Western Digital®

Western Digital® PC SN530 NVMe™ SSD

Product Manual

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Western Digital

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Revision History

Revision	Description	Date
1.0	Initial Product Release	5/2020

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1. Preface

1.1 Typographical Conventions Used

The following is a list of the typographical conventions used in this manual:

Italics – Used to indicate a technically defined term or state.

`Constant width` – Used to show a literal technical command or response.

1.2 Glossary of Abbreviations and Acronyms

AES	Advanced Encryption Standard
APST	Autonomous Power State Transitions
ASPM	Active State Power Management
ECC	Error Correction Code
EDC	Error Detection Code
ESD	Electrostatic Discharge
FFU	Field Firmware Update
FW	Firmware
HCTM	Host Control Thermal Management
LBA	Logical Block Addressing
LDPC	Low-Density Parity Check
MLC	Multi Level Cell
MTTF	Mean Time to Failure
NVMe	Non-Volatile Memory Express
PCIe	Peripheral Component Interconnect Express
RTD3	Runtime D3
SSC	Security Subsystem Class
SD	Storage Device
SED	Self-Encrypting Drive
SLC	Single Level Cell
SSD	Solid State Drive
TBW	Terabytes Written
TCG	Trusted Computing Group
TLC	Triple Level Cell

2. Introduction

This manual describes the functional, mechanical, and interface specifications for the Western Digital PC SN530 NVMe SSD.

2.1 General Description

The Western Digital PC SN530 NVMe SSD is designed to deliver high performance user experience in a small form factor, using up to 4 lanes of PCIe Gen3.

Introducing the new Western Digital in-house architecture with enhanced nCache™ 3.0, 3-gear LDPC engine, multi-pages XOR protection, full ECC data-path protection and other innovative features to optimize performance, power and reliability for the client environment and needs.

The nCache™ 3.0 is the 3rd generation of Western Digital in-house tiered-caching architecture, designed to improve performance and endurance. It supports an advanced SLC to TLC eviction policy, as well as direct-TLC writes.

The Western Digital PC SN530 NVMe SSD is optimized for the demanding power frame and thermal management requirements of low power hosts. It features NVMe low-power state of 5mW, NVMe power management, NVMe HCTM (Host Control Thermal Management), NVMe APST (Autonomous Power State Transitions) and ASPM (Active State Power Management). In addition, the SSD includes a self-thermal throttling mechanism as the last level of thermal protection.

The Western Digital PC SN530 NVMe SSD is available in three form factors: M.2 2230, M.2 2242 and M.2 2280. All configurations are single-sided assembly (S3; Z height ≤1.5mm), offered with capacities of 256 gigabytes (GB)[1], 512GB and 1024GB.

[1] 1 gigabyte (GB) = 1 billion bytes. Some of the drive capacity is used for formatting and other functions and is not available for data storage.

2.2 Key Features and Specifications

Key Feature	Description
Memory Supported	Western Digital BiCS4 512Gb 2P X3
Unformatted Capacities[2]	256GB, 512GB, 1024GB
Form Factors	M.2 2230-S3-M ; M.2 2242-S3-M ; M.2 2280-S3-M
Host Interface	PCIe Gen3 x4
Host Protocol	NVM Express 1.4
Password Protection	TCG Pyrite 2.0
Performance[3]	Sequential Read: Up to 2,400 MB/s Sequential Write: Up to 1,950 MB/s Random Read 4K: Up to 400K IOPS Random Write 4K: Up to 400K IOPS
HMB	Supported, using HW core
Average Active Power[4]	80mW
Non-Operating Low Power State (PS4)[5]	5mW
Code Protection	Secure Boot, Secure FFU
SLC Cache	nCache 3.0
Thermal Throttling	NVMe Host Control Thermal Management (HCTM); Self-Throttling
Power Management	NVMe Power Management; NVMe Autonomous Power State Transitions (APST); Active State Power Management (ASPM)
Mean Time to Failure (MTTF)	1.75M hours
Uncorrectable Bit Error Rate (UBER)	1 bit per 10^{16} bits read
ECC Algorithm	Multi-Gear Hardware LDPC Engine

[2] Logical capacity of the drive conforms to the IDEMA HDD Specification. See www.idema.org for details. A portion of the drive capacity is not available for data storage. 1 gigabyte (GB) = 1 billion bytes.

[3] Measured by CrystalDiskMark 5.2.2, 1GB LBA Range. Performance varies by capacity. See Performance Section for further details.

[4] Average power consumption measured with 1024GB drive using MobileMark™ 2014 on host with Windows 10 Pro 64-bit 19H1, Microsoft StorNVMe driver.

[5] PS4 measurements at 25°C.

Data Path Protection	Full ECC Data Path Protection
Multi Pages Recovery	Multi-pages XOR protection
Operating Temperature[6]	0˚C to 70˚C
Non-operating Temperature[7]	-55˚C to +85˚C
Operating Vibration (Random)	$5G_{RMS}$, 10 to 2,000Hz, 15min/axis on 3 axis
Non-Operation Vibration (Random)	$4.9G_{RMS}$, 7 to 800Hz, 15min/axis on 3 axis
Operating and Non-operating Shock	1,500G, 0.5ms half sine

2.3 Functional Description

The Western Digital PC SN530 NVMe SSD supports the following features:

- NVM Express 1.4 compliance
- 3-gear LDPC engine with advanced DSP capabilities in hardware
- NAND XOR protection for multi-pages recovery
- Dynamic and static wear-leveling
- TCG Pyrite Security for password protection
- Secure Boot including RSA Authentication
- Secure FFU

2.4 Advanced Flash Management

2.4.1 Defect and Error Management

The Western Digital PC SN530 NVMe SSD contains an enhanced defect and error management system. If necessary, the device will rewrite data from a defective block to a good block. This action is completely transparent to the host and does not consume any user data space.

2.4.2 Wear-Leveling

NAND based SSDs use dynamic and static wear-leveling and automatic block management to ensure an even distribution of write/erase cycles throughout the entire device. These processes guarantee high data reliability and maximize flash life expectancy. Wear-leveling is done between all TLC blocks and separately between all SLC blocks.

