

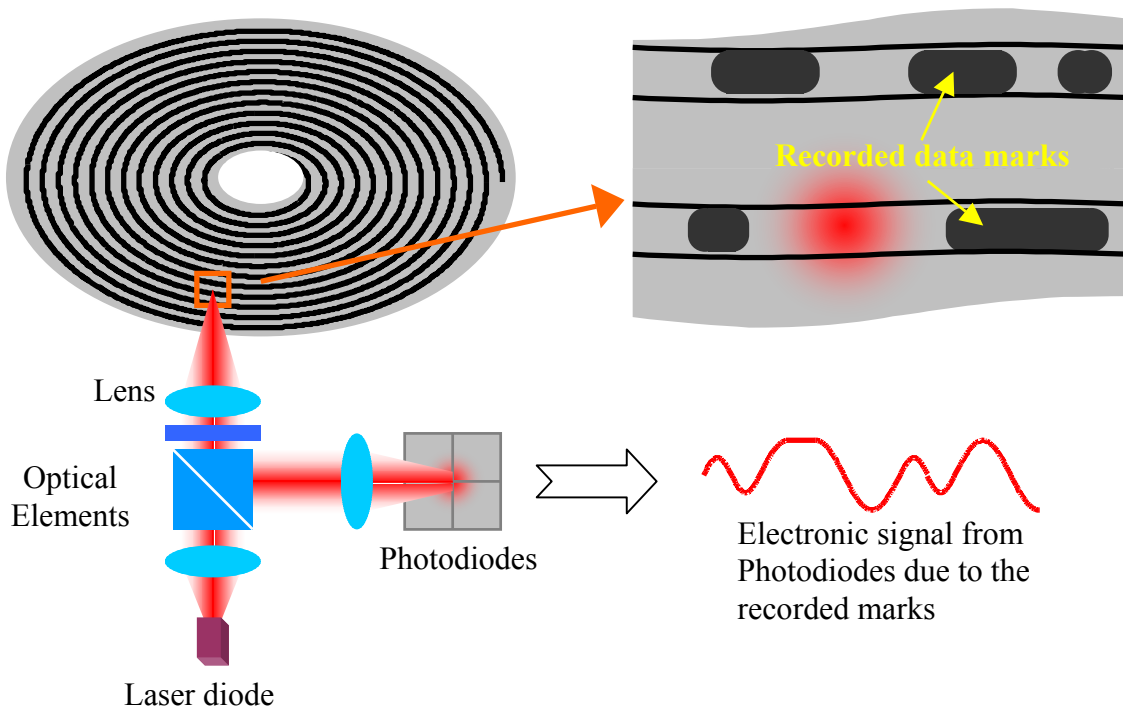
Compatibility

Introduction

The DVD+RW and DVD+R formats were designed to be compatible with both existing and future DVD Players and DVD-ROMs. Compatibility for DVD players and DVD-ROMs is driven by 3 major items – 1) physical compatibility, 2) logical (disc information) compatibility, and 3) the application. Example applications include the Mt. Rainier format, which is designed specifically for data only, and the DVD+RW Video Format, which is a real-time video recording application compatible with the DVD Video Format used in DVD Players. Both applications were designed specifically with the goal to maintain compatibility with existing and future DVD Players and DVD-ROMs.

Physical Compatibility

To understand how physical compatibility works, a brief description of how optical disc drives function is needed first. A laser and the optics in a drive focus light through the plastic substrate of the disc onto the recording layer of the disc. The recording layer can consist of a spiral of pits (DVD Read-only) or a groove (DVD+RW and DVD+R) where information is written. That light is reflected back to the drive, where it is converted to electrical signals.



Physical compatibility is achieved when the signals from a DVD+RW or DVD+R disc are within the specifications defined for DVD Read-only discs. The following table lists the pertinent specifications for DVD+RW, DVD+R and SL (single layer) and DL (dual layer) DVD-Read-only discs.

