

Samsung NVMe SSD 950 PRO

Reaching new levels of performance, power efficiency and reliability for client PCs

SAMSUNG

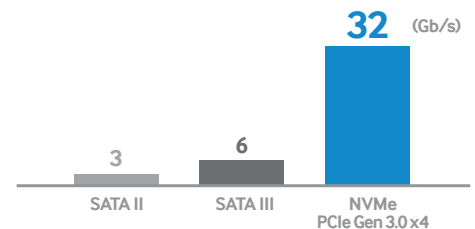
Rethink the possibilities with an unparalleled SSD now available to consumers

Broaden your horizons with an enhanced bandwidth

With the massive data growth and demand for improved quality of data, it has now become a necessity to deliver 4K video with faster connectivity and lower latency. As a result, the SATA interface using only one queue to transfer huge volumes of data creates bottlenecks and is no longer sufficient. The new NVMe interface, on the other hand, provides multiple queues to efficiently transfer data in and out of devices much faster, enabling users to capitalize on the low latency and parallelism of the PCI Express®-based SSD.

The Samsung SSD 950 PRO now makes available to PC consumers the same superb performance that was once only afforded by data centers and large corporations with massive servers — and it fits in their ultra-slim laptops. And now is the perfect time for consumers to experience the maximum performance of the 950 PRO as the PC environment is ready for NVMe adoption with the Intel® Z170 chipset (Skylake architecture) and Windows® 10 operating system, as well as motherboard support for PCI Express (PCIe) Gen 3 x4 lanes in an M.2 slot.

Storage interface comparison



SATA vs. NVMe

	SATA AHCI	PCIe NVMe
# of Queues	1	64,000
# of CMD/Queue	32	64,000

World's first V-NAND-based NVMe SSD for client PCs



As a leader in SSD technology, Samsung designed the 950 PRO - the world's first consumer SSD that combines groundbreaking V-NAND flash memory architecture with the PCIe Gen 3 interface and the NVMe protocol. V-NAND is a breakthrough in overcoming the density limitations, performance and endurance of planar NAND by stacking the layers vertically, rather than decreasing the dimensions of the cells to try to fit them on a fixed horizontal space. The result is higher density, better endurance and superb performance in a smaller footprint than conventional planar NAND architecture.

In addition, by combining the PCIe Gen 3 x4 lanes with the NVMe protocol, which means a higher bandwidth and lower latency, the 950 PRO enables users to process massive volumes of more data than SATA SSDs. The M.2 form factor, which offers a smaller and more flexible physical profile, makes the 950 PRO ideal for today's ultra-thin PCs and workstations. Plus, it is optimized to handle intensive workloads, such as engineering simulations, computer-aided design and data analysis, with ease.

Trade up to the next-generation SSD today

The 950 PRO delivers sequential read/write (R/W) speeds up to 2,500 MB/s and 1,500 MB/s* respectively. And random R/W speeds clock in at up to 300K input/output operations per second (IOPS) and 110K IOPS* respectively. When compared with a SATA SSD, the 512 GB 950 PRO outclassed it with around 4.5 times the sequential read speeds and around 2.9 times the random read speeds when using the PCIe Gen 3 x4 lanes interface as shown in Figure 1.

* 512 GB performance

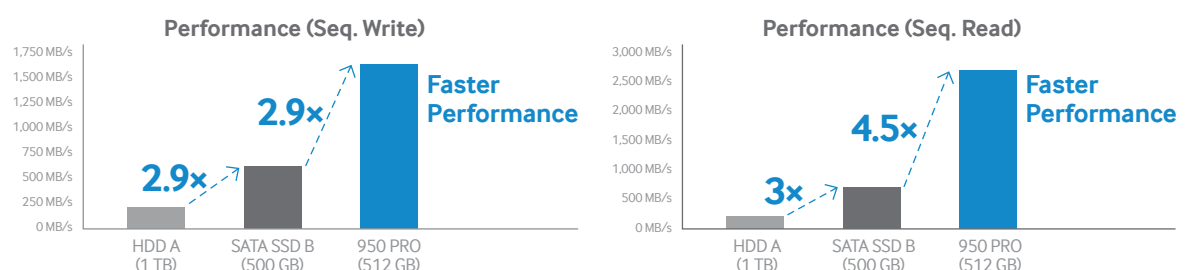


Figure 1. Sequential R/W performance of the 512 GB 950 PRO versus a SATA HDD/SSD (internal comparison test*)

Raise the bar on SSD technology

Ensure endurance and reliability for maximum use



400 Terabytes
Written

When it comes to endurance, the 950 PRO, built on the V-NAND technology, is designed to handle up to 400 terabytes written (TBW) or to guarantee 5-year limited warranty, whichever comes first.

To ensure overheating does not become an issue, Samsung has equipped the 950 PRO with Dynamic Thermal Throttling Protection technology, which monitors and maintains the drive's optimal operating temperature. The throttle feature automatically drops the temperature of the SSD when it reaches a certain threshold, protecting the data and drive while ensuring continual responsiveness.

As an added safeguard, the 950 PRO includes the Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) feature. This valuable feature tracks the health status of the SSD, monitoring it to detect and report on a variety of reliability indicators. S.M.A.R.T. is designed to anticipate failures and warn users of impending ones, enabling users to proactively replace an ailing drive, preventing data loss and unexpected outages.

Reduce power consumption without sacrificing performance



Efficient Power
Management

The faster performance of the 950 PRO equates to less power consumption and more battery life for laptops. These findings conclude that the Samsung 950 PRO is the superior performance-to-power ratio drive, as shown in Figure 2. According to the internal test, the 950 PRO shows 2 times higher sequential R/W performance than the SATA SSD while consuming the same amount of power.