[6]Operational Temperature is defined as temperature reported by the drive. Note that temperature of SSD components is higher than the Operational Temperature reported.

[7] Non-operating storage temperature does not guarantee data retention beyond endurance and data retention specifications.

2.4.3 Bad Block Management

Bad blocks are occasionally created during the life cycle of a flash component. These bad blocks must be marked and replaced dynamically in order to prevent read/write failures. When a bad block is detected, the embedded Bad Block Mapping algorithm removes the block from future use.

2.4.4 Background Garbage Collection

The flash management firmware will perform internal housekeeping activities, such as consolidating and flushing the SLC blocks to the TLC storage or reorganizing the data in the TLC array or SLC array. These activities are performed in the background and are transparent to the host, thus improving performance while providing a seamless user experience.

2.4.5 SLC Cache - nCache 3.0

The Western Digital PC SN530 NVMe SSD utilizes the nCache 3.0 tiered caching (Figure 2-1) which further improves performance and power efficiently by introducing several enhancements as:

- Direct TLC (write) Access - improves sustained write-access power efficiency and write throughput
- Enhanced Evacuation Policy - improves the write-burst access speed

The nCache 3.0 is a pool of X1 (SLC) blocks for sequential and random host operations. These X1 blocks are used as write cache to accumulate and consolidate all writes at high speed. The nCache 3.0 works in the background to flush them into the larger X3 (TLC) storage blocks and uses optimized write transaction sizes to maximize endurance.

Once the SLC blocks are full, the drive will continue to program TLC blocks directly and will relocate the data from SLC to TLC on idle times.

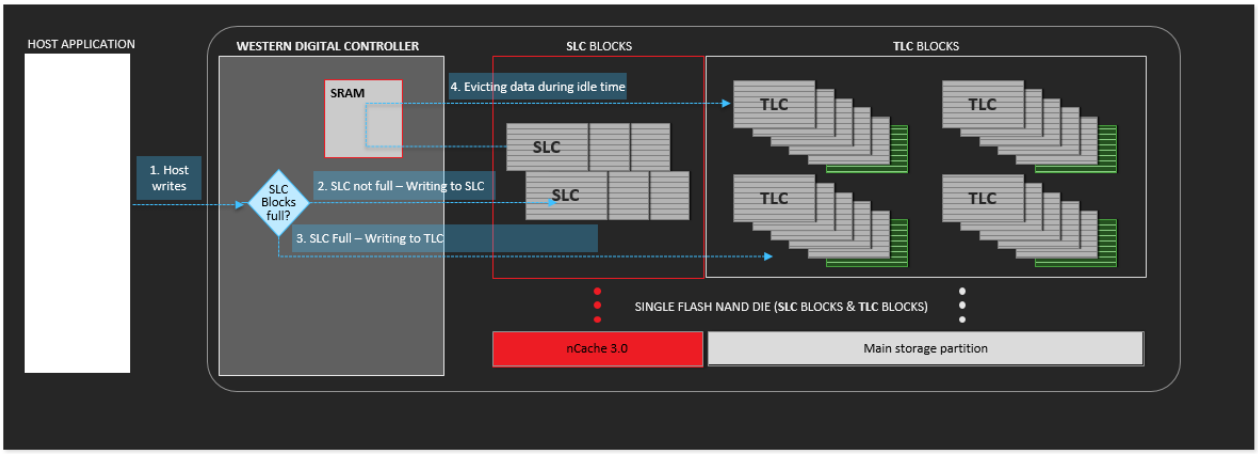

Figure 2-1: Western Digital PC SN530 NVMe SSD Tiered Caching Technology

2.4.6 Error Correction Layers

The Western Digital PC SN530 NVMe SSD advanced error correction and data recovery mechanism constructed from multi layers of protection:

- **Multi-Gear LDPC Engine** - The PC SN530 NVME SSD LDPC use Multi-Gear Hardware LDPC Engine tailored for Western Digital 3D NAND. The ultra-low power and high speed helps reduce the overall power consumed by the LDPC during reads and writes.
- **Hardware DSP and Soft Decode** – Hardware accellerators used for enhanced error correction; at high BER rates.
- **XOR Recovery** - The XOR recovery is an extreme and rare protection layer. It is a RAID-like protection and is able to recovery multi-pages at need.

3. General Product Specification

3.1 Interface

The Western Digital PC SN530 NVMe SSD is a PCI Express Gen3 x4 SSD.

The Western Digital PC SN530 NVMe SSD complies with:

- PCI Express 3.0 up to four lanes, and a bit rate of 2.5Gbps or 5Gbps or 8Gbps
- Configurable lane width: x1, x2 and x4
- NVM Express version 1.4

3.2 Hardware Configuration

Table 1 provides the basic hardware configuration values for the Western Digital PC SN530 NVMe SSD.

Unformatted Capacity[8]	Sectors in LBA Mode[9]	NAND Technology	Memory	Available Form Factors
256GB	500,118,192	BiCS4 512Gb 2P X3	1 x 4D BGA	M.2 2230-S3-M M.2 2242-S3-M M.2 2280-S3-M
512GB	1,000,215,216	BiCS4 512Gb 2P X3	1 x 8D BGA	
1024GB	2,000,409,264	BiCS4 512Gb 2P X3	1 x 16D BGA	

Table 1: Western Digital PC SN530 NVMe SSD Hardware Configuration

[8] 1 gigabyte (GB) = 1 billion bytes. Some of the listed capacity is used for formatting and other functions, and thus is not available for data storage.

[9] 1 Sector = 512 bytes. LBA count based on IDEMA standard.

4. Performance

Table 2 includes the Western Digital PC SN530 NVMe SSD performance as a primary drive in a system that supports PCI Express Gen3 x4.

