

Understanding Double Layer DVD Recording

Double Layer Recording – The Basics

While consumers around the world have enjoyed burning their own DVDs for a few years now, the inevitable question of “what’s next” is now upon the industry. Certainly blue laser technologies such as Blu-Ray will one day become affordable and prevalent; however consumers today are still very much in love with DVD. The DVD format is mature, high quality content is widely available, and players are low cost and now installed in approximately 53 percent of U.S. households.

Double Layer DVD technology is not new. Commonly called “DVD9,” Hollywood has been churning out major motion pictures on stamped Double Layer DVD Discs for years. How else could they include the full length movie plus all the bonus materials commonly found on today’s DVDs? Because Double Layer technology has always been part of the DVD specifications, Double Layer DVD Recording on the desktop is the natural progression of single layer 4.7GB recordable technology.

Double Layer DVD recordable discs offer up to four hours of high quality MPEG-2 video, or up to 8.5GB of data on a single sided disc with two individual recordable “layers”. Double Layer capable recorders will have the ability to record on the new Double Layer DVD recordable discs as well as traditional single layer DVD discs and CDs too. Want more? Because a recorded Double Layer DVD disc is compliant to the DVD9 specification, the discs are compatible with most consumer DVD players and computer DVD-ROM drives already installed in the market.

How Are Double Layer Discs Recorded?

Single-sided Double Layer recordable discs are constructed by one dummy polycarbonate platter base and the other one that contains a single organic recording layer.

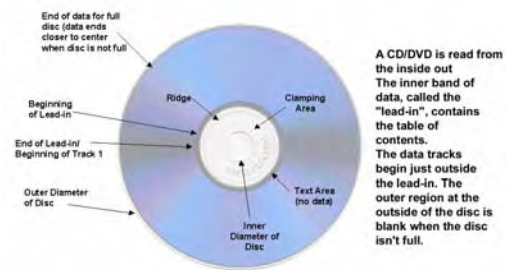


Figure A

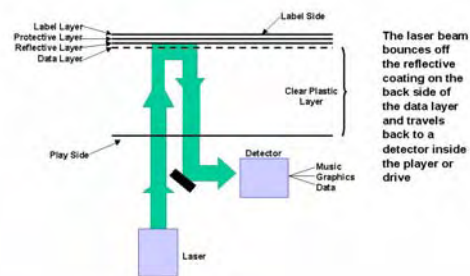
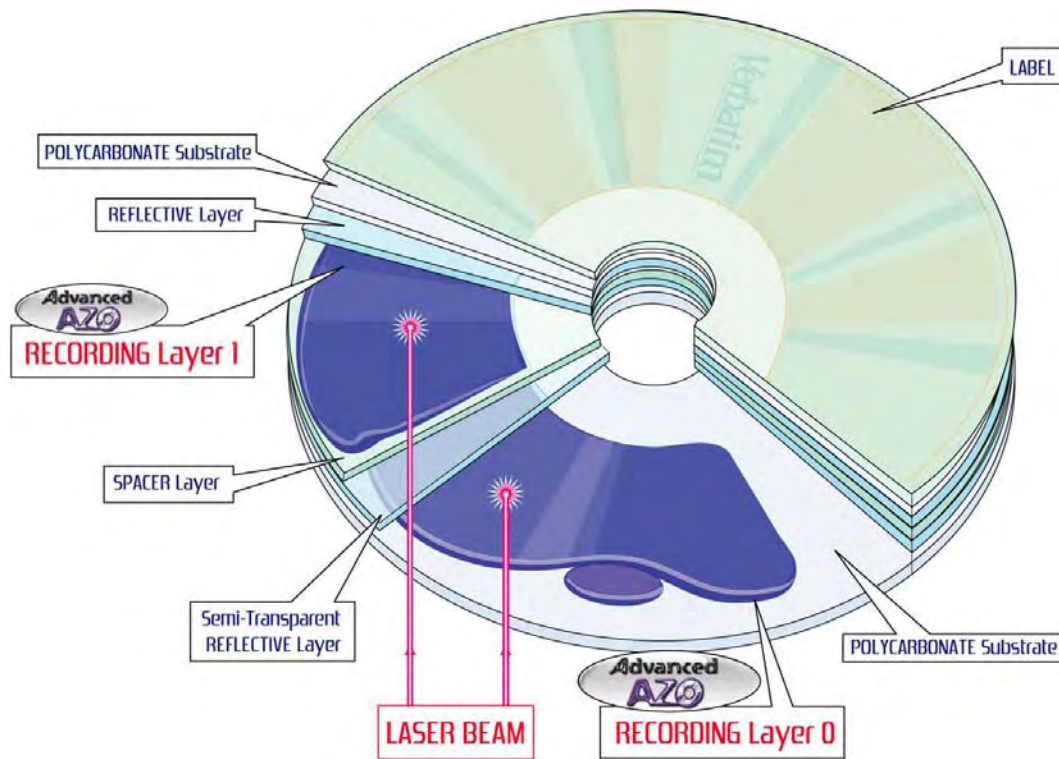


Figure B

Double Layer recordable discs contain two organic dye recording layers (termed L0 and L1, respectively) between dual polycarbonate bases and semi-reflective metal layers separated by a transparent

spacing layer. Single layer DVDs have a wobbled pre-groove molded into the polycarbonate base that control the rotation speed of the disc and provide the addressing scheme for the disc.