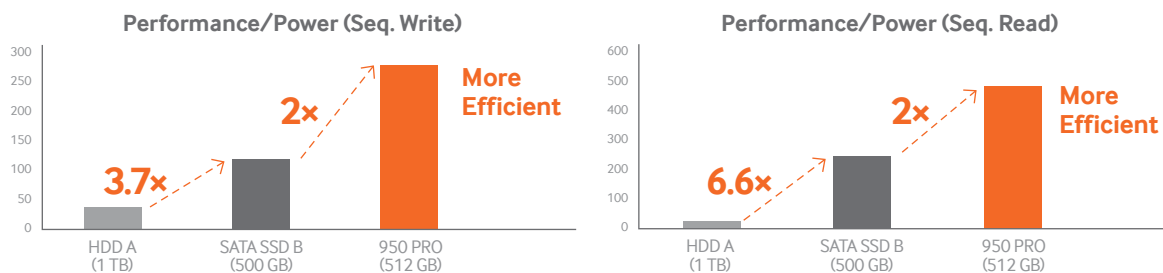


Figure 2. Performance-to-power ratio of the 512 GB 950 PRO versus a SATA HDD/SSD (internal comparison test*)

SAMSUNG
V-NAND SSD
950 PRO



* Internal comparison evaluation environment

For evaluating the SSD's performance, the 950 PRO was used in a non-RAID configuration with no pre-conditioning done on the device in the fresh-out-of-box (FOB) state. In order to accurately assess the device's performance, synthetic as well as real-world workloads were performed on the device. These tests were conducted using inbox NVMe drivers in the Microsoft Windows operating system. The test environment and tools used are listed as follows. Processor: Intel Core® i7-4790k @ 4.0 GHz. Memory: Samsung DDR3 8 GB RAM. Motherboard: ASUS™ Z97 PRO. Operating system: Windows 8.1 PRO K x64 with Inbox driver. Test suite and workloads: Iometer 1.1.0, PCMark® Vantage, PCMark 7. HDD and SSD precondition: fresh-out-of-box (FOB).

Technical Specifications

Samsung 950 PRO SSD			
Usage application		Client PCs	
Model name		MZ-VKV256	MZ-VKV512
Capacity ¹		256 GB	512 GB
Dimensions (L x W x H)		Max. 80.15 x 22.15 x 2.38 mm	
Interface		PCIe 3.0 x4 (up to 32 Gb/s) NVMe 1.1	
Form factor		M.2 (2280) ²	
Controller		Samsung UBX controller	
NAND flash memory		Samsung V-NAND	
DRAM cache memory		512 MB LPDDR3	
Performance ³	Sequential read	Up to 2,200 MB/s	Up to 2,500 MB/s
	Sequential write	Up to 900 MB/s	Up to 1,500 MB/s
	4 KB random read (QD32 thread 4)	Up to 270K IOPS	Up to 300K IOPS
	4 KB random write (QD32 thread 4)	Up to 85K IOPS	Up to 110K IOPS
	4 KB random read (QD1 thread 1)	Up to 11K IOPS	Up to 12K IOPS
	4 KB random write (QD1 thread 1)	Up to 43K IOPS	Up to 43K IOPS
Data security		AES 256-bit for user data encryption TCG Opal family spec and eDrive (IEEE®1667) to be supported by FW update	
Weight		Max. 10 g (512 GB)	
Reliability		MTBF: 1.5 million hours	
Power consumption ⁴		Active average/maximum: 5.1 W/6.4 W (256 GB), 5.7 W/7.0 W (512 GB) Idle: 70 mW, DEVSLP (L1.2 mode): 2.5 mW	
Supporting features		TRIM (Requires OS support), Garbage Collection, S.M.A.R.T.	
Temperature		Operating temperature: 0° to 70°C (Measured by S.M.A.R.T. temperature. Proper airflow recommended.)	
Humidity		5% to 95%, non-condensing	
Vibration		Non-operating: 20 - 2,000 Hz, 20 G	
Shock		Non-operating: 1,500 G, duration 0.5 ms, 3 axis	
Warranty		5 years limited	
TBW		256 GB: 200 TB, 512 GB: 400 TB	

- 1 GB = 1,000,000,000 bytes. A certain portion of capacity may be used for system file and maintenance use, so the actual capacity may differ from what is indicated on the product label.
- M.2 is a specification of a form factor for ultra-thin PCs. The M.2 standard allows widths of 12, 16, 22 and 30 mm and lengths of 16, 26, 30, 38, 42, 60, 80 and 110 mm. Commercially, the M.2 is popular with the 22 mm width and lengths 30, 42, 60, 80 and 110 mm. Samsung provides the most popular form factor with the 22 x 80 mm model (i.e., 2280) for user convenience.
- Sequential performance measurements are based on CrystalDiskMark 5.0.2, and random performance measurements are based on Iometer 1.1.0. Performance may vary based on the SSD's firmware version, system hardware and configuration. Test system configuration: Intel Core i5-6600K @ 3.5 GHz, DDR3 1,600 MHz 8 GB, OS: Windows 10 x 64, Mainboard: MSI® (Skylake) Model: Z170 KRAIT® Gaming
- Power consumption measured with Iometer 1.1.0 with Intel i7-4, 770 K (Haswell, 3.5 GHz), DDR3 8 GB, ASRock® Z87 Extreme9/ac, APST on, OS: Windows 7 Ultimate x 64 SP1



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For more information

For more information about the Samsung 950 PRO SSD, visit www.samsung.com/ssd or www.samsung.com/samsungssd.

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