# Is SD card a good idea for long term data storage?

This question previously had details. They are now in a comment.

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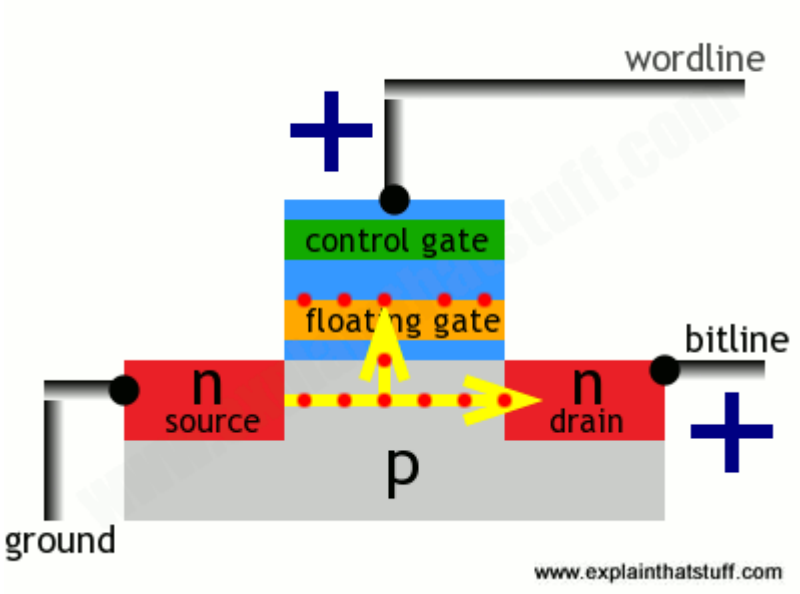
No. Flash memory in general has a relatively short-term reliability. The data doesn't necessarily last for an extended time.




Flash works by storing a charge on the floating gate of a special MOS transistor. The gate is considered "floating" because it's insulated from the transistor's channel and from the control gate via silicon oxide insulators. A process called Fowler-Nordheim tunneling is used to put charge on this gate, to switch it from a "0" after erasure to a "1". That injects charge onto the gate, and that charge basically just stays there.

In a perfect world, it would stay there forever. However, charge does gradually bleed off, as the insulators are not perfect. This general decay of any storage medium has been dubbed "bit rot".

According to Cypress (a manufacturer of NAND flash devices used in SD cards, USB dongles, and SSDs), one of their devices written just once has a data retention life of 20 years (http://www.cypress.com/file/202316/download

). If it’s had less than 1,000 erase-write cycles, it’s good for 10 years. If it’s over 1,000 erase-write cycles, they recommend it only for one year of data retention.

That’s for Cypress single and MLC flash memories. Single cell means basically that the charge you store is an on-off value. But since a FET transistor is basically a variable resistor when in its active range of operation, flash makers have got clever an decided to store more than one value per cell. By using four levels of charge you get an “MLC” (multi-level cell) memory that can stuff two bits per cell. And some even use a “TLC” design, for seven charge levels plus no-charge, storing three bits per cell. These flash memories wear out faster and are likely to have a lower data retention time.

**Storage Alternatives**

Due to their falling prices, some people use hard drives for archival. That’s a good idea… until it’s a bad idea. The good news is that the magnetic storage mechanisms in a hard drive yield very good data retention. The bad news is that they’re mechanical devices. A hard drive sitting for 5–10 years may simply not start up when you decide you need that data.

Another problem with long-term storage has been dubbed “format rot”. I have a bunch of 8mm and DV/HDV tapes here, some floppy discs, etc. Before I recently moved, I still had some ZIP discs around. I think I still have an 8mm camera, I’m sure I have one DV camera, but they haven’t been used in years. I don’t have a Firewire interface in my PC at this moment, but probably in box somewhere. So I could probably get at those tapes, but it would be some work. And that’s assuming the cameras still work. I might have a USB floppy drive around here, but it won’t read any my old Amiga floppies. I don’t have a ZIP drive, I’d have to track one down on eBay if I needed that. Before the move, I had a bunch of old PATA and even ST-506 hard drives.. tossed ’em all without looking. I could probably find a PATA to USB interface, though the ST-506 interface, fuggetaboudit. I also tossed some old computer tapes… no idea what happened to the tape drive, and tape often has bit rot after 10 years or so.

In short, format for archival matters.

