Storage

Whitepaper

Exploring the Popularity of Mobile Hard Disk Drives

Executive Summary

The remarkable growth in the Mobile hard disk drive (HDD) industry should come as a surprise to no one. While the huge popularity of notebook PCs has played a part in this surge, the main impact has come from the consumer electronics (CE) sector, which is taking the market by storm. This paper focuses on the features that make 2.5" Mobile hard disk drives in such great demand, and highlights the exceptional qualities of the Fujitsu MHV series that have made the company a dominant player in the Mobile industry. Also discussed will be the future outlook for Mobile HDD products.

Capacity

The CE market has been a major driving force behind the push to increase Mobile hard disk drive storage capacity. High-end audio/video computer applications such as gaming, video editing, audio recording, and DVR functionality are at the forefront of this demand. Near-line storage is another area that is expanding. By using high-density, lower cost mobile products, customers are able to produce a much more cost-effective solution.

Fujitsu responded to customer demand with the introduction of a 160GB capacity Serial ATA (SATA) model in August 2005. And in March 2006, Fujitsu launched the industry's first 200GB 2.5" Mobile HDD, the first SATA product to achieve this milestone.

Significant technological advances have allowed manufacturers to produce platters capable of up to 60GB of storage. One reason areal densities have increased is due to improvements made to the giant magnetoresistive head (GMR) and tunneling magnetoresistive head (TMR) of the hard disk drives. Fujitsu, in

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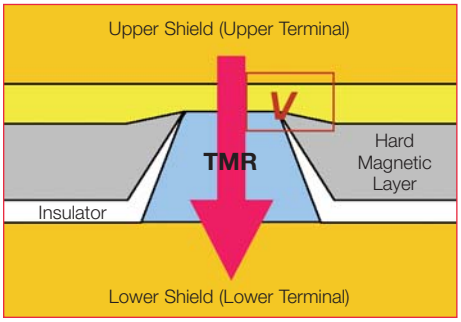
particular, has introduced a new architecture called Current Perpendicular to Plane (CPP), which allows the bits written on the disk to be smaller (Figure 1). This allows for greater bits per inch (BPI) on the final product. The areal density of the current Fujitsu Mobile series is the world's highest at 99.1 Gb/in^2.



- *Sense current is perpendicular to the plane*
- *Upper and lower shields are used as Terminals*
- *No insulator gaps = narrow gap*
- *Insulators under hard magnetic layers (to avoid any shorting around the sensor)*

Figure 1

In addition, the transition to perpendicular magnetic recording (PMR) technology will allow HDD vendors to further increase storage capacity. With PMR, the bits are aligned vertically on the disk rather than horizontally, allowing a greater number to fit onto the media. Hard disk drives featuring PMR will soon be the standard in the industry. Fujitsu expects to release its first Mobile product featuring this technology in 2006.

Performance

Figure 2

The improved performance of Mobile storage products can be attributed to the industry's transition to the new Serial ATA storage interface technology. The successor to Parallel ATA (PATA), SATA became a necessity as it became increasingly difficult for the PATA architecture to support increased HDD speed enhancements.

With the new SATA interface, customers benefit from higher speeds that could not be achieved using PATA. Serial ATA works by sending one bit over a serial cable at a significantly higher frequency than Parallel ATA. The current result is a 150MB/s data transfer rate, which exceeds the performance of its predecessor by 50%. In the coming year, storage products featuring 300MB/s rates will become the standard in the marketplace.

To allow for quicker data access, SATA also includes support for Native Command Queuing (NCQ). This process, driven by the hard disk drive controller, ensures the efficient reordering of commands to maximize the performance of the HDD.

A final critical component to enhanced performance is the compact size of the Mobile hard disk drives. With a 2.5" form factor, four times as many drives can be installed in the same space as a 3.5" model. Under ideal circumstances, with all HDDs operating simultaneously, this results in a higher overall data transfer rate.

Fujitsu is a leader in the promotion of Serial ATA technology, delivering the industry's first product in early 2004. Today, Fujitsu is shipping its second generation of 2.5" SATA hard disk drives (Figure 2).

Reliability

Today's generation of 2.5" hard disk drives operate with extremely low power consumption, which helps preserve battery life. For the Fujitsu MHV series, the link power management (LPM) controls power usage by turning off the interface when not needed. This ability to control power usage helps maximize the efficiency of the HDD. In addition, mobile hard disk drives dissipate less heat, a critical element in order to preserve the sensitive read head element of the hard disk drive. HDDs that feature low power consumption and which generate less heat will have better reliability.

Durability

To enhance the durability of HDDs, manufacturers utilize load/unload technology, in which the heads of the hard disk drives retract from the platter during idle time as well as power off. This feature protects the head from hitting the disk when not in operation, which could otherwise be a potential cause of damage. As a further safeguard, the Fujitsu MHV series features a more lightweight suspension (Figure 3) than previous generations, which also helps to improve the product's shock tolerance.

Figure 3

Acoustics

Utilization of Fluid Dynamic Bearing (FDB) motors, rather than ball bearings, has helped to lower the acoustics of Mobile HDDs. At 2.6 bels or lower, the Fujitsu MHV series has near "silent" operation, a highly desirable trait among notebook customers.

RoHS Directive

By July 2006, as outlined by the European Union's Restriction of Hazardous Substances (RoHS) directive, the HDD industry will have removed all harmful materials such as lead, mercury and cadmium from the manufacturing of hard disk drives. The Fujitsu family of hard disk drives is already in compliance with the RoHS initiative.

Future

As HDD products continue to lean toward smaller form factors, it is necessary to consider the viability of the sub-2.5” models. In particular, 1.8” products are beginning to have an impact in the industry, particularly in the sub-notebook market as well as with mobile audio players. In January 2006, Fujitsu announced its plans to develop a 1.8” product targeting both the CE and IT markets. Fujitsu also believes that laptops will turn in this direction in the near future. Once the 1.8” units are able to achieve sufficient capacity, they will be in high demand for notebook PCs and other consumer electronic applications. The smaller, lighter drives will be coveted for their robustness, as well as their lower use of power, which will surpass what 2.5” models will be able to offer.

Summary

Despite competition from sub-2.5” hard disk drives, Mobile products are continuing to grow at the impressive rate of 30% per year. In the year 2006, the industry is expected to ship well over 100 million Mobile HDDs to OEMs as well as the channel. Key developments such as the introduction of Serial technology and increased capacity have ensured that Mobile products will remain a hot commodity. In order to continue to satisfy the demands of both CE and IT consumers, HDD manufacturers must continue to set higher standards to produce the storage solutions the marketplace needs.

About Fujitsu Computer Products of America, Inc.

Fujitsu Computer Products of America, Inc. is a subsidiary of Fujitsu Limited, a leading provider of customer-focused IT and communications solutions for the global marketplace. FCPA provides innovative solutions for the U.S. marketplace. Current product and service offerings include high performance hard disk drives, Magneto-Optical drives, scanners and scanner maintenance, palm vein recognition technology, 10Gb Ethernet switches and degaussers.

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