Parameter	Queue Depth / Threads	256GB	512GB	1024GB
Sequential Read 128KB MB/s[10] up to	QD= 32,T= 1	2,400	2,400	2,400
Sequential Write 128KB MB/s[10] up to	QD= 32,T= 1	950	1,750	1,950
Random Read 4KB IOPS[10] up to	QD= 32,T= 4	170K	300K	370K
Random Write 4KB IOPS[10] up to	QD= 32,T= 4	110K	200K	270K
Random Read 4KB IOPS[10] up to	QD= 32,T= 8	170K	310K	400K
Random Write 4KB IOPS[10] up to	QD= 32,T= 8	120K	230K	400K
Sustained Sequential Write 128K MB/s[11] up to	QD= 32,T= 1	220	420	850

Table 2: Western Digital PC SN530 NVMe SSD Performance

[10] Test Conditions: Performance is measured by CrystalDiskMark 5.2.1 using 1000MB LBA range ASUS G752VSK . Windows 10 Pro 64-bit using Microsoft StorNVMe driver, Primary drive

[11] Test Conditions: Performance is measured by Iometer 2006 using 100% LBA range, desktop with i7-6700, 8GB RAM. Windows 10 Pro 64-bit RS4 using Microsoft StorNVMe driver, Secondary drive

5. Power Characteristics

5.1 Supply Voltage

Parameter	Specification
Input Voltage	3.3V ± 5%
Maximum Ripple	100mV (peak to peak), 100Hz to 6MHz
Maximum Supply Rise Time	100ms

Table 3: Western Digital PC SN530 NVMe SSD Supply Voltage

5.2 Average Active Power Consumption[12]

The *average active power consumption* is defined as the blended read/write/idle power used by the drive while in operation with a commonly used operating system. It is measured using the MobileMark™ 2014 benchmark. During this test Microsoft StorNVMe driver triggers non-operative low power state.

This benchmark simulates the typical usage of user applications in a Windows environment, providing a reproducible test for measuring average active power consumption.

Test Suite	Unit	256GB	512GB	1024GB
MobileMark™ 2014, Productivity	mW	70	75	80

Table 4: Western Digital PC SN530 NVMe SSD Average Active Power Consumption

[12] Power measurements at 25°C. Measured using MobileMark™ 2014 on ASUS B944UA with i5-7200U, 8GB RAM. Windows 10 Pro 64-bit 19H1 using MicroSoft driver, Primary drive.

5.3 Operating Power Consumption – Average Maximum[13]

Average maximum operating power consumption is measured while the Western Digital PC SN530 NVMe SSD is continuously processing sequential read and write commands (tested separately) for at least 10 seconds, with a transfer size of 256 sectors per command (128KB), queue depth of 32 and 1 thread. The sampling interval is 1 second. This benchmark is designed to test the worst-case scenario, when continuous power is required by the Western Digital PC SN530 NVMe SSD during long read or write command sequences.

Workload	Unit	256GB	512GB	1024GB
Sustained Sequential Read	mW	3,500	3,500	3,500
	A	1.1	1.1	1.1
Sustained Sequential Write	mW	1,800	2,100	2,900
	A	0.54	0.64	0.83

Table 5: Western Digital PC SN530 NVMe SSD Average Max Power Consumption

5.4 Peak Power and In-Rush Current

Peak power consumption is the maximum instantaneous power consumption measured while the Western Digital PC SN530 NVMe SSD is continuously processing sequential read and write commands (tested separately) for at least 10 seconds, with a transfer size of 256 sectors per command (128KB), queue depth of 32 and 1 threads. The sampling interval is 10µs. This benchmark is designed to test the worst-case scenario, when continuous power is required by the Western Digital PC SN530 NVMe SSD during long read or write command sequences.

Maximum in-rush current refers to the maximum instantaneous power consumption of the Western Digital PC SN530 NVMe SSD after a power cycle, until all voltage rails required for operation are stabilized to their nominal values on the drive. The sampling interval is 10µs.

Test	Unit	256GB	512GB	1024GB
Peak Power (10us)	mW	4,700	4,700	5,000
	A	1.4	1.4	1.5
Max In-Rush	mW	2,300	2,300	2,300
	A	0.7	0.7	0.7

Table 6: Western Digital PC SN530 NVMe SSD Peak Power and In-Rush Current

[13] Measured at 25°C. Power consumption can vary due to input voltage and ambient temperature variation.

5.5 Graceful Power-off Requirements

On most operating systems, *write cache* is enabled by default. This feature is not specific to Western Digital SSD products. There may be data residing in the Western Digital PC SN530 NVMe SSD cache that have not been written to the flash memory. To ensure that the data is properly committed to flash memory, the SSD requires the host to write `01b` (normal shutdown) to the `Shutdown Notification` (`CC:SHN`) field. This command instructs the SSD to write all of its volatile data cache to flash memory and returns a `GOOD` status to the host after its successful completion. This command is handled transparently by most operating systems during the shutdown sequence (for example, hibernation, shutdown, and standby.)

However, if power is lost without warning – leading to an ungraceful shutdown – data loss may occur. This may also lead to a longer power-on time for the subsequent power-up.

6. Thermal Throttling

6.1 Self-Thermal Throttling

To protect the integrity of the data and prevent excessive heat dissipation, the Western Digital PC SN530 NVMe SSD utilizes several component temperature sensors to monitor the SSD critical components temperatures. If a sensor temperature rises above the allowable limit, system performance is lowered until the temperature decreases to an acceptable level. The device returns to full performance when the temperature returns to a normal range.

The following table describes the performance results, while thermal throttling is activated.

	256GB		512GB		1024GB	
	Sequential Read	Sustained Sequential Write	Sequential Read	Sustained Sequential Write	Sequential Read	Sustained Sequential Write
Entry Temp [°C]	T_{Nand}>85°C or $T_{controller}$>103°C					
Exit Temp [°C]	T_{Nand}<82°C and $T_{controller}$<99°C					
Power [W]	1.8	1.8	1.8	1.8	1.8	1.8
Performance[14][MB/s]	140	45	140	45	140	45

Table 7: Western Digital PC SN530 NVMe SSD Performance during Self Thermal Throttling

6.2 Denial of Service

To avoid data corruption, and as a last protection measure, if **T_{Nand}>93°C** or **$T_{controller}$>118°C** the device will enter a denial of service state.

