Solid State Drive (SSD)

TDK Launches SDG4A Series of Solid State Drives With 3 Gbps Serial ATA Support

- Enhanced ECC Function Allows Realization of High-Reliability SSD Using MLC NAND Type Flash Memory

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TDK Corporation announced today the launch in May 2013 of the SDG4A series of serial ATA II compatible industrial solid state drives (SSDs) in 2.5 inch form factor with a maximum capacity of 512 GByte[*1].

The product employs the newly developed TDK SSD Controller GBDriver RS4 Series. Even without using DRAM cache memory, this makes it possible to meet the requirements for SSDs in industrial applications, with an effective access speed of 180 MByte/sec[*2].

The use of the latest MLC type NAND flash memory and the addition of a read retry function indispensable for enhancing data reliability are major advantages of the new products, augmented by features of the existing GBDriver series such as auto recovery, data randomizer, and auto refresh. Integrated control of these functions enables the product to easily accommodate coming trends in flash memory.

The requirements of customers looking for further enhanced data reliability are met by the Enhanced ECC function. This not only enables a dramatic jump in data reliability, it also provides the option to balance cost and reliability in an optimized configuration, allowing customer to access the cost benefits of MLC NAND without incurring the reliability drawbacks inherent in conventional designs[*3].

The GBDriver power interruption tolerance algorithm which has won high acclaim especially among industrial users, and an integrated power supply backup circuit are standard features, making the SATA Flash Drive resistant against power supply problems, a highly desirable characteristic for demanding industrial applications.

The sophisticated static wear leveling algorithm averages the write and erase process over all blocks of the memory area, thereby drastically improving the lifespan of installed flash memory. SMART (Self-Monitoring & Analysis Reporting Technology) provides information about the number of times that memory blocks have been erased(programmed), which facilitates quantitative lifespan management of flash storage.

Data security has also been enhanced. In addition to ATA standard security functions, AES[*4] 128-bit encryption is also available. This makes it possible to store data in the NAND type flash memory in encrypted form, to guard against the risk of data leaks and tampering.

The TDK SDG4A series of industrial SSDs are SATA flash memory drives ideally suited for use as replacements for hard disc drives in industrial equipment and embedded devices. They provide high-speed performance, data reliability, storage lifespan, and data security at the highest levels in the industry.

Main applications

- Factory automation equipment such as semiconductor manufacturing equipment, NC machine tools, sequencers, programmable logic controllers, panel computers, and embedded CPU boards
- Railway and transport equipment such as automated ticket gates, automated ticket vending machines, commuter pass vending machines, train operation management systems, automated air ticket vending machines, and automated check-in systems
- Cashless registers and other point-of-sales (POS) equipment, convenience store and kiosk terminals, ATMs and other banking terminals
- Terminals and thin-client computers, SATA RAID SSD installations and other IT equipment for cloud computing systems
- Automotive equipment such as car navigation systems, digital tachographs, drive recorders, and rear-view monitors
- Office equipment such as multi-function printers (MFPs), commercial projectors, telephone conferencing systems, and electronic blackboards
- Amusement devices such as karaoke on demand, arcade games, and game consoles
- Advertising display equipment such as digital signage, electronic billboards, and electronic point-of-purchase (POP) displays
- Medical and measuring instruments and nursing-care equipment such as diagnostic imaging systems, blood analysis equipment, medical PCs, electronic patient records systems, DNA microarray systems, automatic biochemistry analyzers, remote medical care devices, and automated care devices
- Base station equipment for 4th generation (4G) mobile data communication systems such as LTE-Advanced/WiMAX2 and other communications and broadcasting equipment and information system devices
- Smart grid equipment such as smart electricity meters, power grid infrastructure equipment, automated power equipment control systems, energy management systems, and building air conditioning systems
- Security and surveillance equipment such as biometric authentication systems, entry/exit control systems, and security terminals for surveillance cameras
- Disaster prevention related equipment such as earthquake early warning systems and household fire detectors

Main features

1. Uses GBDriver RS4 NAND Flash Memory Controller Developed by TDK
The memory controller chip determines SSD performance and data reliability. The drives use the GBDriver RS4 series developed by TDK. By reflecting the latest NAND flash memory specifications and developments in the controller design, TDK enhances performance of solid state drives and ensures compatibility among flash memory generations. This means that the same product line can meet the flash storage needs of industrial and embedded applications, and the same configuration can be used to fit various flash storage needs and offer enhanced replacement products.

2. High-Speed Access
Compliant with Serial ATA Revision 2.6 Specification. Compatible with Gen. 1 (1.5 Gbps), Gen. 2 (3.0 Gbps), and NCQ commands. Supports read access speeds up to 180 MByte/second and write access speeds up to 130 MByte/second[*5] with no DRAM or other cache while maintaining high reliability.

