KIOXIA

Performance Brief

New PM6 Series 24G SAS SSDs Deliver Industry-Leading Performance

KIOXIA released its new enterprise PM6 Series 24G SAS SSDs that feature a range of supported capacities, endurances, security options and dual-port capabilities to meet most any application requirement. The series also includes the largest 2.5-inch[1] SAS SSD capacity at 30.72 TB[2].

SSDs based on the Serial-Attached SCSI (SAS) interface are used for business-critical applications that place a premium on performance, high availability and data protection. The interface is supported by an industry consortium and a defined technology roadmap that 'effectively' doubles bandwidth for each new SAS generation. The current generation is 24G SAS (SAS-4) and delivers key improvements over the previous 12 gigabits per second (Gb/s) generation (SAS-3):

Performance Improvements	Reliability Improvements	Flexible and Adaptable
Doubles the effective bandwidth: 12 Gb/s SAS vs 24G SAS	128b/150b encoding 20-bit Forward Error Correction Adaptive PHY Training Algorithm (APTA)	Fairness enhancements SMP priorities Storage intelligence Backwards-compatible

24G SAS SSDs achieve significant performance gains over 12 Gb/s SAS SSDs. KIOXIA compared[3] its PM6 Series SSDs (22.5 Gb/s line rate) to leading and currently shipping 12 Gb/s SAS SSDs with the focus on read-intensive models as they are the most popular and represent the widest range of supported capacities. A performance comparison chart and a summary of improvements is also presented.

Read-Intensive Performance Comparisons

The following performance comparisons include PM6-R Series 24G SAS SSDs versus the latest and currently shipping 12 Gb/s SAS SSDs (from a leading vendor), with supported capacities from 960 GB[2] to 30,720 GB (at 1 DWPD[4] endurances):

PM6-R Series (24G SAS)

SPECIFICATION	Units	960 GB	1,920 GB	3,840 GB	7,680 GB	15,360 GB	30,720 GB
Sequential Read *(128 KB; QD=32; 18W)*	MB/s	4,150	4,150	4,150	4,150	4,150	4,150
Sequential Write *(128 KB; QD=32; 18W)*	MB/s	1,450	2,700	2,450	3,700	3,700	3,200
Random Read *(4 KB; QD=256; 18W)*	KIOPS	595	595	595	595	595	595
Random Write *(4 KB; QD=32; 18W)*	KIOPS	75	125	115	155	160	80
Random Read Latency *(@ QD=1)*	µs	100	100	100	100	125	155
Random Write Latency *(@ QD=1)*	µs	30	30	30	40	40	60

12 Gb/s SAS SSDs

SPECIFICATION	Units	960 GB	1,920 GB	3,840 GB	7,680 GB	15,360 GB	30,720 GB
Sequential Read *(128 KB; QD=64; 13.5W)*	MB/s	2,100	2,100	2,100	2,100	2,100	2,100
Sequential Write *(128 KB; QD=64; 13.5W)*	MB/s	1,000	1,800	2,000	2,000	1,800	1700
Random Read *(4 KB; QD=64; 13.5W)*	KIOPS	380	430	450	400	400	400
Random Write *(4 KB; QD=64; 13.5W)*	KIOPS	40	60	90	90	65	60

PM6-R Series Advantages

SPECIFICATION	960 GB	1,920 GB	3,840 GB	7,680 GB	15,360 GB	30,720 GB
Sequential Read	+97%	+97%	+97%	+97%	+97%	+97%
Sequential Write	+45%	+50%	+22%	+85%	+105%	+117%
Random Read	+56%	+38%	+32%	+48%	+48%	+48%
Random Write	+87%	+108%	+27%	+72%	+146%	+33%

In summary, PM6-R Series 24G SAS SSDs demonstrated significant performance improvements over a leading 12 Gb/s SAS SSD:

- *Up to 97% faster sequential read performance (regardless of capacity)*
- *Up to 117% better sequential write performance*
- *Up to 56% quicker random read performance*
- *Up to 146% greater random write performance*

For applications that require a mixed-use of read and write operations, KIOXIA's PM6-V Series 24G SAS SSDs also deliver significant performance improvements versus previous generation 12 Gb/s SAS SSDs, with supported capacities from 800 GB to 12,800 GB, at 3 DWPD endurances.

The advanced performance is also prevalent in KIOXIA's PM6-M Series of write-intensive 24G SAS SSDs when compared to previous generation 12 Gb/s SAS SSDs. The PM6-M Series supports capacities from 400 GB to 3,200 GB, at 10 DWPD endurances.