A recovery to functional mode is only by a full power cycle.

[14] While during self-throttling mode the SSD is keeping the power value flat; performance may varied between devices due to process variation

7. Endurance

The endurance of the Western Digital PC SN530 NVMe SSD is calculated using JEDEC client workload (JESD219), assuming data retention of 1 year at the end of life, unconnected to power in environment with 30°C.

Endurance is a direct function of user workload and access pattern. It is defined in terms of Terabytes Written (TBW). Refer to the table below.

Parameter	256GB	512GB	1024GB
Drive Endurance	200TBW	300TBW	400TBW

Table 8: Western Digital PC SN530 NVMe SSD Endurance

8. Security

There are two types of Western Digital® PC SN530 NVMe SSD SKUs:

- Non-Encrypted Drives (Non-SED). They support two security protocols:
  - TCG Pyrite 2.0
  - ATA Security passthrough over NVMe

- Self-Encrypting Drives (SED). They support two security protocols:
  - TCG Opal 2.01
  - ATA Security passthrough over NVMe

8.1 Support of TCG Pyrite 2.0

The non-SED version of the Western Digital® PC SN530 NVMe SSD supports password locking of user data conforming to the standard: "TCG Storage Security Subsystem Class: Pyrite. Specification Version 2.00." It includes the following capabilities and characteristics:

- Provides a mechanism that locks access to the entire user media by NVMe read and write commands. When configured, access is locked automatically upon device power cycle.
- Supports the following TCG features:
  - TCG Block SID Authentication
  - TCG PSID Revert conforming to the standard: "TCG Storage Opal SSC Feature Set: PSID". Block Erase is implemented as Data Removal Mechanism
- Supports up to 5 authentication attempts with the wrong password. After that, it requires a power cycle before accepting a new authentication
- Protects unlock password received from the host using a cryptographic digest. No plaintext password is stored inside the device
- By default, the device ships with TCG security disabled and with default SID credentials
- Relies on the host BIOS to implement the security protocol for password locking:
  - Host issues TCG Block SID Authentication command for devices with disabled security to prevent malicious host applications from taking control over device security using the default password
  - Host sets user password to enable device locking
  - Host submits user password to unlock locked device during system boot

8.2 Support of ATA Security passthrough over NVMe (ATA Security)

Both Non-SED and SED versions of Western Digital® PC SN530 NVMe SSD support ATA Security passthrough over NVMe (ATA Security) conforming to the definition of security protocol "ATA Device Server Password" in SPC-5 (SCSI Primary Commands 5 (SPC-5), T10/INCITS).

Here is the complete list of supported ATA Security commands:

- Security Set Password
- Security Unlock

- Security Disable Password
- Security Freeze Lock
- Security Erase Prepare
- Security Erase Unit

The SED version of Western Digital® PC SN530 NVMe SSD uses an internally generated data encryption key to protect data at rest. The password received from the host is used to wrap this key cryptographically prior to saving it to an internal security storage. User password is required to unwrap this key and decrypt the stored user data.

8.3 Support of TCG Opal 2.01

The SED version of Western Digital® PC SN530 NVMe SSD supports password locking and hardware-accelerated full disk encryption of user data at rest conforming to the standard: "TCG Storage Security Subsystem Class: Opal. Specification Version 2.01". It includes the following capabilities and characteristics:

- Superset of password locking commands from TCG Pyrite 2.0 (see section 8.1)
- AES-XTS 256-bit hardware encryption for user data
- Support of the following TCG features:
  - TCG Single User Mode
  - TCG Block SID Authentication
  - TCG PSID Revert
  - TCG Additional DataStore
  - MBR Shadowing with MBR size 128MB
- TCG Opal implementation was tested for compatibility with WinMagic and McAfee security management software

8.4 Co-existance of TCG and ATA Security protocols

ATA Security and TCG security protocols can not be activated together. Only one of the protocols can be active at any given time. If the ATA Password is set, interactions with TCG commands are implemented as specified in TCG SIIS standard v1.7 for interaction of these protocols.

When the device is in TCG Manufactured-Inactive state the host command ATA Freeze Lock also enables TCG BlockSID state.

8.5 Secure Erase Commands

Western Digital® PC SN530 NVMe SSD supports sanitization of user data using several NVMe commands and using standard commands of the supported security protocols. They implement combination of the following sanitization operations:

1. FTL Cleanup implements logical erase of user data by manipulation and clean-up of the Flash Translation Layer (FTL) tables. It makes any subsequent read request return uninitialized data. Previously written user data is not physically erased from the media but is inaccessible.
2. Block Erase implements physical erase of user data using NAND Block Erase operations. The scope of erasure includes all user LBAs including any spare and re-allocated blocks.

3. Crypto Erase erases the user data encryption key from security storage making it impossible to decrypt the data at rest. This mode is supported only on SED devices.

Table 9 summarizes operations implemented by different commands and methods together with their results.

Command	Mode	PC SN530 Non-SED, Pyrite 2.0			PC SN530 SED, Opal 2.01		
		Operations	Data at Rest	Read Result	Operations	Data at Rest	Read Result
Format NVM	No Secure Erase (SES = 000b)	FTL Cleanup	Untouched	Zeroes	FTL Cleanup	Untouched	Zeroes
	User Data Erase (SES = 001b)	FTL Cleanup Block Erase	NAND Erase	Zeroes	FTL Cleanup Block Erase	NAND Erase	Zeroes
	Crypto Erase (SES = 010b)	N/A			FTL Cleanup, Crypto Erase	Untouched, Decryption key erased	Zeroes
Sanitize[15]	Block Erase (SANACT = 010b)	FTL Cleanup Block Erase	NAND Erase	Zeroes	FTL Cleanup	NAND Erase	Zeroes
	Crypto Erase (SANACT = 100b)	N/A			FTL Cleanup, Crypto Erase	Untouched, Decryption key erased	Zeroes
TCG Revert[16]**, Revert SP**	KeepGobalLocking RangeKey/KeepData = FALSE	FTL Cleanup Block Erase	NAND Erase	Zeroes	FTL Cleanup, Crypto Erase	Untouched, Decryption key erased	Zeroes
ATA Security	Normal	FTL Cleanup Block Erase	NAND Erase	Zeroes	FTL Cleanup Block Erase	NAND Erase	Zeroes
	Enhanced	FTL Cleanup, Block Erase	NAND Erase	Zeroes	FTL Cleanup, Crypto Erase	Untouched, Decryption key erased	Zeroes

Table 9: Western Digital PC SN530 NVMe SSD Data Erase Command and Results

8.6 Security of Read-Only Mode

Device enters read-only mode upon reaching end-of-life conditions for user media. In this mode, it stops accepting commands that might write user or system data.

