

# Texas Instruments Electronics Online Challenge



**ROBOPOWER TEAM**  
(36637A)



# Table of Contents: -


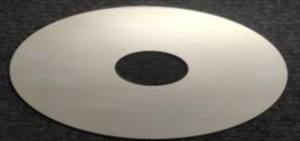






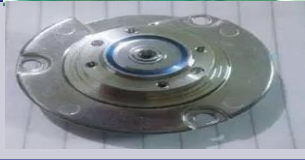


| Title                               | Page |
|-------------------------------------|------|
| 1- Introduction.....                | 3    |
| 2- List of Internal Components..... | 4    |
| 3- Summary & Pictures.....          | 5    |
| 4- Conclusion.....                  | 15   |
| 5- References.....                  | 16   |



# 1- Introduction: -

- **Texas instrument** is one of the largest electronics companies in the world in the sense that any electronic part from TI you need will definitely have the most modern and accurate all the electronics.
- Amidst the vast array of electronics, our team opted to disassemble a hard disk.
- One day while we were working on the laptop, we wondered how does it store all of these data. So, we searched about the most important storage units in the electronic devices and then we decided to deconstruct the hard disk which is the main storage units in the most of the electronic devices to find out how it stores data and to discover its internal components.

## 2- List of Internal Components: -

| Components                           | Photos   | Components              | Photos  |
|--------------------------------------|--|-------------------------|---|
| IC Processor (88I6540-LFH1)          |    | Circular Magnetic Discs |    |
| IC RAM (EM636165TS-6G)               |    | Magnets                 |    |
| IC Power (L6283 1.3)                 |    | SMD Resistors           |    |
| IC Memory (25f1024AN)                |   | SMD Capacitors          |   |
| Motors                               |  | SMD Diodes              |  |
| Reading and Writing Headers<br>Heads |  |                         |   |



### 3- Summary & Pictures:-

**First glimpse of the device we will be taking apart hard disk.**



**First glimpse of the inner components of the hard disk.**

**Aerial view of all the beginning processes of disassembly**



## When we disassembled the hard disk, we found:

- 1- A small electronic circuit: We searched for any TI components and other electronic components whose functions we don't know yet. We didn't find any TI elements, but we found another component which is similar in function with TI components, so we searched about it to know its function.
- 2- Some mechanical components, so we looked at how these components saves data. [\[1\]](#)



# A-The Electrical Components

## The Logic Board:

It contains all the hard disk's electrical components.

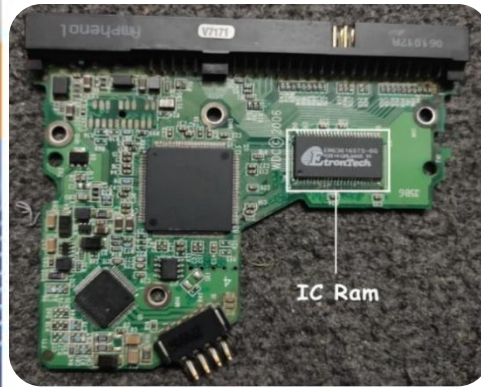


## 1- IC Processor (88I6540-LFH1):

This item is from MARVELL Company, this element transfers data between the hard disk and the processor and it controls the motors in the hard disk (Writing headers) In order for you to write and read on a CD.

## 2- IC RAM (EM636165TS-6G):

It is a component of EtronTech Company. It is the temporary memory which is erased as soon as the power is turned off or restarted. [7]



## 3- IC Power (L6283 1.3):

It is a component produced by STMicroelectronics. This is a power IC that supplies the motor with electric current due to the small current. This IC magnifies the current. The motor so this IC receives the command from the lfh-88i6540 to enlarge the current and send it to the motor [3]





