Holographic Recording

Applications

- Recording of HD/SD content (Enabled by greater capacity and higher transfer rates)
- Archival storage of spots, shows and data
- Creating one-off samples of HD/SD content, only one disc needed to fit an entire HD/SD movie (no multiple discs)
- Complimentary product to current HD tape due to high transfer rate and capacity
- Conversion from tape to disc to save space, decrease maintenance and increase longevity of the content

Feature | Benefit
--- | ---
- Parallel access to data | - Fast data transfer rates
- Multiplex data pages in one location | - Ultra-high storage densities
- Removable Media | - Transportability

- Record by crossing signal beam with a reference beam
- Readout by presenting reference beam to media
- Media does not need to spin during recording and reading
- Joint Development with InPhase Technologies, Inc.
- Prototype media is scheduled to be available late in 2004, with 100GB capacity / 80Mbps
- The first media products will be available early in 2006, with 200GB capacity / 160Mbps
- Second generation products will be available in late 2007, with 400GB capacity / 320Mbps

Maxell’s Future Optical Storage Solutions

Recordable Media | Data Storage | Portable Energy | Technological Partnerships
--- | --- | --- | ---

© 2004 Maxell Canada
Maxell Canada • 50 Locke St., Concord, Ontario, Canada L4K 5R4
www.maxellcanada.com
**Blu-ray**

Applications
- Ideal for consumer HD digital content recording
- For the movie studios, authoring houses and duplicators - BD will provide the next generation of packaged media with dazzling HD picture and superior protection from piracy
- For the Consumer Electronics Manufacturers - BD will offer unprecedented capacity, with the option for compatibility with CD and DVD media
- Currently available only in the Japanese consumer market

Next Generation (Future Development)
- Advanced technologies based on Blu-ray, such as double layer and higher recording speed media, are also under development

Blu-ray Specifications

<table>
<thead>
<tr>
<th>Blu-ray</th>
<th>DVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>25 GB/ide</td>
</tr>
<tr>
<td>Data Rate</td>
<td>23.3 GB/side</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>12cm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>1.2mm (0.1mm cover + 1.1mm)</td>
</tr>
<tr>
<td>Cartridge</td>
<td>Required</td>
</tr>
<tr>
<td>Recording Film</td>
<td>Phase Change</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.85</td>
</tr>
</tbody>
</table>

* ROM and Recordable specifications are under preparation

**Blue MAMMOS** *(Magnetically Amplifying MO System for Blue Laser)*

Applications
- Recording of HD/SD content (Enabled by greater capacity and higher transfer rates)
- Archival storage of spots, shows and data
- Editing digital content directly on the disc
- Creating one-off samples of HD/SD content, only one disc needed to fit an entire HD/SD movie (no multiple discs)
- Complimentary product to current HD tape due to high transfer rate and capacity
- Conversion from tape to disc to save space, decrease maintenance and increase longevity of the content

Blue MAMMOS Specifications

<table>
<thead>
<tr>
<th>Blue MAMMOS</th>
<th>HD DVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (1st Generation)</td>
<td>50GB/side</td>
</tr>
<tr>
<td>Capacity (2nd Generation)</td>
<td>100GB/side</td>
</tr>
<tr>
<td>Data Transfer Rate</td>
<td>100Mbps</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>130mm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>1.2mm (0.015mm cover x 2 + 1.17mm)</td>
</tr>
<tr>
<td>Cartridge Required</td>
<td>Yes</td>
</tr>
<tr>
<td>Recording Film</td>
<td>MO (MAMMOS)</td>
</tr>
<tr>
<td>Recording Position</td>
<td>On Groove</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.85 (same as Blu-ray)</td>
</tr>
<tr>
<td>Availability</td>
<td>late 2005 early 2007</td>
</tr>
</tbody>
</table>

* MAMMOS Recording Film specially tuned for blue laser wavelength
* MAMMOS stands for Magnetically Amplifying MO System, which magnetically amplifies the recorded signal during readout
* Ideal for both archival and backup storage with over 1 million read/write cycles
* MAMMOS is Maxell's original technology and the drive system was developed with Fujitsu Laboratories

**HD DVD**

Applications
- Ideal for consumer HD digital content recording and distribution
- Ready for both CE and IT platforms with UDF format, the same as DVD
- Archival storage of spots, shows and data
- Complimentary product to current HD tape due to high transfer rate and capacity
- Approved by the DVD Forum as the post DVD format

Benefits
- Similar manufacturing processes and equipment, as is used for DVD, can be utilized for production
- Physical compatibility with DVD provides ease of use