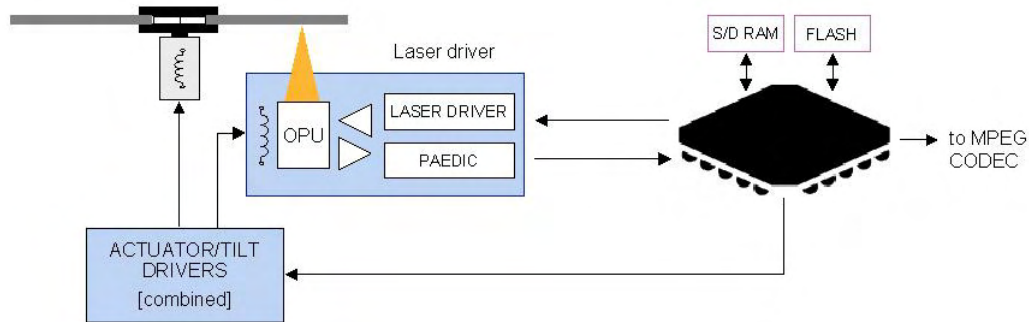
In a Double Layer recordable DVD, each recording layer has its own wobbled pre-groove that controls rotation speed and addressing for that layer. However, the entire “table of contents” and system area of a Double Layer recordable disc is contained only on the first recordable layer (L0).

detected the laser will be able to move down or up its range of focus to access any one of the two recordable layers. The drive will then focus on the Lead-In area of the disc to determine whether the disc is completely blank, partially recorded in Multi-session format, or Finalized (completed).

When a Double Layer recordable disc is inserted into a Double Layer compliant recorder, the optics will focus the laser at one of the Double Layers to try and detect an “Address In Pre-groove” (ADIP) signal. From the ADIP signal, the recorder can detect whether the disc is Double Layer and which layer it’s focused on. Once the media type and the layer are

The two layers represent one contiguous address stream for recording as a Video Disc, a DVD-ROM, or even a packet recorded disc. When recording on Double Layer media, the drive first records on the first recordable layer L0 from the inside hub area outward, just like a typical DVD recordable disc.

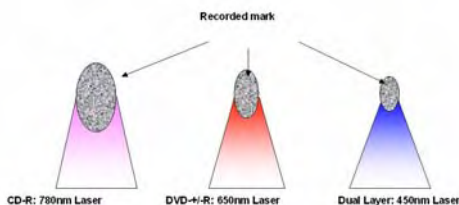
Typical DVD Recordable Architecture



Semiconductors, DVD+R/+RW Advanced Digital Video Recorder solution, 5-12-2002

When the end of information recorded in L0 is reached, Middle Zone 0 is added. Next, the drive focuses on the second recordable layer L1 to create Middle Zone 1 that over-wraps Middle Zone 0. The disc is then recorded from the outside rim inwards. Multi-session discs can be recorded with Double Layer recordable media, so it's possible to add data in "sessions" on a disc.

ity between the L0 and L1 layers however, is greater than 50 percent because the upper (second) recording layer absorbs and reflects some of energy that is directed at the lower (first) recording layer L0, in order for organic dye to be recorded. As a result, the organic dye formulation and shape of the pre-groove in Double Layer discs must be optimized to provide the appropriate reflectivity for both layers. The spacer layer separates the two recording layers and prevents cross layer recording. It is transparent to allow the laser to easily focus on either recording layer by simply changing the position of the laser's object lens.



Reflectivity of both recording layers of a Double Layer recordable disc is the similar: greater than 18 percent. The reflectiv-

The Recordable DVD Format Debate and Double Layer

Both the DVD Plus ("+") and Dash ("-") formats are still very much alive and well and appear to be with us for the foreseeable future. Presently, the DVD+RW Alliance is the first of the two organizations

to present a Double Layer recordable standard. The formal name of the format is **Double Layer**. Initially available only in a write once format called **DVD+R DL**, this technology should debut by the middle of 2004 with drives and media from several major manufacturers including Sony. Recording speeds for DVD+R DL are initially 2.4X, however they are expected to increase in the future. Drives supporting DVD+R DL will also be able to record single layer discs at up to 8X or faster (using write once media) and support high speed CD-R/RW burning as well.

What of the DVD Forum and the Dash format? While not available at the time of this writing, it's expected that the DVD forum will offer up a recordable Double Layer disc specification in the near future and probably within 2004.