# Pin Descriptions

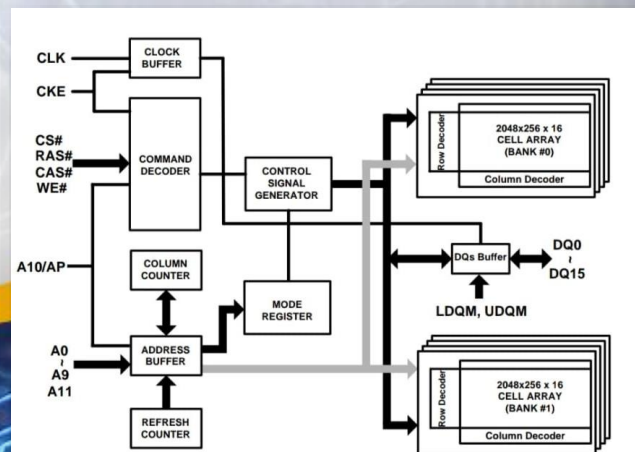
**Pin Assignment (TSOP II Top View)**

|        |    |    |      |
|--------|----|----|------|
| VDD    | 1  | 50 | VSS  |
| DQ0    | 2  | 49 | DQ15 |
| DQ1    | 3  | 48 | DQ14 |
| VSSQ   | 4  | 47 | VSSQ |
| DQ2    | 5  | 46 | DQ13 |
| DQ3    | 6  | 45 | DQ12 |
| VDDQ   | 7  | 44 | VDDQ |
| DQ4    | 8  | 43 | DQ11 |
| DQ5    | 9  | 42 | DQ10 |
| VSSQ   | 10 | 41 | VSSQ |
| DQ6    | 11 | 40 | DQ9  |
| DQ7    | 12 | 39 | DQ8  |
| VDDQ   | 13 | 38 | VDDQ |
| LDQM   | 14 | 37 | NC   |
| WE#    | 15 | 36 | UDQM |
| CAS#   | 16 | 35 | CLK  |
| RAS#   | 17 | 34 | CKE  |
| CS#    | 18 | 33 | NC   |
| A11    | 19 | 32 | A9   |
| A10/AP | 20 | 31 | A8   |
| A0     | 21 | 30 | A7   |
| A1     | 22 | 29 | A6   |
| A2     | 23 | 28 | A5   |
| A3     | 24 | 27 | A4   |
| VDD    | 25 | 26 | VSS  |

**Ball Assignment (VFBGA Top View)**

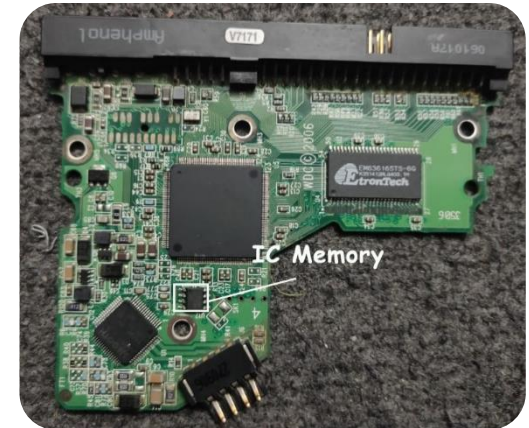
|   | 1    | 2    | ... | 6    | 7    |
|---|------|------|-----|------|------|
| A | VSS  | DQ15 |     | DQ0  | VDD  |
| B | DQ14 | VSSQ |     | VDDQ | DQ1  |
| C | DQ13 | VDDQ |     | VSSQ | DQ2  |
| D | DQ12 | DQ11 |     | DQ4  | DQ3  |
| E | DQ10 | VSSQ |     | VDDQ | DQ5  |
| F | DQ9  | VDDQ |     | VSSQ | DQ6  |
| G | DQ8  | NC   |     | NC   | DQ7  |
| H | NC   | NC   |     | NC   | NC   |
| J | NC   | UDQM |     | LDQM | WE#  |
| K | NC   | CLK  |     | RAS# | CAS# |
| L | CKE  | NC   |     | NC   | CS#  |
| M | A11  | A9   |     | NC   | NC   |
| N | A8   | A7   |     | A0   | A10  |
| P | A6   | A5   |     | A2   | A1   |
| R | VSS  | A4   |     | A3   | VDD  |

## Block Diagram



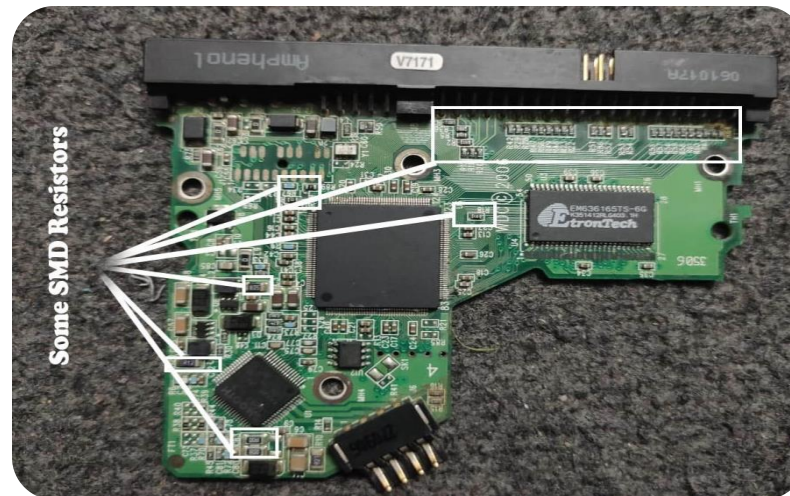
#### 4- IC Memory (25f1024AN):

This component is produced by Atmel Corporation. This element stores the hard disk information (manufacturer data - hard disk space - production date - system Employment). [4]



#### 5- SMD Resistor:

It reduces the electrical current passing by the components of the board.

