Samsung PM983 NGSFF NVMe™ SSD

Smart Flexibility, Enhanced Scalability

Product Brief



Highlights

Hyper scalability

As the industry's first 16 terabyte (TB) NGSFF, the PM983 provides up to **576TB system capacity** in a 1U server.

Outstanding performance

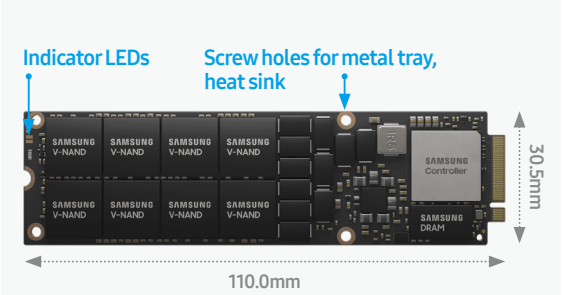
The PM983 is **1,000 times faster** than an SAS HDD in random read/write and three times better performing than a 2.5 inch SAS SSD in system.

Increased compatibility

The NGSFF form factor is able to replace an **M.2 or 2.5 inch SSD/HDD** without major changes or difficulty.

Exceptional value

Advanced features with hot-swap capabilities and indicator LEDs provide **easy front-accessibility.**
The NGSFF form factor includes four screw holes to be attached to the heat sink for better thermal characteristics.



Overview

The Samsung PM983 NGSFF takes solid-state drives (SSDs) to the next level of memory storage capacity and IOPS (input/output operations per second) performance. Measuring only 30.5mm x 110mm x 4.38mm, the NGSFF form factor offers three times the capacity of a 2.5 inch while maintaining serviceability in an M.2 size.

Equally important, the PM983 provides hyper-scale data center servers with substantially better performance and scaling options. This makes it an ideal choice for enterprise-level applications such as content delivery networks (CDN), infrastructure as a service (IaaS), shared hosting, NoSQL databases, and cloud data storage.

As a pioneer in NVMe SSDs, Samsung has been delivering the advantages of industry standard NVMe performance longer than anyone else. Samsung also has the advantage of being a vertically integrated supplier of SSDs, providing the highest levels of quality.

The highest density form factor

By building the NGSFF form factor for SSDs in 1U servers, the Samsung PM983 provides maximum system density. The NGSFF form factor can support twice the drive capacity of contemporary 2.5 inch 7mm-thick SSDs, and up to four-times the capacity of contemporary M.2 SSDs. Furthermore, the NGSFF form factor allows up to 36 front-accessible SSDs to fit in a single 1U server. (The maximum number of NGSFF SSD could be increased more depending on heat removal scheme efficiency in server system.). Compared to a typical 2U server using 24 2.5 inch SSDs, the NGSFF allows three times the number of front-accessible SSDs per rack unit. With a combination of higher drive capacity and higher system-level density, the NGSFF enables up to 1.5 times the storage capacity of 2.5 inch 32TB SSDs.

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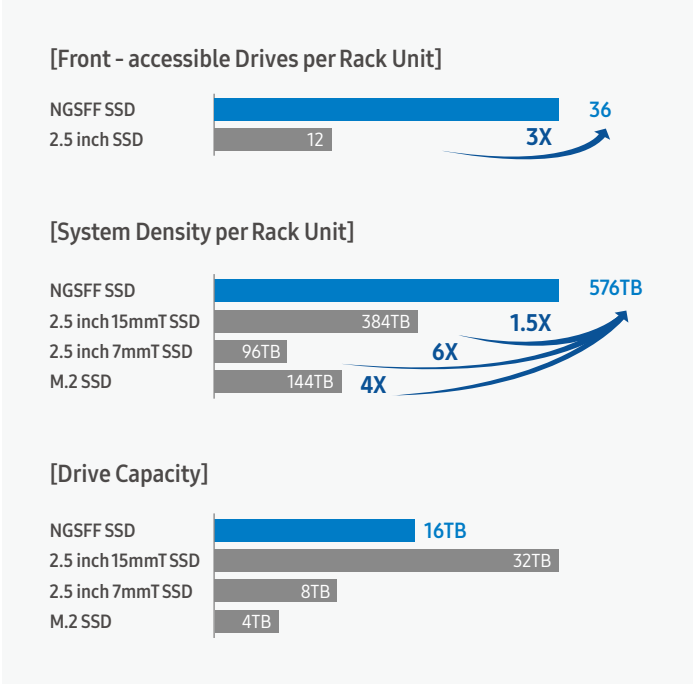
Taking Server Storage into the New Dimension



Demonstrated performance

Using the Samsung PM983 16TB NGSFF SSD instead of 4TB M.2 drives in a 1U server can increase the storage capacity of the system by four times. In fact, Samsung has demonstrated a reference server system that delivers 576TB in a 1U rack, using 36 units of 16TB NGSFF SSD. The 1U reference system can process about 10 million random read IOPS, which triples the IOPS performance of a 1U server equipped with 2.5-inch SSDs. A petabyte capacity can be achieved using only two of the 576TB systems in a 2U server.