3. Global Static Wear Leveling

TDK's proprietary global static wear leveling algorithm counts the number of times each memory block is erased (programmed) and replaces all blocks uniformly. Static blocks such as for the OS are also periodically leveled, which drastically improves the lifespan of the installed flash memory. For example, assuming a daily data write volume of 10 GB, an SSD with 16 GB capacity will support over 200 years[6] of rewrite operations. The range for static wear leveling can be freely set. (In this case, dynamic wear leveling is used for other areas.)

4. Improved Power Interruption Tolerance

A power interruption tolerance algorithm on the SSD onboard controller and an internal power supply protection circuit reliably prevent collateral data errors such as corruption of data other than the data being written if power is interrupted when writing data. This provides robust reliability against sudden power supply problems.

5. Enhanced ECC Function

30-bit ECC, 44-bit ECC or 71-bit/1KByte ECC can be selected, based on flash evaluation. For applications requiring even higher reliability, the GBDriver RS4 provides an Enhanced ECC function which uses 71 bits per 512 bytes.

6. Read Retry Function

As the cells of NAND flash memory get smaller, electric potential fluctuations at the floating gate can occur more easily, especially with MLC flash memory. When an ECC error has occurred in a read operation, the GBDriver RS4 changes the read potential and attempts to read the data again.

7. Data Randomizer Function

Data patterns are automatically randomized during the write process, to minimize the risk of bit errors due to writing the same data repeatedly.

8. Error Recovery

The auto-recovery function automatically corrects bit errors (read disturbance errors) that can occur when data are read repeatedly. The auto-refresh function reads all data including little used areas and automatically performs error correction if required. This guards against data loss due to read disturbance errors and data hold errors. Auto refresh processing is performed in the background, so even when performing correction processing, there is virtually no delay in command response.

9. Automated Encryption Using 128-bit AES

The integrated 128-bit AES encryption function automatically encrypts data when writing to the NAND flash memory, to prevent leaking of and tampering with personal data and confidential information.

10. ATA Trim Command

The ATA Trim command allows complete data erasure which is vital when replacing or discarding a drive. The command also improves write performance when erasing unneeded data.

11. Other Functions

(a) Total sector number setting function (clipping function)
The number of logical blocks allocated to a data area can be adjusted up or down in individual sector units. For example, the number of times data can be written to the flash memory can be increased by reducing the number of logical blocks. Conversely, in the case of applications that do not require an extended life span, the memory capacity can be maximized by increasing the number of logical blocks in the data area.

(b) Protection function
Incorporation of an ATA standard protection function allows customers to set and remove a password to implement independent authentication and protect important data.

(c) SMART command support
The number of times all memory blocks are erased (programmed) can be obtained using the SMART command, which allows for easy determination of the flash memory status and facilitates appropriate lifespan management.

12. Solution Support

TDK has independently developed and marketed the GBDriver series of NAND Flash memory controllers since 2000. We provide technical support to customers in Japan and overseas backed up by advanced proprietary technologies, including dispatch of field application engineers and support for implementation of reliability monitoring functions, for which there is strong demand in the industrial equipment embedded flash storage market.

Glossary

*1) Initial lineup will include products up to 256 GB.
*2) and 5) With onboard SLC flash memory. 4-channel interleaved connection. May vary depending on system environment.
*3) Using a combination of eMLC NAND and Enhanced ECC functions.
*4) Compliant with United States Department of Commerce Federal Information Processing Standard FIPS PUB197.
*6) Theoretical value for SLC flash memory with 50,000 times endurance rating.

About TDK Corporation

TDK Corporation is a leading electronics company based in Tokyo, Japan. It was established in 1935 to commercialize ferrite, a key material in electronic and magnetic products. TDK's portfolio includes electronic components, modules and systems marketed under the product brands TDK and EPCOS, power supplies, magnetic application products as well as energy devices, flash memory application devices, and others. TDK focuses on demanding markets in the areas of information and communication technology and consumer, automotive and industrial electronics. The company has a network of design and manufacturing locations and sales offices in Asia, Europe, and in North and South America. In fiscal 2013, TDK posted total sales of USD 9.1 billion and employed about 80,000 people worldwide.

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Contact for media

Contact		Phone	Mail
Ms. Mari Konishi	TDK Corporation	+81 3 6852-7102	pr@jp.tdk.com

Contact for customers

Contact		Phone	Mail
Mr. Shunichi. Hanafusa	TDK Corporation	+81 47 378-9130	shanafus@jp.tdk.com