

# Solid State Memory

SSDs are called “solid-state” because they have no moving parts.

SSDs serve the same purpose as HDDs: they store data and files for long-term use. They use electrical charge to store 1s and 0s.

SSDs use a grid of electrical cells to store data. These grids are separated into sections called “pages”. Pages are clumped together to form “blocks”.

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## How electrical charge is used:

The basic unit of storage in an SSD is the electrical cell. This contains a transistor capable of holding an electric charge. It can hold this charge after power is removed, so it's non-volatile, unlike RAM (but they use transistors in a similar way).

If a cell holds an electrical charge it represents a 1. If it has no charge it's a 0. This is the binary which when put together stores data and instructions.

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## Writing and rewriting data:

SSDs can only write to empty pages in a block. In HDDs, data can be written to any location on the plate at any time, and that means that data can be easily overwritten. SSDs can't directly overwrite data in individual pages. They can only write data to empty pages in a block.

This means that SSDs become slower over time and a complex process is needed to delete blocks.

One of the biggest issues with SSDs is that each cell can only be rewritten to a limited number of times.

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## Limits to using each cell:

As an SSD is used, the electrical charges within each of its data cells must be reset. The electrical resistance of each cell increases slightly with every reset, which increases the voltage necessary to write into that cell. Eventually, the required voltage becomes so high that the particular cell becomes impossible to write to.

So, SSD data cells have a limited number of writes, whereas HDDs can, in theory, be rewritten as many times as required. But the limit is 1000s of writes which is usually enough to last over 10 years with normal use.

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## Power failure:

SSDs are also susceptible to power failure, leading to corruption of data or even the failure of the drive itself. The power surge which happens with a power cut off can damage cells.

USB flash drives and SD cards, have similar issues to solid state drives. They have fewer components but the types of memory cell used are usually cheaper so they are less reliable.

Just pulling a device out of a computer can cause a power surge capable of corrupting the storage device.

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## Long-term storage:

Data cells used in SSD devices may have a limited lifespan - they need to retain electrical charge. As a result, SSD may not be a good choice for long term storage.

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Pros of SSD	Cons of SSD
Smaller - due to cost	More expensive per MB
Quicker than HDD when new	Slow down once blocks have been written to - process of moving data around is more difficult on SSD
Write time likely to be more than 10 years - HDD will be likely to suffer mechanical failure before this	Limit to number of times each cell can be written to
No moving parts - more resilient to damage	Vulnerable to power outages
No moving parts so need less power	Lifespan limited due to need to keep electrical charge
No moving parts so less heat created	Not compatible with old systems
USB drives and SD cards very portable	