Designed for at-scale data centers

To meet the demand for high-utilization, high-duty cycle data centers, the Samsung PM983 SSD uses firmware that prioritizes quality of service (QoS) for sustained random workloads, helping to keep all virtual machines running smoothly. The firmware is also optimized for always-on, always-busy workloads to support quick response to incoming work requests. The PM983 leverages the same controller and NAND flash memory as high-volume laptop PCs, allowing data centers to deploy NVMe SSDs at scale.

Enterprise-level power loss protection

The Samsung PM983 SSD has been designed to prevent data loss resulting from unexpected power shutdowns with its power-loss protection architecture. Upon detection of power failure, the SSD immediately uses the stored energy from tantalum capacitors to provide enough time to transfer the cached data in DRAM to the flash memory, for protection against loss of data.

Samsung PM983 NGSFF NVMe™ SSD specifications

User Capacity[1]	15.36 TB* / 7.68 TB* / 3.84 TB
Physical Capacity[2]	16 TB* / 8 TB* / 4 TB
Form Factor	NGSFF
Dimension (W X L X H)	30.50 X 110.00 X 4.38 mm
Interface	PCIe Gen 3 x4 @ 32 Gb/s
Sequential Read (128 KB)[3]	Up to 3100 MB/s[4]
Sequential Write (128 KB)[3]	Up to 2000 MB/s[4]
Random Read (4 KB, QD32)[3]	Up to 540,000 IOPS
Random Write (4 KB, QD32)[3]	Up to 50,000 IOPS
Reliability (MTBF)[5]	2 Million Hours
Reliability (UBER)[6]	1 sector per 10^{17} bits read
Endurance (DWPD)[7]	1.3 drive write per day within 3 years
Allowable Voltage	12V ± 10%
Average Power Consumption[8]	Active Read/Write Max. 9.0/11.5W, Idle : 3.6W
Weight	Max. 22g
Operating Temperature[9]	0 - 70°C

1. 1MB = 1,000,000 Bytes, 1GB = 1,000,000,000 Bytes, unformatted Capacity. User accessible capacity may vary depending on operating environment and formatting.
   * 15.36 TB (16 TB) and 7.68 TB (8 TB) are scheduled to be in mass production from Sep 2018. However, this schedule may change without notice.
2. The content related to the capacity is written based on the physical capacity (no over-provisioning).
3. Based on PCI Express Gen 3 x4, Random performance measured using FIO 2.1.3 in Linux RHEL 6.6 (Kernel 3.14.29) with 4KB (4,096 bytes) of data transfer size in queue depth 32 by 4 workers and Sequential performance with 128KB (131,072bytes) of data transfer size in queue depth 32 by 1 worker. Actual performance may vary depending on use conditions and environment.
4. 1 MB/sec = 1,000,000 bytes/sec was used in sequential performance.
5. Mean Time between Failures (MTBF) is the estimated time between failures occurring during SSD operation.
6. Uncorrectable Bit Error Rate (UBER) is a metric for the rate of occurrence of data errors, equal to the number of data errors per bits read as specified in the JESD218 document of JEDEC standard.
7. The endurance of SSD in enterprise application is defined as the maximum number of drive writes per day (DWPD) that can meet the requirements specified in the JESD218 document of JEDEC standard.
8. Active power is measured using IOMeter2006 on Windows Server 2012.
9. Operating Temperature is measured at the hottest point on the case. Sufficient airflow is recommended to be operated properly on heavier workloads wthin device operating temperature.

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For more information

For more information about Samsung PM983 NGSFF NVMe™ SSDs, visit **www.samsung.com/semiconductor.**

The technical white paper of NGSFF and reference NGSFF server system design technical details can be downloaded.

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The NVM Express® design mark is a registered trademark of NVM Express, Inc. highly recommended to provide sufficient airflow to keep SSD working properly within the operating temperature even on heavier workload.

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