Format NVM in the User Data Erase mode is supported when device turns read only mode. It provides a secure option to erase all user data before disposal of the device or before returning it for failure analysis. Successful status returned for the command is an indication of complete sanitization of user data. If device fails to complete the process, sanitization should be addressed by physical destroy methods, e.g. shredding.

Device preserves TCG locking settings as configured before transition to read-only mode. Host application shall be ready in case NVMe command Format NVM is aborted when device is write-locked. Host shall unlock device with valid user password before applying the command.

[15] Sanitize doesn't support parameter NDAS and Overwrite operation

[16] TCG Revert does not erase user data if TCG protocol is not activated

8.7 Secure Field Firmware Update (FFU)

The genuine Western Digital® firmware update image is encrypted and signed. The RSA digital signature algorithm with 2048-bit key is used for signing of the file, while AES-CBC-256 algorithm is used for encryption.

The device automatically verifies the signature of a firmware update image during FFU and rejects images that fail the procedure. A root certificate is provisioned to permanent eFuse storage in the SSD controller during device manufacturing. The firmware signing process in Western Digital relies on HSM-based signing servers for the storage of private keys to guarantee protection against key leakage and enable auditability of firmware releases.

The Western Digital PC SN530 NVMe SSD implements no interface to update device firmware that bypasses regular FFU commands or to disable digital signature verification.

8.8 Secure Boot

The Western Digital PC SN530 NVMe SSD verifies digital signatures of firmware images loaded from NAND Flash storage before running them. Signatures cover all parts of the stored firmware images including the boot loader. The boot loader itself is verified by ROM, then it verifies other parts. If the verification fails, the SSD enters failure mode where it does not handle user data commands except Identify Controller.

Secure Boot uses an RSA digital signature algorithm with 2048-bit keys. The firmware signing process in Western Digital relies on HSM-based signing servers for storage of private keys. The SSD controller includes hardware acceleration for RSA calculations to ensure that signature verification does not cause significant delays for the Western Digital PC SN530 NVMe SSD initialization. The RSA Public key for verification is provisioned to the device during manufacturing and rooted to the SSD controller one-time programmable eFuse.

8.9 Secure RMA

All Western Digital® PC SN530 NVME SSD devices implement hardware “locks” for debug access to the SSD controller and for any vendor-specific diagnostic commands. Removing of these “locks” is limited only to authorized engineers in WD facilities. The unlock procedure requires authentication on Western Digital® HSM-based Signing Server with an RSA challenge-request protocol that generates a device-specific unlock token. The public key for verification of the procedure is provisioned to device during manufacturing and rooted to the controller eFuse.

9 Physical Specifications

9.1 M.2 2230 Form Factor

The M.2 2230 form factor complies with PCI Express M.2 (NGFF) Electromechanical Specification, rev. 1.1.

Parameter	Specifications
Type	256GB: M.2 2230-S3-M 512GB: M.2 2230-S3-M 1024GB: M.2 2230-S3-M
Width	22 ± 0.15mm
Length	30 ± 0.15mm
Thickness (max)	2.38mm
Typical Weight	3.2 ± 0.5g

Table 10: Western Digital PC SN530 NVMe SSD M.2 2230 Form Factor Mechanical Specifications

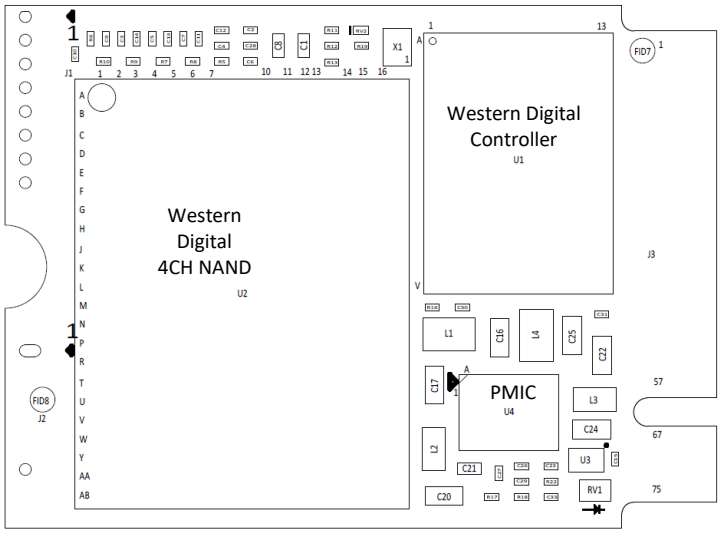

Figure 9-1: Placement of Western Digita PC SN530 NVMe SSD M.2 2230 Form Factor

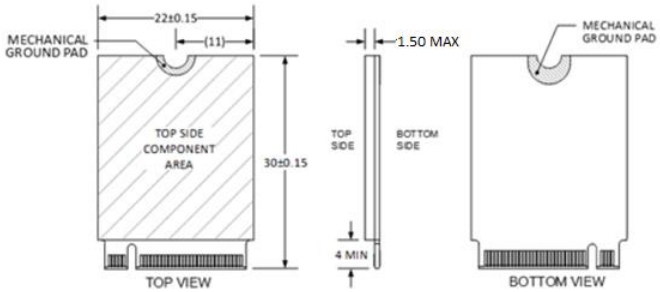

Figure 9-2: Mechanical Dimensions of Western Digital PC SN530 NVMe SSD M.2 2230-S3-M Form Factor

9.2 M.2 2242 Form Factor

The M.2 2230 form factor complies with PCI Express M.2 (NGFF) Electromechanical Specification, rev. 1.1.