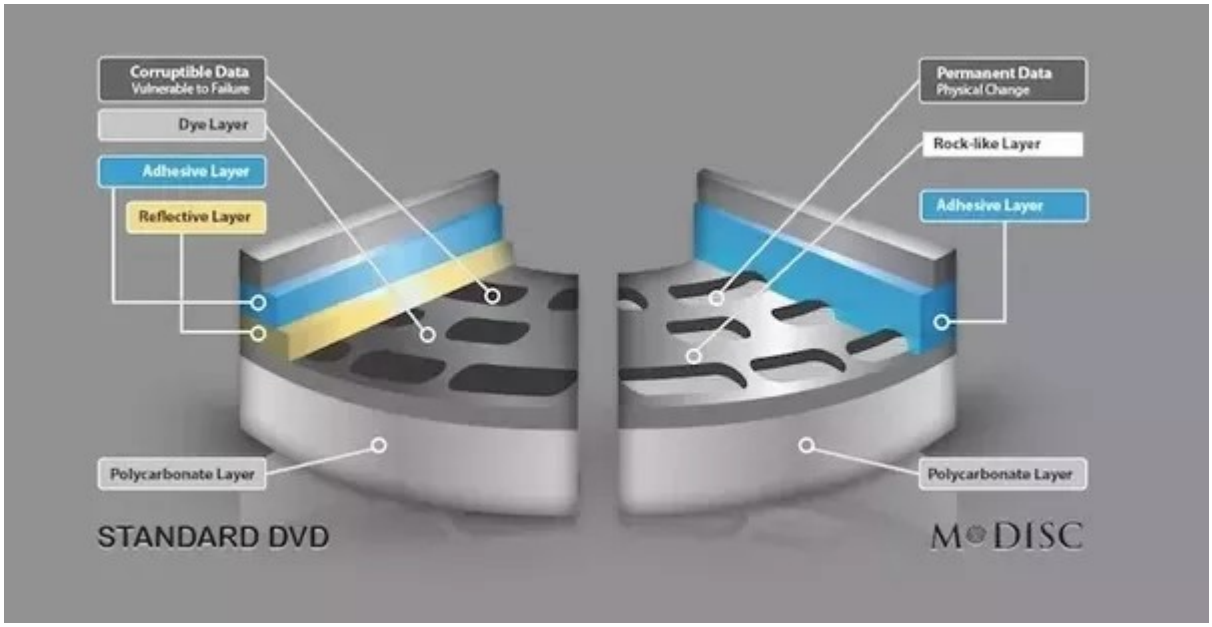
People used to use CD-R and DVD-R, I’m not so sure those are popular options anymore, due mostly to data capacity. Forgetting about capacity for second, CD-R and DVD-R mostly use some kind of organic dye formulation. What this means is that the disc starts out all “dark” (low reflectivity) and your laser zaps a bit of material, revealing the reflective layer underneath. Works good.

But there are problems. The organic dye itself can gradually degrade. Some kind of organic dye will be “exposed” by sunlight.. you could destroy the old CD-Rs leaving one on your car dashboard for an afternoon. The reflective layer can be gold or aluminum, usually a layer so thin you can see through it, and it, too is subject to degradation over time.

As a result, conventional CD-R and DVD-R is usually not recommended for anything but short-term storage. The newer dyes like AZO are better than the original Cyanine, but it’s still not a long-term solution.

The original Blu-ray recordable disc, however, is a big improvement. This is currently dubbed “high to low” (or HTL) Blu-ray. In an HTL Blu-ray, the recording layer is a sputtered copper and silicon,

which starts out reflective. When a laser hits it, the copper and silicon fuse, creating an area of low reflectivity. This inorganic solution is much less prone to degradation over time, by heat and light, etc.




The best format for long term storage that's available to the average consumer is probably M-Disc (Torture testing the 1,000 year DVD

). M-Disc claims to "laser engrave" your data onto a hard "glassy carbon" material layer in the disc… it's actually quite a bit like the way BD-R HTL works, only with proprietary materials. Like BD-R HTL, the material itself is reflective, there's no gold or aluminum sputtering needed. These used to be pretty expensive, but the technology has been broadly licensed lately, dropping the price quite a bit.

You need a CD/DVD/BD drive specifically made to support M-Disc, mostly I think because it's writing high-to-low rather than low-to-high for a conventional DVD-R, so essentially, the drive has to write a "negative" pattern. Supposedly, a disc can be read by any old drive of the appropriate format. They're expensive, but not crazy expensive… I just saw a 100GB BDXL M-Disc offered at about $20 each… $5.00 more than a standard BDXL disc. Or a pack of 5 DVD-Rs for $16 (23.5GB total). Or a pack of 25 25GB BD-Rs for $60 (625GB total). A quick look around found me a 64GB SDXC card for $25. So the M-Disc storage these days isn't insane, based on what you're getting. M-Disc rates their storage life at 1,000 years. I'm probably good even if it only goes 500.

**Overlapping Archival Methodology**

The best advice: never put all your eggs in one carton. I have a practice for backing up my photos. First of all, they get imported to a RAID 10 hard drive system, which of course isn't archive but does provide protection against a single device failure. The photo data from the RAID is copied to a 16TB Drobo (basically another kind of RAID). The in-PC RAID only stores recent photos, last year or two, the Drobo has everything.

Every month or two, I fully back up the Drobo onto a pair of 5TB hard drives (yeah, I might eventually need a third). That's proof against any double drive failure that could make restoring that Drobo a big pain in the butt.

I also archive all photos on BD-R. I regularly copy over the most recent 25GB of photos to BD-R, so I have every photo on at least two BD-Rs. This year I'm expecting to add off-site storage on BDXL, now that the prices are more reasonable (a year ago, you could pay over $50 for a single 100GB BDXL).

Some people archive online as well. That's an option if you either don't produce a great deal of data and/or don't have internet service provider data caps. These all charge a montly service, and they're easy to use, often automatic, etc. Great, until they're not. Some of these companies have failed, leaving the users with a pretty short time to find a replacement service. They may also have varying degress of promise when it comes to data integrity. However, if you're the sort of person who does not have the discipline to do your own backups, this might be a great option. Review here: 25 Online Backup Services: Ranked & Reviewed

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