

High-Reliability FC-MAMR Nearline HDD with a Capacity of 18 TB

As demand for nearline HDDs for data centers is growing, the requirements for data storage solutions for both cyber and physical spaces are diversifying, making it necessary to develop new innovative technologies for not only reading but also writing data. High-reliability technologies are attracting plenty of attention as a means to overcome the limit to the HDD recording density and thereby solve the information explosion problem.

1. Releasing the MG09 series of Gen-9 nearline HDDs

In January 2019, Toshiba Electronic Devices & Storage Corporation launched the MG08 series of Gen-8 conventional magnetic recording (CMR) nearline HDDs with a capacity of 16 TB* incorporating helium-sealing, high-density assembly, and two-dimensional magnetic recording (TDMR) technologies. As a successor to the MG08 series, Toshiba will unveil the MG09 series of Gen-9 HDDs in March 2021.

The volume of data generated worldwide is predicted to grow to 175 ZB by 2025. In recent years, many solutions have appeared that collect, analyze, and utilize these data. As industry endeavors to produce even more attractive solutions, the amount of data analyzed is also growing every year, spurring exponential growth in the demand for data storage.

Under these circumstances, Toshiba has developed the MG09 series to meet the demand of data centers for high-capacity HDDs.

While employing helium-sealing technology used for the MG08 series, the MG09 series provides a higher capacity of 18 TB, making it possible to reduce the total cost of ownership (TCO) for data centers. Flux-controlled microwave-assisted magnetic recording (FC-MAMR) is the enabler for such a high capacity.

2. FC-MAMR, a technology to increase the recording density

Conventional HDDs use one writer and one reader per head whereas the MG08 series incorporates TDMR technology that uses two readers per head. With TDMR, a two-dimensional equalizer processes data read from two readers at the same time in order to improve the S/N ratio of the read signal, making it possible to increase the recording density. In contrast, FC-MAMR uses a microwave-assisted recording technique as a principle of perpendicular magnetic recording. FC-MAMR mainly directs more magnetic field flowing from the magnetic recording pole toward the recording media to increase its recording capacity.

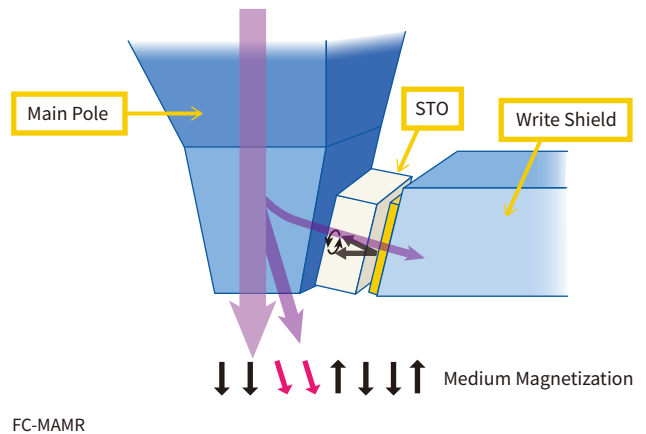
The key to increasing the HDD capacity lies in increasing the amount of data that can be written and read per unit area. Toshiba has been working to increase the HDD recording density for more than 60 years. Since 2005, our focus has been on perpendicular magnetic recording. However, the recording density achievable with this technique is now approaching its limit (roughly 1 Tbit per square inch). This is known as trilemma of perpendicular magnetic recording, i.e., the conflicting requirements for the S/N ratio of the read signal, thermal fluctuation characteristics of the recording media, and the write ability of recording heads.

While the use of TDMR had helped overcome the difficulty of read operations for the previous MG08 series, new technology was needed to further increase the recording density. Therefore, FC-MAMR was employed for the write head of the MG09 series. TDMR and FC-MAMR are a perfect combination to realize nearline HDDs with high read and write capabilities.

3. Future challenges and outlook for FC-MAMR models

Microwave-assisted switching MAMR (MAS-MAMR) has higher potential for increasing the recording density than FC-MAMR used for the MG09 series. MAS-MAMR superimposes a microwave magnetic field generated by a spin torque oscillator (STO) with a recording magnetic field from the recording magnetic pole in order to reduce the magnetic field necessary for magnetization reversal and thereby enhance the ease of recording. Toshiba started to commercialize FC-MAMR HDDs as Gen-9 models ahead of MAS-MAMR models and established common MAMR technology to develop MAS-MAMR.

And we will continue to pursue superb highreliability microwave-assisted recording techniques to develop nearline HDDs with high recording density that help reduce the total cost of ownership.



FC-MAMR



18TB MG09

*: Definition of recording capacity: A terabyte (TB) is 10^{12} (1 000 000 000 000) bytes. A computer operating system, however, indicates storage capacity using powers of 2 for the definition of 1 TB = 1 099 511 627 776 (240) bytes and therefore shows less storage capacity. Available storage capacity will vary based on file size, formatting, settings, software and operating system and/or pre-installed software applications.

Toshiba Electronic Devices & Storage Corporation

<http://toshiba.semicon-storage.com>

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