Parameter	Specifications
Type	256GB: M.2 2242-S3-M 512GB: M.2 2242-S3-M 1024GB: M.2 2242-S3-M
Width	22 ± 0.15mm
Length	42 ± 0.15mm
Thickness (max)	2.38mm
Typical Weight	3.9 ± 0.5g

Table 11: Western Digital PC SN530 NVMe SSD M.2 2242 Form Factor Mechanical Specifications

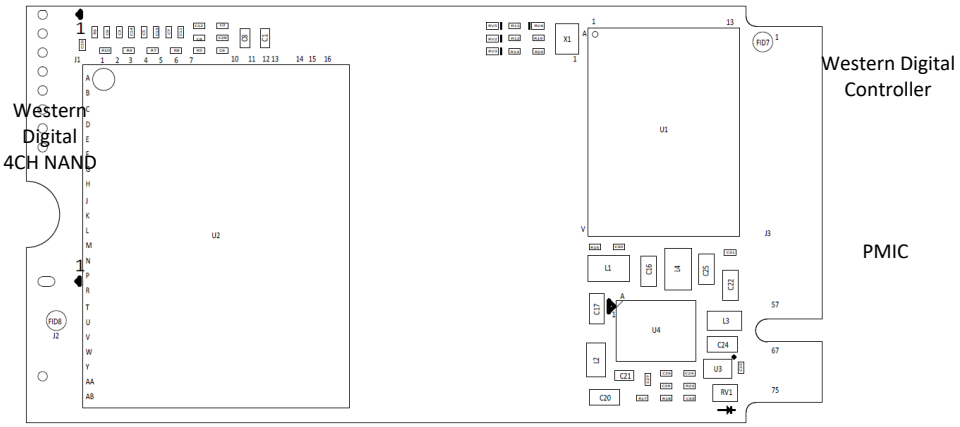

Figure 9-3: Placement of Western Digita PC SN530 NVMe SSD M.2 2242 Form Factor

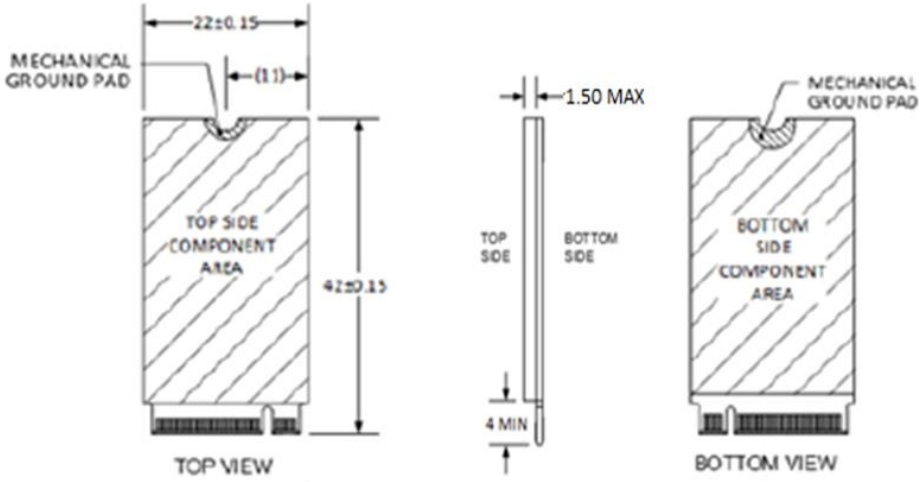

Figure 9-4: Mechanical Dimensions of Western Digital PC SN530 NVMe SSD M.2 2242-S3-M Form Factor

9.3 M.2 2280 Form Factor

The M.2 2280 form factor complies with PCI Express M.2 (NGFF) Electromechanical Specification, rev. 1.1.

Parameter	Specifications
Type	256GB: M.2 2280-S3-M 512GB: M.2 2280-S3-M 1024GB: M.2 2280-S3-M
Width	22 ± 0.15mm
Length	80 ± 0.15mm
Thickness (max)	2.38mm
Typical Weight	7.5±1g

Table 12: Western Digital PC SN530 NVMe SSD M.2 2280 Form Factor Mechanical Specifications

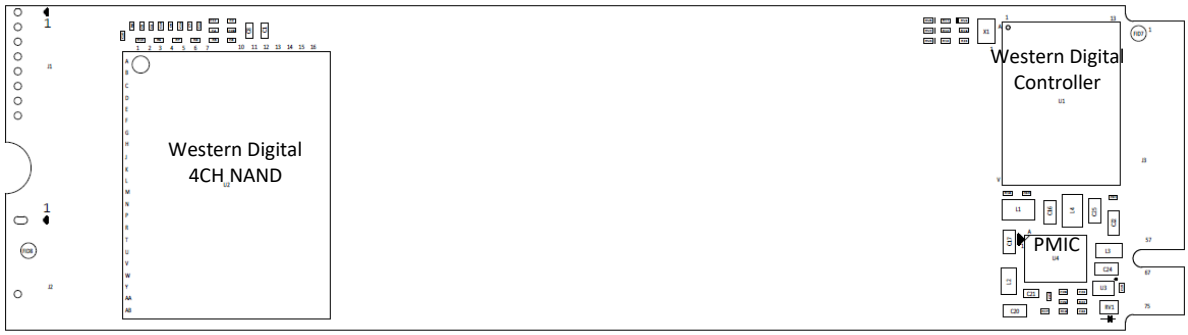

Figure 9-5: Placement of Western Digital PC SN530 NVMe SSD M.2 2280 Form Factor

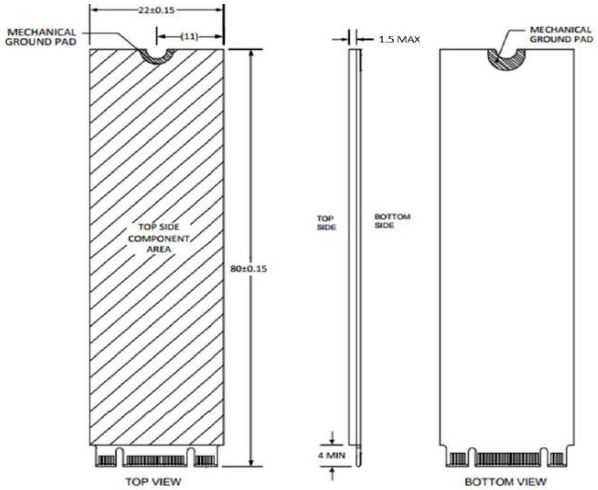

Figure 9-6: Mechanical Dimensions of Western Digital PC SN530 NVMe SSD M.2 2280-S3-M Form Factor