Certainly dual format DVD burners are overtaking the commercial market and Sony was the Pioneer of Dual Format burners. Sony is a member of, and is committed to continuing to support the DVD+RW Alliance and the DVD Forum for Double Layer DVD recordable/rewritable technology.

Applications for Double Layer Recordable Technology

Consumer Applications

With up to four hours of high quality MPEG-2 video on a single sided disc, consumers can really take their home movies to the next level with Double Layer DVD recording. One benefit of the additional space is the ability to increase the bit rate of the video when authoring to get higher quality on the finished disc. Typical DVD authoring software applications use variable bit rate encoding to

maximize utilization of the DVD disc space. By forcing the application to always encode at the highest bit rate supported, more space will be used on the disc, however the quality difference is noticeable and worth it.

Double Layer DVD recording makes it possible for a consumer to create longer home movies and even consolidated many home movie projects onto a single disc. Let's not forget that up to 8.5GB of uncompressed DVD disc space is a great place to store data and keep your PC's valuable data, applications, and settings backed up for when disaster strikes. You can pack up to 12 CDs or 5,902 floppy disks' worth of information onto a single Double Layer DVD disc.

With the additional capacity of a Double Layer DVD recordable disc, a consumer can store approximately 2,000 songs in MP3 format or up to 17,000 high quality JPEG images. Talk about a cool place to store all that stuff cluttering up your hard drive!

Business Applications

Those businesses that have already embraced DVD for the distribution of training video on DVD know that more space is often needed to deploy all of the material. Just like with the example provided for consumer applications, higher bit rate encoding of the video translates into better quality training video for the viewer. Some of the world's best companies, from major automobile manufacturers, fast food restaurant chains, and others, depend on DVD for their training video needs for one simple reason – it works.

Independent filmmakers and studios alike will appreciate the ability to author a Double Layer DVD video disc and try it out without resorting to expensive and time consuming replication. This group

of users can now fine tune their works on cost effective Double Layer DVD recordable discs before creating the master for replication.

Certainly business users will appreciate the increased storage capacity of a Double Layer DVD recordable disc when distributing a large amount of data on a single disc is needed and even for desktop system backup and single server backup with time and cost savings over traditional tape technologies. IT managers can even create their system “images” for configuring client PCs on a single disc for rapid deployment of new computers on corporate networks.

Double Layer Implications for DVD Recording Software

Because double layer recordable discs are basically one contiguous stream of block addresses, it's not very difficult for software makers to make their disc mastering software compatible with Double Layer drives and media, as least where recording data is concerned.

DVD Video authoring software has to manage the “break point” of where the video will be split between layers. This “layer jump” is typically not visible when you watch a DVD movie even though there is a very brief interruption to allow the player to focus on the second layer. Managing this break point is difficult but straightforward once all the video for a project has been imported into the authoring application where it is separated and allocated for a video DVD.

Andy Marken

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Andy Marken is president of Marken Communications and has been involved in the marketing of storage technology for more than 15 years. His experience includes work with Panasonic, Verbatim, Matsushita, Plasmon, Nikon, Mitsubishi Chemical and a number of hard drive manufacturers. Andy can be reached at andy@markencom.com.

Precautions When Handling Discs

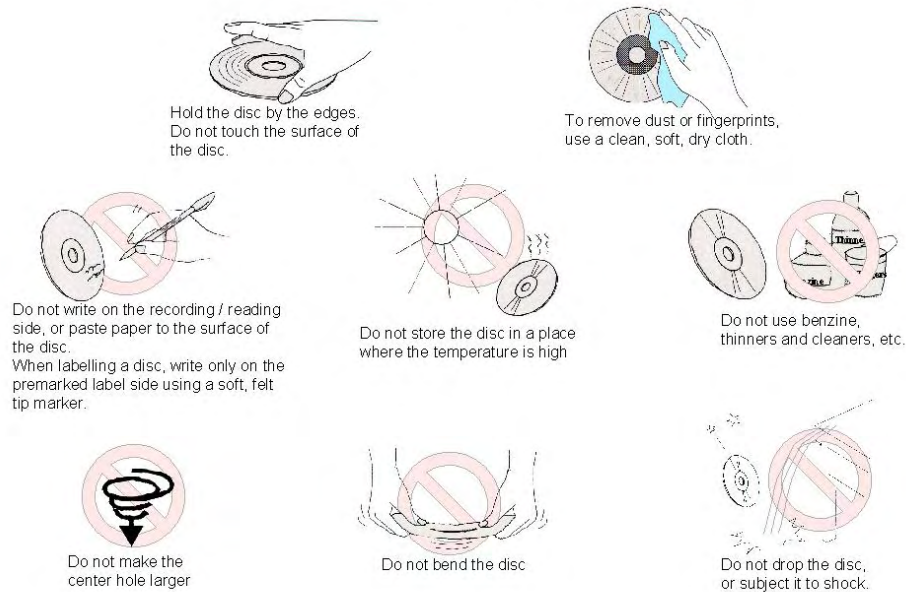


Figure C