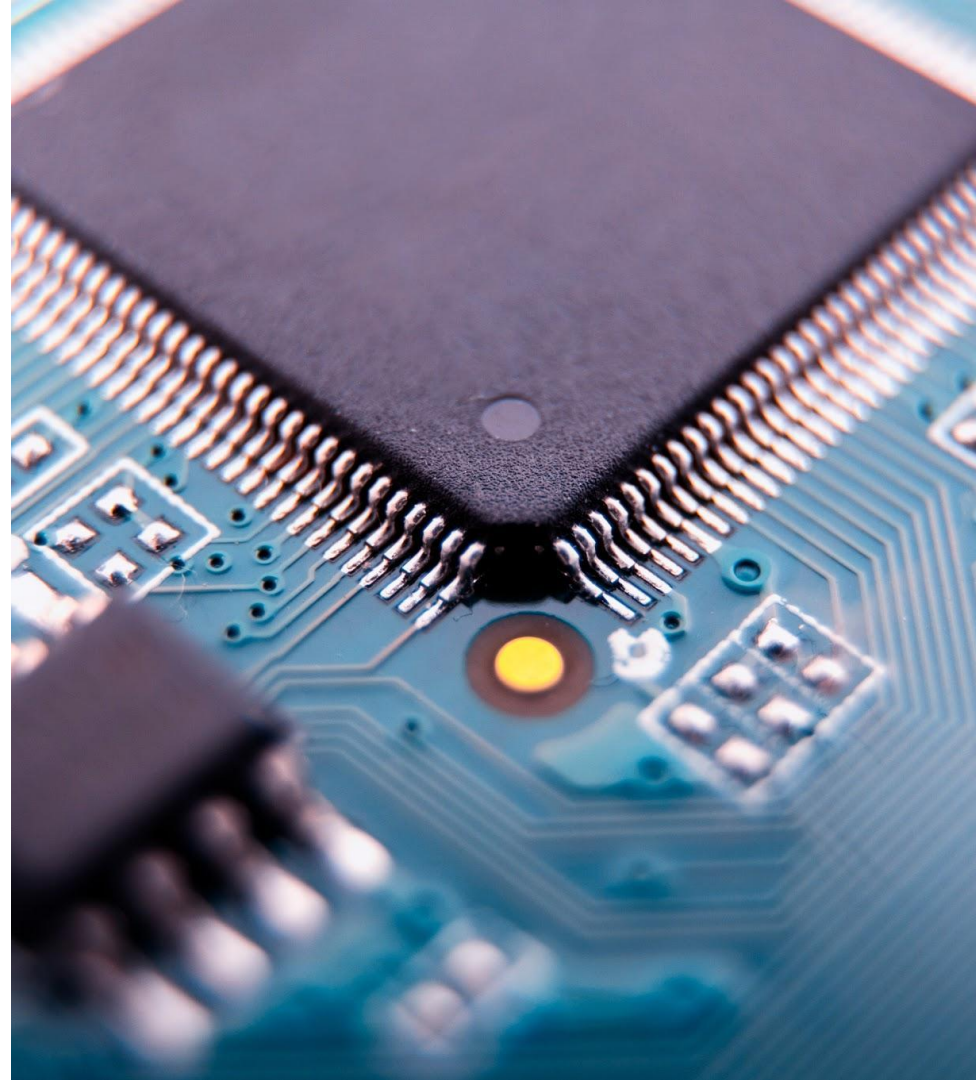
All of the components inside the hard drive work together to transfer what we save on a computer (documents, photos, spreadsheets, even calendars) to the magnetic platter as binary code. This code can be retrieved every time we open a previously saved file and translated into what we see on our computer screen.

The hard drive is a very sensitive piece of equipment inside of the CPU. Dust, fingerprints, and magnets can all destroy the data stored on the platter. The drives we deconstructed were built very sturdy to ensure the platter and read-write head and actuator arm functioned smoothly and securely. But as we found, once one of these hard drives are opened up, it is nearly impossible to retain the integrity of the data.

Want to see more?

We have created a short time lapse video of our deconstruction to share with fellow students and anyone interested in how things work:

https://www.youtube.com/watch?v=sXC4yIbVmK4

Citations:

How a Hard Drive Works *Retrieved December 3, 2020:*

https://cs.stanford.edu/people/nick/how-hard-drive-works/#:~:text=The%20hard%20drive%20contains%20a,the%20stored%200's%20and%201's

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