

Demystifying SD Cards by [ERIC REAGAN](#) on JANUARY 20, 2011 in [LEARN](#)



This article was sparked by a recent conversation I had with some folks at SanDisk. We were talking about the numerous types and ratings of SD cards and how there are lots of questions from users about the acronyms, labels and speed ratings associated with SD cards.

In this article, we're going to look at the different types of SD cards, along their speed class designation, and why these are important for you and your camera. By the end of this article, you should have a better understanding of what works in your camera and why. Moreover, you should be able to choose the right SD card for your camera and the way you want to use it.

What Are SD Cards?

In 2000, SanDisk, Panasonic and Toshiba formed the SD Association to develop a memory card storage device that could be used across a broad range of consumer electronics.

SD cards are the result of standardized specifications established by the SD Association.

There are currently 3 different form factors for SD cards.

Standard Size SD Card

The most common SD card used in digital cameras today measure 24mm x 32mm and is 2.1mm thick. These cards are the most widely used for digital cameras of all sizes – ranging from compact point and shoot cameras to full-size professional DSLRs.

miniSD Card

The miniSD card is 20mm x 21.5mm and is 1.4mm thick. miniSD cards were previously very common in cell phones; however, over the past couple of years or so we've seen microSD cards more widely used in cell phones, cameras and other compact electronics.

microSD Card

The microSD card is 11mm x 15mm – about the size of small child's fingernail. microSD cards are common nowadays in cell phones and are being seen more and more in point and shoot digital cameras.

SD, SDHC and SDXC Specifications (Card ‘Types’)

The SD Association develops specifications for all SD cards and devices. In order to use a particular type of SD card in a camera, for instance, the camera manufacturer must adhere to the SD Association’s specifications.

Currently, there are 3 main SD card types – SD, SDHC and SDXC.

The key difference in all of these cards is their storage capacity.

- Standard SD cards can be made with a max capacity of up to 2GB.
- SDHC cards come in capacities ranging from “greater than 2GB” to 32GB.
- SDXC cards range from “greater than 32GB” to 2TB. At present, the 2TB limit is a max theoretical limit only, with most SDXC cards in the 64GB flavor.

SD Card Speed Classes

SD cards are classified with numerical speed classes. At present, there are 4 non-UHS Speed Classes and 1 UHS Speed

Class in use. These ratings are based on a **minimum** sustained data writing speed.

- Class 2: 2MB/s minimum write speed
- Class 4: 4MB/s minimum write speed
- Class 6: 6MB/s minimum write speed
- Class 10: 10MB/s minimum write speed
- UHS Speed Class 1 (UHS-I): 10MB/s minimum write speed

Note that the card **type** (SD, SDHC or SDXC) is different from the card **speed class** (Class 2, 4, 6, etc.).

The speed classes were established in order to clearly identify the **constant speed requirements** for video capture.

Again, these speed classes are minimum requirements and SD card manufacturers can define constant minimum write speeds that are higher than the speed class designation of the SD card.

For example, SanDisk can make a card that has a minimum write speed of 15MB/sec and that card would still be a Class 10 card (*or a UHS-I card if it was a UHS design*). But a Class 10 card will always perform at a Class 10 standard as a base performance level.

Card manufacturers may provide even higher speeds (above the minimum) in their data transfer rate claims. Often the

numbers you see on the package cite the **maximum** read or write speed of a card. These are the fastest data transfer rates that the card is capable of achieving under optimal connection conditions.

The speed class ratings, however, are crucial for video capture. Because of video capture data rates are critical for camera manufacturers, they will typically recommend a particular SD speed class for use when capturing video with a camera or camcorder.

Speed Class Labeling

Each SD card is labeled with one of the above speed class ratings on the card's label. In non-UHS cards, you will find the speed class number within a letter "C" on the label. See the example below from Panasonic's SDXC Class 10 card.



For UHS rated cards, you will find the numeric class rating within the letter “U” on the card’s label. See the example below from SanDisk’s Extreme Pro SDHC UHS-I card.



Professional Speed Cards for Professional Results

I’ll say it one more time. The SD card “Speed Class” relates to minimum write speed for video capture purposes.

For still images, it’s another story. If you capture a still image with even the slowest of slow SD cards in your camera, it will record the image to the card . . . eventually.

Often times though, still photographers want to capture many images in quick succession. This means the camera needs to process those image files and get them off the camera’s built-in memory or buffer so that the camera can process more photos.

Memory Card Metaphor

Think of this process like a cook in a diner – filling orders as fast as he can. Every time he finishes preparing an order, he sets it on the counter for the waitresses to pick up. As long as the waitresses pick up those orders and deliver them to the customers in a timely manner, the cook can work as fast as he wants to.

However, if the waitresses are too slow, the counter fills up with orders. As a result, the cook has to wait for the slow waitresses to pick up an order before he can put another order on the counter.

The cook is your camera. The orders are your image files. The waitresses are your SD card.