PRODUCT HIGHLIGHTS

PM6-R: Targeted Read-intensive Use Cases:
- Large Data Center Topologies
- Media Streaming / VoD
- Data Warehousing
- Content Delivery Networks

PM6-V: Targeted Mixed-Use Cases:
- High Performance Computing
- Databases
- Software-Defined Storage

PM6-M: Targeted Write-intensive Use Cases:
- Virtualized Environments
- OLTP / e-Commerce
- Compute-side AI / ML
- Data Analytics
- Caching

PM6 Series Overview

The PM6 Series is KIOXIA's 6th SAS SSD generation that builds on the company's successes as a leading SAS SSD vendor. The series leverages industry-leading 96-layer BiCS FLASH™ 3D flash memory technology and is optimized for tier 1 server and storage OEMs. Market availability in servers from leading OEMs is expected in Q1 2021. The PM6 Series also features multiple data security options that include Sanitize Instant Erase[5] (SIE) and Self-Encrypting Drive (SED) with TCG-Enterprise encryption[6] security options[7] and SED FIPS 140-2 (Level 2) support[8].

Sanitize Instant Erase (SIE)	Self-Encrypting Drive (SED)	FIPS 140-2 (Level 2)
Describes a mechanism in which an encryption engine in a drive is used solely for the purpose of 'instantly' erasing the data. With an SIE drive, the data is not 'locked' behind a password (unlike an SED drive), but is erased by telling the drive to change the key used to encrypt.	Encrypts all data to the SSD and decrypts all data from the SSD, via an alphanumeric key (or password protection) to prevent data theft. It continuously scrambles and descrambles data written to and retrieved from the SSD.	Validates that the cryptographic module within an SSD's security system will maintain the confidentiality and integrity of the data being protected. Higher levels of protection indicate drives that are progressively more resistant to attack. FIPS standards and guidelines are developed by the National Institute of Standards and Technology (NIST) in accordance with the Federal Information Security Management Act (FISMA).

Summary

Along with NVM Express™, SAS is one of the main storage interfaces between computing and storage subsystems in data centers worldwide. In comparison to 12 Gb/s, 24 G SAS effectively doubles the bandwidth and demonstrates significant performance improvements in throughput, IOPS and latency.

With the greatest breadth of 24G SAS SSDs available, KIOXIA's PM6 Series includes read-intensive, write-intensive and mixed-use SSDs in a variety of capacities, endurances, security options, and with single- or dual-port capabilities. Reliability is enhanced even further with the implementation of KIOXIA's sixth-generation two-die failure management architecture that enables PM6 Series SSDs to sustain a simultaneous two flash memory die failure, recover from it and still read all of the data. With the addition of 20-bit Forward Error Correction that corrects errors on-the-fly, the PM6 Series delivers a powerful combination for high-reliability that will help extend KIOXIA's leadership position in enterprise SAS.

NOTES:

[1] Based on publicly available specifications from competitive 24G SAS SSD products as of this publication – March 2021, Rev. 2.0.

[2] Definition of capacity - KIOXIA Corporation defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1 Gbit = 2^{30} bits = 1,073,741,824 bits, 1 GB = 2^{30} bytes = 1,073,741,824 bytes and 1 TB = 2^{40} bytes = 1,099,511,627,776 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

[3] Based on publicly available performance specifications covering the PM6 Series and a leading 12 Gb/s SAS SSD.

[4] Drive Write(s) per Day: One full drive write per day means the drive can be written and re-written to full capacity once a day, every day, for the specified lifetime. Actual results may vary due to system configuration, usage, and other factors.

[5] The Sanitize Instant Erase (SIE), Self-Encrypting Drive (SED), FIPS (Federal Information Processing Standards) optional models are available. SIE option supports Crypto Erase, which is a standardized feature defined by the technical committees (T10) of INCITS (InterNational Committee of Information Technology Standards).

[6] SED supports TCG-Enterprise SSCs. For more details, please make inquiries through "Contact us" in each region's website, https://business.kioxia.com/

[7] Optional security feature compliant drives are not available in all countries due to export and local regulations.

[8] FIPS drives are designed to comply with FIPS 140-2 Level 2, which define security requirements for cryptographic module by NIST (National Institute of Standards and Technology). For the latest validation status of each model, please contact us in each region's website, https://business.kioxia.com/

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