Lexar™

When Memory Matters™

Understanding SD Association Speed Ratings
SD and SDHC Class Rating vs. Commercial "x" Rating

The objective of this whitepaper is to clarify the differences between the Speed Class Rating and commercial "x" speed rating given to SD™ , SD High Capacity (SDHC™), and SD Extended Capacity (SDXC™) flash memory cards.

Demystifying Read and Write Speeds

A card's read speed describes how fast data can be retrieved from a card. This performance is seen when transferring card contents to other host devices (computers, printers, etc.). The read performance is important for improving photography workflow.

A card's write speed describes how fast data can be saved onto a card. This performance is seen when a camera saves a picture or a video clip to the card. Write speed is typically slower than read speed for SD cards.

The performance of a SD card in-system depends on both the performance of the card and the performance of the host device, since the system device (camera, card reader, printer, computer, etc.) may have internal limitations that may constrain card performance.

Commercial "x" Speed Ratings—to Optimize Sustained Speed

Commercial x rating is based on a multiple of the initial standard CD-ROM speed of 150KB/sec (x = 150 KB/sec). Modern CD-ROM and DVD devices are also measured in multiples of this initial speed.

The x rating provided by Lexar is tested in the Lexar® Quality Labs. Lexar x ratings are tested on certified test equipment and report the read speed capabilities of the card.

Lexar offers three distinct lines of SD, SDHC, and SDXC cards based on speed and performance. Standard nomenclature and associated read speeds are noted below:

- Lexar standard cards - unrated
- Lexar Platinum II/Premium Series cards –read speed up to 15MB/sec (up to 100x)

- Lexar Professional line cards –minimum guaranteed read speeds:
    o Professional 133x SDHC and SDXC —20MB/sec (≥133x)
    o Professional 400x UHS-I—60MB/sec (≥400x)
    o Professional 600x UHS-I---90MB/sec (≥600x)

Higher x ratings are important for consumers looking to optimize media capture and to minimize the time reading data from the card. For instance, some digital cameras can utilize higher write speed cards to capture more still photographs in rapid succession. Digital single-lens reflex (DSLR) and mirrorless-interchangeable-lens (MIL) cameras contain buffers to take fast sequences of pictures, so it's important to use cards with high write speeds with these cameras. This helps prevent missed shots while waiting for the camera to finish writing these buffered pictures to the card.

For advanced enthusiasts or professional photographers, using a card with both high read and write speeds is important to accelerate the digital photography workflow. High read speeds allow you to quickly transfer images and video from the memory card to computer—allowing users to share them or move on to other work faster.

SD Association Speed Class Ratings

The SD Association has created a standardized speed class rating test for video capture. The test differs from the test used for x rating, as it is focused on finding the absolute minimum data transfer rate of SD, SDHC, and SDXC cards (or performance floor), not a sustainable rate. Video capture quality requires certain data transfer rates and the SD Association speed class rating system is specifically designed to qualify cards for specific video applications.

The speed class rating specifications were established based on request from movie and video companies, as video recording in different formats and resolutions requires specific minimum write speeds when recording to the card. As a result, the class ratings allow consumers to easily identify cards that meet the minimum level of required performance based on their use or application of the host device. Below is a listing of typical applications for each speed class.

SD/SDHC/SDXC Speed Class	Application	Guaranteed minimum write speed	Equivalent x rating
Class 2	H.264 video recording, MPEG-4, MPEG-2 video recording Standard definition video recording VGA Basic DSC	2MB/sec	13x
Class 4	High definition video recording	4MB/sec	26x

	MPEG-2 (HDTV) video recording DSC still image consecutive shooting		
Class 6	Full 1080p HD video recording Professional-level camcorder Professional-level interchangeable lens camera	6MB/sec	40x
Class 10**	Full 1080p HD video recording High-definition still consecutive recording Professional-level camcorder or interchangeable lens camera	10MB/sec	66x
SDHC/SDXC UHS Speed Class	**Application**	**Guaranteed minimum write speed**	**Equivalent x rating**
1* ***	Full 1080p HD video recording High-definition still consecutive recording Professional-level camcorder or interchangeable lens camera	10MB/sec	66x

**Note: Class 10 uses a different testing methodology than Class 2, 4, and 6.
***Note: UHS Speed Class U1 uses a different testing methodology than Class 10. Although the speed classes U1 and Class 10 guarantee the same minimum capture rate, the "x" speed ratings of UHS-I SD cards can be much higher than standard high-speed SD cards.

Cards tested to this standard are rated into three ratings:
- Cards which can write 2MB/sec or greater under these conditions
- Cards which can write 4MB/sec or greater under these conditions
- Cards which can write 6MB/sec or greater under these conditions
- Cards which can write 10MB/sec or greater under these conditions

For more information, visit:
http://www.sdcard.org/consumers/faq/#speedclass

The speed class rating system serves two purposes, providing consumers with a consistent measurement of performance across all manufacturers, and providing an absolute minimum write speed rating to allow consumers to easily identify cards that meet the required performance based on their use or application of the host device.

What to Look for in a Speed-Rated Card

The SD Association Speed Class Ratings provide minimum write speeds, or a speed performance floor, whereas commercial x speed ratings provide the optimal in-device performance capabilities of the memory card. Speed Class Ratings ensure compatibility and define the minimal performance required for certain video/photo applications, while the x rating provides the consumer a reference for technical achievable performance of a card in a host device.

The table below provides an overview of commercial x rating converted to write speed.

Commercial x rating	Sustained sequential write speed*
60x	9MB/sec
66x	10MB/sec
80x	12MB/sec
100x	15MB/sec
120x	18MB/sec
133x	20MB/sec
140x	21MB/sec
150x	23MB/sec
200x	30MB/sec
400x	60MB/sec
600x	90MB/sec

*With a new card.

Summary

While deciphering the various speeds and classes given to SD, SDHC, and SDXC cards can seem daunting, it's helpful to remember that the Speed Class Rating is a classification given by the SD Association that helps to determine a card's compatibility with various video formats, while the commercial x speed rating serves to show the speed to maximize in-device performance and accelerate photography workflow.

For general information about SD, SDHC, and SDXC cards, visit

http://www.sdcard.org/home.

Note: This white paper addresses SD High-Speed and SD UHS-I card speeds only. These limits and restrictions do not apply to CompactFlash memory cards, which can currently achieve speeds of >600x.

The Lexar "x" speed rating describes speed capability where x=150KB/sec speed.
Actual usable memory capacity may vary. 1GB equals 1 billion bytes.