	SL DVD-RO	DL DVD-RO	DVD+R	DVD+RW
Laser wavelength	645 nanometers – 660 nanometers			
Numeric Aperture	0.60			
Reflectivity	45%-85%	18%-30%	45%-85%	18%-30%
Modulation	≥ 0.15			
	≥ 0.60			
DPD tracking	$0.5 \leq x \leq 1.1$ at 0.1 μm offset			
Tangential push-pull	$0 \leq x \leq 0.9$			
Asymmetry	$-0.5 \leq x \leq +0.15$			
Track cross signal	≥ 0.10			
Jitter	$\leq 8\%$		$\leq 9\%$	
Substrate thickness	0.60 mm \pm 30 μm		0.60 mm \pm 20 μm	
Radial deviation	$\leq 0.8^\circ$		$\leq 0.7^\circ$	

Most values (grey cells) are the same for DVD+RW and DVD+R as DVD Read-only except for reflectivity and the last 3 rows of the table. Jitter describes the amount of variation that the edges of pits or written marks of the data. Drives are typically designed to handle up to ~15% jitter, which is much greater than the amount allowed on the disc. This is because drives must account for other tolerances, including some amount of defocus, or being slightly off track, or the disc tilted slightly, etc. This is often referred to as the system margin, which includes tolerances for both the drive and media.

Disc manufacturing is not perfect and can vary from disc to disc and within the same disc. This includes the thickness of the polycarbonate (plastic) substrate of the disc or the amount of radial deviation (tilt) of the disc. Note that while the specification for the maximum jitter value for DVD Read-only is ~ 11% better than the values for DVD+RW and DVD+R, the values for thickness variation and radial deviation for DVD Read-only are worse by 50% and 14%, respectively. This gives the equivalent amount of system margin for DVD+RW and DVD+R as DVD Read-only, and therefore, has no impact on compatibility. Additionally, these are minimum and maximum specification values, in practice most DVD+RW and DVD+R discs have much lower jitter.

The overall reflectivity for DVD+R is the same as single layer DVD Read-only, while the reflectivity for DVD+RW is the same as a dual layer DVD Read-only disc. This means that all DVD products should have the necessary electronics to handle DVD+RW, however there are a few products that can become confused by DVD+RW, which is a single layer, but has the reflectivity of a dual layer disc.

Logical Compatibility

All DVD discs have a Lead-in area, a Data area, and a Lead-out area. The user's data or video exists in the Data area, while the Lead-in area contains information about the type of disc, such as read-only, rewritable, or write-once media, the number of layers, etc. This information is contained in the Control Data zone in the Lead-in and is repeated 192 times. DVD drives and players will, after media is inserted, go through a process to

focus the laser and spin-up the media, before seeking to the Control Data zone, where it can then determine all necessary information about the disc.

There are 3 pieces of disc information that can affect compatibility, commonly referred to as Disc Category, Disc Structure and Sector Headers. The Disc Category exists as a reference to the type of format on the disc that, except in the case of a DVD-RAM disc, contains non-essential information,. The Disc Structure tells the drive/player how many layers are present and if the disc is read-only, rewritable, or write-once. The Sector Headers duplicates the information in the Disc Structure and adds information regarding the reflectivity.

In developing the DVD+RW and DVD+R formats, compatibility testing using different values and combinations of bit settings were used to determine the best compatibility. Testing brought out some issues regarding some DVD players. Some DVD player manufacturers were using the Disc Category as a shorthand approach to determining the Disc Structure. To address playability in those products and allow the customer to enhance the compatibility of their disc, an alternative bit settings is allowed. Many DVD+RW drives include a software utility that allows the user to adjust the bit setting to make their disc compatible with some DVD Players and DVD-ROMs that may otherwise be incompatible. A list of known DVD Players that are compatible with the two different settings may be found at www.dvdrw.com/compatibility.html.

Application Compatibility

The final area that can affect compatibility is the software used to write the video. The DVD+RW format also includes a real-time video recording format that is compatible with the DVD Video format, while some other application formats, such as DVD-VR, are not compatible with the standard DVD Video format. Additional information on the DVD+RW Video Specification can be found at www.dvdrw.com/pdf/CE.pdf.

Summary

Every aspect of the DVD+RW and DVD+R format was designed to achieve the maximum compatibility possible. The physical, logical and application features of the format were decided only after extensive testing on all of the available choices. This approach has established the DVD+RW and DVD+R formats as the industry standard for compatibility.