10. Environmental Specifications

10.1 Temperature

Parameter	Specifications
Operational[17]	0°C to 70°C
Non-operational[18]	-55°C to 85°C

Table 13: Western Digital PC SN530 NVMe SSD Temperature Specifications

10.2 Humidity

Parameter	Specifications
Operational	
Humidity (Non-condensation)	5% to 95%
Maximum Wet Bulb	30°C
Non-operational	
Humidity (Non-condensation)	5% to 95%
Maximum Wet Bulb	40°C

Table 14: Western Digital PC SN530 NVMe SSD Humidity Specifications

10.3 Vibration

Parameter	Specifications
Operating (Random)	$5G_{RMS}$, 10 to 2,000Hz, 15min/axis on 3 axes
Non-Operation (Random)	$4.9G_{RMS}$, 7 to 800Hz, 15min/axis on 3 axes

Table 15: Western Digital PC SN530 NVMe SSD Vibration Specifications

[17] Operational temperature is defined as temperature reported by the drive. Note that drive temperature readings are expected to be higher than ambient temperature when the SSD is placed inside a system

[18] Non-operational storage temperature does not guarantee data retention

10.4 Shock

Parameter	Acceleration Force	Half Sine pulse duration
Operational	1,500G	0.5ms
Operational	1,000G	1.0ms
Non-operational	500G	2ms
Non-operational	1,500G	0.5ms

Table 16: Western Digital PC SN530 NVMe SSD Shock Specification

10.5 Altitude

Parameter	Specifications
Operational/Non-operational	-1500ft (-457m) to 40,000ft (12,192m)

Table 17: Western Digital PC SN530 NVMe SSD Altitude Specification

10.6 Electrostatic Discharge (ESD)[19]

Parameter	Test Voltage
Contact	±4kV
Air	8kV

Table 18: Western Digital PC SN530 NVMe SSD ESD Specification

10.7 Acoustics

The Western Digital PC SN530 NVMe SSD does not generate any acoustic noise (0dB).

[19] Tested per IEC 61000-4-2 Standard.

10.8 Regulatory Agency Approvals and Declarations

The Western Digital PC SN530 NVMe SSD meets the standards of the following regulatory agencies:

- **Federal Communication Commission**: Verified to comply with FCC Rules for Radiated and Conducted Emission, Part 15, Subpart B, for Class B Equipment.

  This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

  - Reorient or relocate the receiving antenna.
  - Increase the separation between the equipment and receiver.
  - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
  - Consult the dealer or an experienced radio/TV technician for help.
- **Canada EMI Compliance**: Per ICES-003 Issue 5, Class B
- **CE Compliance for Europe Countries and Morocco**: Verified to comply with EN55032:2015 for RF Emissions and EN55024:1998, A1:2001 + A2:2003, EN61000-3-2:2000, EN61000-3-3:1995 + A1:2001 for Generic Immunity as applicable. Verified to meet or exceed Directive of Electromagnetic Compatibility 2014/30/EU and Safety Low Voltage Directive 2014/35/EU.
- **RCM Compliance for Australia and New Zealand**: Verified to comply with AS/NZ3548 for RF Emissions as required by the Australian Communications Authority.
- **Korean KC Mark**: Registered as a Class-B product with the South Korean Ministry of Information and Communication.
- **Taiwan BSMI ROHS Compliance**: Certified as a Class-B product with the Bureau of Standards Metrology and Inspection (BSMI ROHS).
- **Voluntary Control Council for Interference (VCCI):** verified to comply with VCCI V-2 (V-3 Technical Requirements), the Voluntary Control Council for Interference by Information Technology Equipment.

  この装置は、クラスB機器です。この装置は、住宅環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
  取扱説明書に従って正しい取り扱いをして下さい。 VCCI－B

- **CB-Scheme Safety Standard:** Verified safety compliance per IEC 60590-1 (IEC System for Mutual Recognition of Test Certificates for Electrical Equipment (IECEE)).
- **Underwriters Laboratories for USA and Canada product safety**: Bi-National UL Standard CAN/CSA-C22.2 No. 60950/UL 60950-1 Standard for Safety of Information Technology Equipment, including Electrical Business Equipment.

- **EU Safety Compliance**: IEC 60950-1 per EN 60950-1/IEC 62368-1 per EN 62368-1, Standard for Safety of Information Technology Equipment, including Electrical Business Equipment.

10.9 Chemical Restrictions

The Western Digital PC SN530 NVMe SSD complies with the European Union's Restriction on Use of Hazardous Substances in Electrical and Electronic Equipment (EU RoHS) Directive 2011/65/EC and European Union's Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Regulation (EC) 1907/2006.

The Western Digital PC SN530 NVMe SSD complies with the European Community Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

It also complies with China's management methods for controlling pollution by electronic information products (China RoHS).

11. Reliability Characteristics

11.1 Error Rate

The non-recoverable error rate is 1 error per 10^{16} bits read.

11.2 Mean Time to Failure (MTTF)[20]

Mean Time to Failure (MTTF) is the reliability figure most often used for electronic equipment. The Western Digital PC SN530 NVMe SSD has an estimated MTTF using a prediction methodology based in accordance with the Telcordia Special Report SR-332. The prediction is based on a Parts Stress Analysis.

Quality levels were defined as industrial grade (I) for all of the components. The detailed prediction for the system was performed at a temperature of 25°C in a GB (ground, benign) environment.