If you've got a fast cook, you want a fast waitress.

If you've got a slow cook, you don't really need a fast waitress. She'll just be more expensive.

Manufacturers' Speed Ratings



SD card manufacturers make fast SD cards that are well above the minimum write speeds defined for video capture purposes. You often see these numbers in terms of MB/s (that is, megabytes per second), or as a number with an ‘x’ beside it (like 40x speed) – deeming it to be so many times faster than something else. Either way, bigger is better.

That ‘x’ rating is actually a multiplication of the standard data transfer rate of a CD-Rom drive, which may as well be Greek for most of us. So look for the numbers that say MB/s – they should be on the package somewhere, even if the print is smaller.

Additionally, manufacturers may show the “read” speeds and not “write” speeds in big bold font. Typically, write speeds are more important for photographers because that number affects how fast our cameras can dump info from the processor to the SD card.

However, “read” speeds are also important for photographers who are in a time crunch to deliver photos (*e.g.*, sports photographers and photojournalists at breaking news events). In order to deliver photos to their editors, these photographers must get the photos from the card and onto the computer. The computer “reads” the card when it copies the images – so, yeah, “read” speeds can be important too. While UHS-I specifications provide a maximum theoretical transfer limit of 104MB/s, current cards are nowhere near that number. As of the date of this article, SanDisk’s Extreme Pro SDHC UHS-I cards are the fastest SD cards available at a rated 45MB/s read and write speed. Kingston’s new UltimateXX SDHC UHS-I card is rated at 60MB/s read speed, but only 35MB/s write speed.

Matching the Right SD Card With Your Camera



Recall the info above about what the SD Association does. Both SD card and camera manufacturers have to follow the appropriate SD specifications. While SD card labels are pretty straightforward so long as you know what to look for (hopefully, you now know), it is sometimes a little more difficult to understand what type of card works with your camera.

You can often find a camera's SD card *type* compatibility on the camera itself, on the camera's box, or on the manufacturer's website listing for the camera. Likewise, you can always find it listed in the camera manual in a couple of places. Look for a section near the beginning of the manual where it discusses inserting the memory card. Additionally, you should be able to find a listing in the technical specifications at the back of the camera manual.

As noted above, camera manufacturers will typically a specific minimum Speed Class rating for a camera with video capture. For example, the [Canon PowerShot G12](#) manual recommends using a SD Class 4 or higher card for optimal video capture. Otherwise, the camera may not be able to transfer data fast enough to the card and, as a result, will stop recording video. When it comes to performance with still image capture, as a general rule, low-end cameras will not have the processing

power to take full advantage of the higher speed SD cards. As a result, you can buy a slower SD card. Most SD cards on the market today are more than capable of handling speeds from budget-oriented compact cameras.

More advanced point and shoot, super zoom and DSLR cameras, however, will likely be able to provide faster performance with better cards. In many cases, it makes sense to purchase a fast and high-capacity SD card. Of course, your own shooting style may further dictate your needs. If you are not the type of photographer who takes frequent photos in close succession, then a top-of-the-line high-speed card won't be necessary.

If, however, you've ever missed a shot because you were waiting for your camera to write previous photos to the memory card, then you know how important a fast card can be. This is where knowing the difference between **Speed Classes for video performance** and **maximum data transfer rates** of a card is important. Not all Class 10 SD cards are the same when it comes to still photography. If you are looking for the fastest card for still photography, you need to look at the manufacturer's maximum rated "write" speed (*e.g.*, 45MB/s).

As noted earlier, if you've got a fast cook, you want a fast waitress.

SD Technology is Backwards Compatible

What does “backwards compatible” mean when it comes to SD cards?

The short of it is that you can buy a camera like the [Nikon D7000](#), which is compatible with SDXC UHS-I cards, and use any older SD, SDHC or SDXC cards in it. Even though those cards may be slower and smaller capacity than what you get from a card with a SDXC UHS-I label, you can still record images and video to cards with older technology.

The same is true with devices that accept SDHC cards. You can use standard 2GB or smaller SD cards in those devices without any compatibility problems.

However, you can't go the other way. An SDXC card is not compatible with a SDHC device. Even worse, if you format a SDXC card in a SDHC device, that card is no longer a SDXC card.

In summary, if a camera uses SDXC cards, it also uses SDHC and SD cards.

If a camera uses SDHC cards, it also uses SD cards.

If a camera uses SD cards, it only uses SD cards – not SDHC or SDXC.

Final Thoughts . . .

Special thanks to Alisa at the SD Association for her prompt responses to my inquiries related to this article. I would encourage those of you interest in this topic to visit sdcard.org for additional information about the SD card specifications and the SD Association. Additionally, SanDisk, Lexar and Kingston have good information relative to their specific products on each company's respective website.

I hope this helps clear the air a bit for those of you having a hard time finding the right SD card for your camera. If you have any additional questions or comments regarding SD cards, please feel free to ask in the comments below.