

# STEP UP TO DOUBLE LAYER DVD

In Tech-Tip Number 7, J. Kohrs explained the alphabet soup of DVD formats. Double layer DVD writers and the blank discs for them were just hitting the market then so he didn't have much to say about the latest and largest-capacity optical disc system. Since then, DL drives and media have popped up all over at decent prices so it's time to dig a little deeper.

That last sentence is a bit of a pun on the whole double layer thing because it works by burying your data a little deeper into the disc. We'll discuss why double layer is so exciting, and when you can economize by using the less expensive single layer discs.

## 1. Refresh on How DVDs Store Data



Most explanations of how optical discs work start with an allusion to LP records with a track that spirals across the face of the disk and a pickup that follows the track to extract the data stored there. Unfortunately, the flat disc and the spiral are about the only things in common.

Optical discs like CD-ROM and DVDs are made up of a clear plastic disc with a layer of very thin metal buried just under the surface of the plastic. The track is actually molded into the plastic, a thin metal layer is laid over the plastic, and the whole thing is sealed up with a clear lacquer finish.

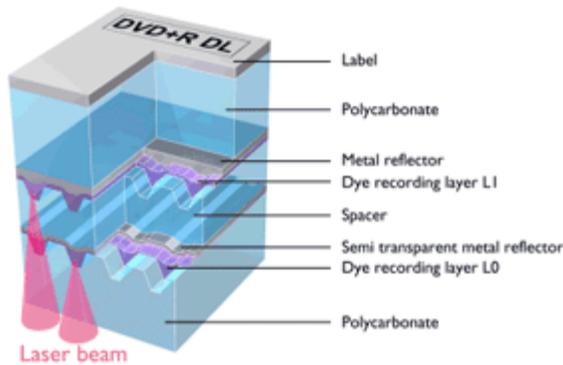
## 2. Not Grooves: A Trail of Bumps

LP records are easy to visualize because they use a V-shaped groove that forms the track. The sharp point of the pickup fits down in the groove and the groove wall pushes the pickup to keep it tracking the spiral. Optical discs are completely different, with a laser light focused into the spiral track of bumps. An optical sensor picks up the reflections of the bumps and electronic tracking circuits command tiny motors to move the pickup to keep it aligned with the track.

Notice I said track and not tracks? There is a single track that starts at the inside near the center hole and spirals out, just the opposite of the LP record. It's not concentric tracks like a hard drive or floppy disk. The disk could be any size up to the maximum of 120 millimeters, about 5 inches. There are smaller optical discs available, all the way down to business card-sized with only a few dozen Megabytes of storage.

Speaking of tracks and dimensions, they pack almost 8 miles of data in that single track. The double layer DVD disc has about 15 miles of storage track. That means the track has to be wound pretty tight with a pitch of only 0.74 micrometers (millionths of a meter) between them. That takes some pretty precise tracking!

## 3. Ones and Zeros Become Lands and Bumps



Along the track, there are flat reflective areas called lands. This is really just the non-bumped part of the disc surface. Then, there are the non-reflective bumps. A flat reflective area represents a binary 1, while a non-reflective bump is a binary 0. The DVD drive shines a laser at the surface of the DVD and can detect the reflective areas and the bumps by the amount of laser light they reflect. The optical pickup converts the reflections into 1's and 0's to extract digital data from the disc.

This describes how commercially-pressed audio CDs, CD-ROMs and DVD movies work. They are read-only devices with the simplest construction and are the easiest to explain. A recordable disc, however, also needs to allow the drive to write data onto the disc.

In order for a recordable DVD-R or DVD+R disc to work, there must be a way for a laser to create a non-reflective area on the disc. These discs have an extra layer that is a dye that can be changed by shining a strong laser beam on it. On a blank recordable disc, the entire surface of the disc is reflective. The laser can shine through the dye and reflect off the metal layer. When the drive writes data to the disc, the laser heats up the dye layer and changes its transparency, which is the equivalent of a non-reflective bump.

#### 4. The Trick of Double layer

Now we know how a single layer DVD works, both the prerecorded type and the ones you can burn at home. Just how the heck do they put two layers of data on one side of the disc? It would be real easy to say magic at this point, but the real explanation is pretty simple.