HD DVD Specifications

<table>
<thead>
<tr>
<th>HD DVD</th>
<th>Rewritable</th>
<th>Read Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (Single Layer)</td>
<td>4.7GB/side</td>
<td>4.7GB/side</td>
</tr>
<tr>
<td>Capacity (Double Layer)</td>
<td>9.4GB/side</td>
<td>15GB/side</td>
</tr>
<tr>
<td>Data Rate</td>
<td>300Mbps</td>
<td>36Mbps</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>12cm</td>
<td>12cm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>1.17mm (0.6mm x 2)</td>
<td>1.2mm (0.6mm x 2)</td>
</tr>
<tr>
<td>Cartridge Required</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Recording Film</td>
<td>MO (MAMMOS)</td>
<td>MO (MAMMOS)</td>
</tr>
<tr>
<td>Recording Position</td>
<td>LAG</td>
<td>LAG</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
<td>650nm (Red)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.85</td>
<td>0.65</td>
</tr>
</tbody>
</table>

**Schematic Comparison**

- Blu-ray vs. DVD
- HD DVD vs. DVD
- Blue MAMMOS vs. Blue MAMMOS

- Next Generation (Future Development)
  - Advanced technologies based on Blu-ray, such as double layer and higher recording speed media, are also under development

- Benefits
  - Similar manufacturing processes and equipment, as is used for DVD, can be utilized for production
  - Physical compatibility with DVD provides ease of use

- Applications
  - Ideal for consumer HD digital content recording and distribution
  - Ready for both CE and IT platforms with UDF format, the same as DVD
  - Archival storage of spots, shows and data
  - Complimentary product to current HD tape due to high transfer rate and capacity
  - Approved by the DVD Forum as the post DVD format

- Specifications
  - Blu-ray
  - HD DVD
  - Blue MAMMOS

- Technical Details
  - Blu-ray: 25 GB/ide, 23.3 GB/side, 12cm diameter, 1.2mm (0.1mm cover + 1.1mm) thickness
  - HD DVD: 4.7GB/side, 9.4GB/side (double layer), 12cm diameter, 1.2mm (0.6mm x 2) thickness
  - Blue MAMMOS: 50GB/side, 100GB/side, 130mm diameter, 1.2mm (0.015mm cover x 2 + 1.17mm) thickness

- Future Development
  - Similar manufacturing processes and equipment, can be utilized for production
  - Physical compatibility with DVD provides ease of use
  - Advanced technologies based on Blu-ray, such as double layer and higher recording speed media, are also under development

- Availability
  - Blu-ray: currently available only in the Japanese consumer market
  - HD DVD: 2004
  - Blue MAMMOS: late 2005 early 2007

- Technologies
  - Blu-ray: Laser Wavelength 405nm (Blue-Violet), Lens NA 0.85
  - HD DVD: Laser Wavelength 650nm (Red), Lens NA 0.65
  - Blue MAMMOS: Laser Wavelength 405nm (Blue-Violet), Lens NA 0.85

- Archival Storage
  - HD DVD: Archival storage of spots, shows and data
  - Blue MAMMOS: Complimentary product to current HD tape due to high transfer rate and capacity

- Conversion
  - HD DVD to Blue MAMMOS: Conversion from tape to disc to save space, decrease maintenance and increase longevity of the content

- Future Products
  - Blue MAMMOS: MO (MAMMOS) recording film, 0.85 NA, 405nm wavelength, 23.3GB/side

- Future Technology
  - Blue MAMMOS: Magnetically Amplifying MO System for Blue Laser

- Conclusion
  - Blu-ray, HD DVD, and Blue MAMMOS offer advanced technologies for HD digital content recording and distribution.
**Blu-ray**

**Applications**
- Ideal for consumer HD digital content recording
- For the movie studios, authoring houses and duplicators - BD will provide the next generation of packaged media with dazzling HD picture and superior protection from piracy
- For the Consumer Electronics Manufacturers - BD will offer unprecedented capacity, with the option for compatibility with CD and DVD media
- Currently available only in the Japanese consumer market

**Next Generation (Future Development)**
- Advanced technologies based on Blu-ray, such as double layer and higher recording speed media, are also under development

**Blu-ray Specifications**

<table>
<thead>
<tr>
<th>Blu-ray</th>
<th>DVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>25 GB/side</td>
</tr>
<tr>
<td>Data Transfer Rate</td>
<td>20Mbits</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>8cm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>1.1mm (0.1mm cover + 1.0mm)</td>
</tr>
<tr>
<td>Cartridge</td>
<td>Required</td>
</tr>
<tr>
<td>Recording Film</td>
<td>Phase Change</td>
</tr>
<tr>
<td>Recording Position</td>
<td>Inner Groove/LG</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.85</td>
</tr>
</tbody>
</table>