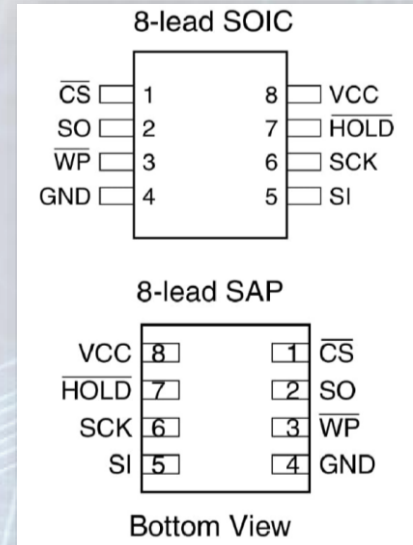




# IC Memory (25f1024AN)

## Pin Configurations

| Pin Name | Function                   |
|----------|----------------------------|
| CS       | CS Chip Select             |
| SCK      | SCK Serial Data Clock      |
| SI       | SI Serial Data Input       |
| SO       | SO Serial Data Output      |
| GND      | GND Ground                 |
| VCC      | VCC Power Supply           |
| WP       | WP Write Protect           |
| HOLD     | HOLD Suspends Serial Input |

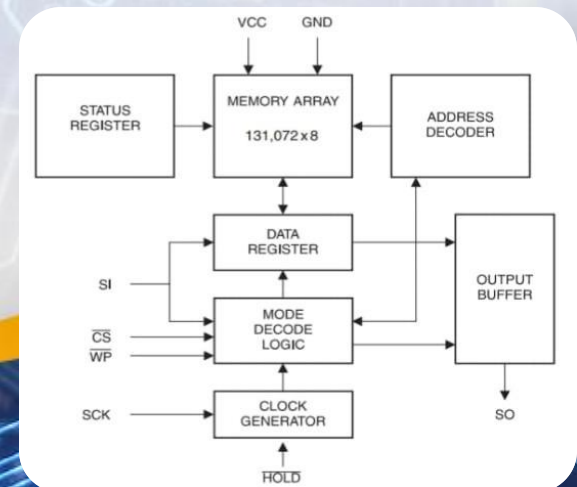


[5]

## Absolute Maximum Ratings

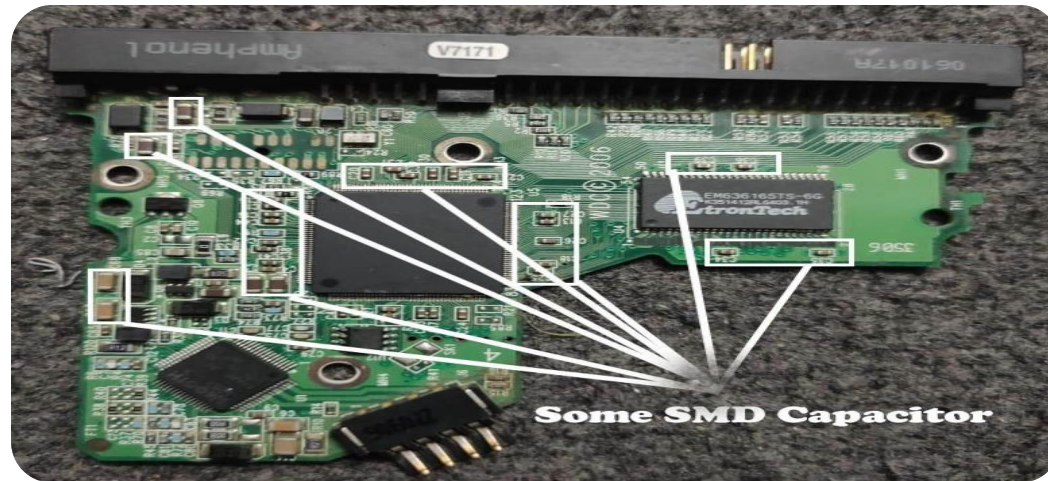
Operating Temperature.....-40°C to +85°C  
Storage Temperature .....-65°C to +150°C  
Voltage on Any Pin  
with Respect to Ground..... -1.0V to +3.6V  
Maximum Operating Voltage ..... 3.6V  
DC Output Current..... 5.0 mA

## Block Diagram



## 6- SMD Capacitors:

A capacitor is a passive two-terminal electrical component that stores electrical energy in an electric field.



## 7- SMD Diode:

It makes the current flow in one direction and doesn't allow it to flow in the opposite one.