Think about how when you walk up to a window with a screen and look out that you see the scene outside and don't even see the screen. It's close to your face so it's out of focus and you don't even notice it is there. If you back up a little and force your eyes to focus on the screen, it pops right out and you can see it and the scene outside is all a blur.

Double layer DVDs pull a similar trick. There is only one reflective layer, but there are two layers of dye where the actual data is stored. The lens in the pickup focuses the beam on the top layer to read the first bunch of data, and then the lens focuses the beam on the bottom layer and sees right through the top layer. Because the top layer is out of focus, the data stored there just disappears and the bottom layer is read instead.

All that build up and detailed explanation to find out it's a simple trick of optics that even your own eyeballs can do!

#### 5. So What's the Benefit?

When recordable DVD media first hit the market, it hadn't grown up yet and capacity wasn't too much bigger than CD-R. As DVD-R and DVD+R came of age, the capacity of a single-sided disc settled on 4.7 Gigabytes. That was enough room for a two-hour medium resolution compressed movie. It's also a handy size for normal backups of your hard drive or all the digital photos from your vacation even if you shot them all in high quality mode.

But, what if you want to record a truly high definition movie? It won't fit in 4.7 Gigabytes. Even a medium definition movie won't fit if it extends past two hours. How many movies come with a separate disc for the extra features? It's a pain to have to get out of the easy chair to change discs. The double layer DVD solves this by having 8.5 Gigabytes of storage without having to flip the disc.



## 6. What Do I Need?

Naturally, older DVD drives don't have the mechanism to switch focus between the two levels of a double layer disc. The pickup has to be physically moved to change the focus point from top to bottom, so you need a drive with this built in. The LG 16x Double Layer DVD±RW/DVD-RAM IDE Drive is typical and attractively priced. Computer drives that can read double layer usually also write double layer and that's the case here. Be aware that double layer DVDs have to be written at the 4X speed as opposed to the 16X for single layer discs.

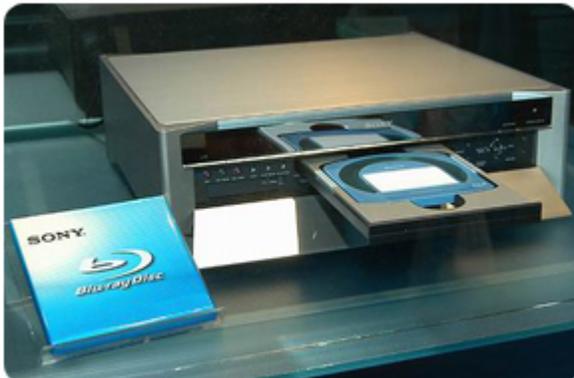
## 7. Blank DVDs Are a Bargain

CD-R media are really inexpensive these days, with recordable DVDs being a little more expensive. But, are they? A single layer DVD-R or DVD+R can hold as much as seven CD-Rs. That means that if a DVD is less than seven times more expensive, it is actually cheaper than a CD-R for those large data storage tasks. They are also a lot more convenient than shuffling a stack of CD-Rs in and out of your drive.

If you just want to test the waters without springing for a tall spindle of blank double layer DVDs, try the Verbatim Double Layer Solution Kit (DVD+R, DVD+R DL, DVD+RW) , which gives you a sampling of three different blank optical disc types. If your storage needs are less than about 4 Gigabytes, then stick with the single layer discs.

## 8. HD DVD versus Blu-Ray

While double layer DVD seems like a huge amount of storage, the requirements of super high definition video and huge hard drive backup push the optical drive manufacturers to even larger capacity discs. HD DVD is a refined version of the DVD we use now. It uses the same trick of double layers to almost double the capacity up to 30 Gigabytes per side; backing up a full image of a 160 Gigabyte hard drive takes a half dozen discs.



Blu-Ray answers this with the promise of up to 200 Gigabyte discs eventually becoming available. They pack the data in even tighter than HD DVD and can stack up several layers

to increase storage.

Unfortunately, HD DVD and Blu-Ray will probably be only available as commercially produced DVDs for viewing movies for the near-term. Somewhere down the road, we'll start seeing recordable versions to mount in our computer's drive bays.

Source : <http://www.geeks.com/techtips/2006/techtips-02mar06.htm>