* ROM and Recordable specifications are under preparation

---

**HD DVD**

**Applications**
- Ideal for consumer HD digital content recording and distribution
- Ready for both CE and IT platforms with UDF format, the same as DVD
- Archival storage of spots, shows and data
- Complimentary product to current HD tape due to high transfer rate and capacity
- Approved by the DVD Forum as the post DVD format

**Benefits**
- Similar manufacturing processes and equipment, as is used for DVD, can be utilized for production
- Physical compatibility with DVD provides ease of use

**HD DVD Specifications**

<table>
<thead>
<tr>
<th>HD DVD</th>
<th>Read Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (Single Layer)</td>
<td>20GB/side</td>
</tr>
<tr>
<td>Capacity (Double Layer)</td>
<td>20GB/side</td>
</tr>
<tr>
<td>Data Rate</td>
<td>20Mbits</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>120mm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>0.6mm x 2</td>
</tr>
<tr>
<td>Cartridge</td>
<td>Required</td>
</tr>
<tr>
<td>Recording Film</td>
<td>MAMMOS</td>
</tr>
<tr>
<td>Recording Position</td>
<td>On Groove</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.65</td>
</tr>
</tbody>
</table>

**Schematic Comparison**

![Schematic Comparison](image)

---

**Blue MAMMOS**

**(Magnetically Amplifying MO System for Blue Laser)**

**Applications**
- Recording of HD/SD content (Enabled by greater capacity and higher transfer rates)
- Archival storage of spots, shows and data
- Editing digital content directly on the disc
- Creating one-off samples of HD/SD content, only one disc needed to fit an entire HD/SD movie (no multiple discs)
- Complimentary product to current HD tape due to high transfer rate and capacity
- Conversion from tape to disc to save space, decrease maintenance and increase longevity of the content

**Blue MAMMOS Specifications**

<table>
<thead>
<tr>
<th>1st Generation</th>
<th>2nd Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>50GB/side</td>
</tr>
<tr>
<td>Data Transfer Rate</td>
<td>100Mbps</td>
</tr>
<tr>
<td>Disc Diameter</td>
<td>130mm</td>
</tr>
<tr>
<td>Disc Thickness</td>
<td>1.2mm (0.015mm cover + 1.17mm)</td>
</tr>
<tr>
<td>Cartridge</td>
<td>Required</td>
</tr>
<tr>
<td>Recording Film</td>
<td>MO (MAMMOS)</td>
</tr>
<tr>
<td>Recording Position</td>
<td>On Groove</td>
</tr>
<tr>
<td>Laser Wavelength</td>
<td>405nm (Blue-Violet)</td>
</tr>
<tr>
<td>Lens NA</td>
<td>0.65</td>
</tr>
<tr>
<td>Availability</td>
<td>late 2005</td>
</tr>
</tbody>
</table>

**Benefits**
- Employs MAMMOS recording film specially tuned for blue laser wavelength
- MAMMOS stands for Magnetically Amplifying MO System, which magnetically amplifies the recorded signal during readout
- Ideal for both archival and backup storage with over 1 million readwrite cycles
- MAMMOS is Maxell’s original technology and the drive system was developed with Fujitsu Laboratories

**Schematic Comparison**

![Schematic Comparison](image)
Holographic Recording

Applications

- Recording of HD/SD content (Enabled by greater capacity and higher transfer rates)
- Archival storage of spots, shows and data
- Creating one-off samples of HD/SD content, only one disc needed to fit an entire HD/SD movie (no multiple discs)
- Complimentary product to current HD tape due to high transfer rate and capacity
- Conversion from tape to disc to save space, decrease maintenance and increase longevity of the content

Feature | Benefit
---|---
Parallel access to data | Fast data transfer rates
Multiplex data pages in one location | Ultra-high storage densities
Removable Media | Transportability

- Record by crossing signal beam with a reference beam
- Readout by presenting reference beam to media
- Media does not need to spin during recording and reading
- Joint Development with InPhase Technologies, Inc.
- Prototype media is scheduled to be available late in 2004, with 100GB capacity / 80Mbps
- The first media products will be available early in 2006, with 200GB capacity / 160Mbps
- Second generation products will be available in late 2007, with 400GB capacity / 320Mbps