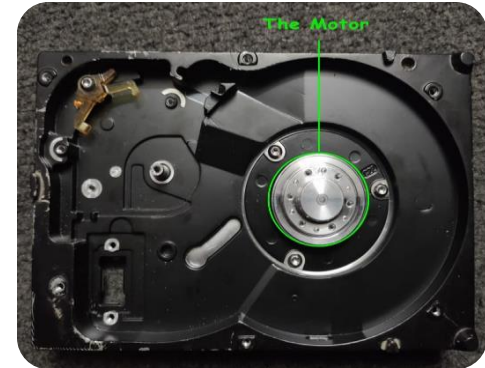




# B-The Mechanical Components

## 1- The Motor:

It is responsible for the movement of the circular magnetic disk. [6]



## 2- Reading and Writing Header's Heads:

It moves backwards and forwards on the circular disks through horizontal arms extending over both the upper and lower layers and It can reach a point on a magnetic disk through its movement with the rotating movement of the disks based on the heads Writing and reading by writing data to the hard disk, and there are heads that read the data. [2]



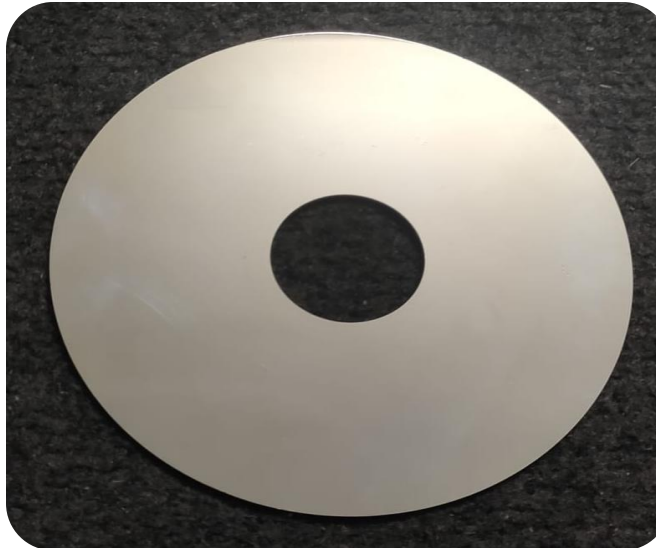
### 3- The Magnets:

These two magnets move the reading and writing header's head on the hard disk [2]



### 4- Circular Magnetic Discs:

It saves the data written on it, where the motor controls its rotation, and the writing and reading heads write the data on it.





## 4- Conclusion

In conducting this research project, we discovered a lot important components and the true electrical function of them. We had heard of before, but never looked into. While this device is not associated with Texas Instruments, we learned more about the very global path that the products we use must travel in order to make it into our possession and how even the simplest of devices is very complex on the inside. We also concluded how the hard disk works.

- 1- Commander intervention IC ([lfh-88i6540](#)) to perform its processors where the command gives reading or writing the data. Next, it sends the IC commands to the power to enlarge the current and send it to the motor. Then, the magnetic disks start to rotate the read and write headers write the data.
- 2- The data is written in the machine language, which is zero and one, and then stored on magnetic cylinders for preservation and reference.
- 3- The characteristics of the hard disk can be known by IC ([25f1024an](#)), and by this IC can be known ([Hard](#) disk space, manufacturer, production date, and operating system). [\[6\]](#)

# 5. References

- [1] Fernando, Gayanath, (2008). "Metallic Multilayers and their Applications in Handbook of Metal physics science direct" <https://www.sciencedirect.com/topics/physics-and-astronomy/magnetic-hard-disk>
- [2] Hassan, Ahmed, (2016). "Hard Disk Series. The components of the hard disk inside, Computer world" <https://www.computer-wd.com/2016/05/hard-disk-components.html?m=1>
- [3] L6280 (THREE CHANNELS MULTIPOWER DRIVER SYSTEM (STMicroelectronics) 2018 <https://pdf1.alldatasheet.com/datasheet-pdf/view/22562/STMICROELECTRONICS/L6280.html>
- [4] Nahal, Raed, (2015). "The hard disk and its components and the characteristics and disadvantages of each species, Matrix219" <https://www.matrix219.com/eg/2016/10/30/%D8%A7%D9%84%D9%87%D8%A7%D8%B1%D8%AF-%D8%AF%D9%8A%D8%B3%D9%83/>
- [5] SPI Serial Memory page (1:18) <https://cdn.datasheetspdf.com/pdf-down/2/5/F/25F1024AN-ATMEL.pdf>
- [6] Yones, Osama, (2017). "How does the hard drive work? What are its components and modus operandi? I believe in science" <https://www.ibelieveinsci.com/?p=27933>
- [7] Zlatanov, Nikola, (2015). "Hard Disk Drive and Disk Encryption. IEEE Computer Society " <https://www.researchgate.net/publication/299282101HardDiskDriveandDiskEncryption>



Thank You