The following table summarizes the estimated MTTF results for each capacity.

Capacity	Condition	MTTF (Hours)
256GB	Telcordia SR-332, GB, 25°C	1.75M
512GB	Telcordia SR-332, GB, 25°C	1.75M
1024GB	Telcordia SR-332, GB, 25°C	1.75M

Table 19: Western Digital PC SN530 NVMe SSD MTTF

[20] Based on internal testing using Telcordia stress part testing.

12. Windows Device Certifications

12.1 HCK Certification

The Western Digital PC SN530 NVMe SSD is certified with Windows HCK (Hardware Certification Kit) for Windows 7

Category: Device

Product Type: Hard Drive

12.2 HLK Certification

The Western Digital PC SN530 NVMe SSD is certified with Windows HLK (Hardware Lab Kit) for Windows 10.

Category: Device

Product type: Hard Drive

13. Interface

13.1 Supported Standards

The Western Digital PC SN530 NVMe SSD complies with the following standards:

- PCI Express® Base Specification Revision 4.0

13.2 Pin Assignments — M.2 with M Key

Pin #	Function	Pin #	Function
1	GND	2	3.3V
3	GND	4	3.3V
5	PETn3	6	NC
7	PETp3	8	PLN #
9	GND	10	LED/DAS
11	PERn3	12	3.3V
13	PERp3	14	3.3V
15	GND	16	3.3V
17	PETn2	18	3.3V
19	PETp2	20	NC
21	GND	22	NC
23	PERn2	24	NC
25	PERp2	26	NC
27	GND	28	NC
29	PETn1	30	PLA_S3 #
31	PETp1	32	NC
33	GND	34	NC
35	PERn1	36	NC
37	PERp1	38	NC
39	GND	40	NC
41	PETn0	42	NC
43	PETp0	44	NC
45	GND	46	NC
47	PERn0	48	NC
49	PERp0	50	PERST#
51	GND	52	CLKREQ#
53	REFCLKn	54	NC
55	REFCLKp	56	NC
57	GND	58	NC
59	M key	60	M key

Pin #	Function	Pin #	Function
61		62	
63		64	
65		66	
67	NC	68	NC
69	NC	70	3.3V
71	GND	72	3.3V
73	GND	74	3.3V
75	GND		

Table 20: Western Digital PC SN530 NVMe SSD M.2 Pin Assignments

14. Supported PCIe NVMe Commands and Features

14.1 NVMe Command Set

The Western Digital PC SN530 NVMe SSD supports NVMe 1.4 standard command set and the following configurations:

- 1 Namespace
- 16 Queues
- 8 Async. Events Notifications

Command Name	Opcode	Comment
Admin Commands		
Delete I/O Submission Queue	00h	
Create I/O Submission Queue	01h	
Get Log Page	02h	
Delete I/O Completion Queue	04h	
Create I/O Completion Queue	05h	
Identify	06h	
Abort	08h	
Set Features	09h	
Get Features	0Ah	
Asynchronous Event Request	0Ch	Max of 8
Firmware Commit	10h	
Firmware Image Download	11h	
Device Self-Test	14h	
Format NVM (User Data Erase)	80h	
Security Send	81h	
Security Receive	82h	

Sanitize	84h	
NVM Commands		
Flush	00h	
Write	01h	
Read	02h	
Write Uncorrectable	04h	
Compare	05h	
Write Zeros	08h	
Dataset Management	09h	
Set Features/Get Features		
Feature Identifiers – Mandatory	Arbitration	
Feature Identifiers – Mandatory	Power Management	
Feature Identifiers – Optional	LBA Range Type	
Feature Identifiers – Mandatory	Temperature Threshold	
Feature Identifiers – Mandatory	Error Recovery	
Feature Identifiers – Optional	Volatile Write Cache	
Feature Identifiers – Mandatory	Number of Queues	
Feature Identifiers – Mandatory	Interrupt Coalescing	
Feature Identifiers – Mandatory	Write Atomicity	
Feature Identifiers – Mandatory	Asynchronous Event Configuration	
Feature Identifiers – Optional	Host Controlled Thermal Management (HCTM)	
Feature Identifiers – Optional	Non-operational Power State Configuration (Permissive mode)	
Feature Identifiers – Optional	Telemetry	

Feature Identifiers – Optional	Host Memory Buffer	
Feature Identifiers – Optional	Timestamp	

Table 21: Western Digital PC SN530 NVMe SSD Command Set

14.2 NVMe Identify Controller Response

The following table defines the specifics of the Identify Controller returned by the Western Digital PC SN530 NVMe SSD.

Bytes	Field	Value	Comments
Controller Capabilities and Features			
01:00	PCI Vendor ID (VID)	15B7h	
03:02	PCI Subsystem Vendor ID (SSVID)	Vendor ID: 15B7h	
23:04	Serial Number (SN)	Variable	Unique serial number in ASCII
63:24	Model Number (MN)	“Western Digital PC SN530” & SKU	
71:64	Firmware Revision (FR)	Variable	
72	Recommended Arbitration Burst (RAB)	4h	
75:73	IEEE OUI Identifier (IEEE)	001B44h	
76	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)	0h	7-3 Reserved 2 0 = PCI Function 1 0 = Single Controller 0 0 = Single PCIe Port
77	Maximum Data Transfer Size (MDTS)	7h	512KB
79:78	Controller ID (CNTLID)	1h	

Bytes	Field	Value	Comments
83:80	Version (VER)	10400	Was 10300
87:84	RTD3 Resume Latency (RTD3R)	7A120h	500,000us
91:88	RTD3 Entry Latency (RTD3E)	F4240h	1,000,000us
95:92	Optional Asynchronous Events Supported (OAES)	200h	
99:96	Controller Attributes (CTRATT)	2h	
111	Controller Type (CNTRLTYPE)	1h	
255:240	NVMe Management Interface	0h	
Admin Command Set Attributes & Optional Controller Capabilities			
257:256	Optional Admin Command Support (OACS)	17h	Supported commands: • Security Send and Security Receive • Format NVM • Firmware Commit and Firmware Image Download • Device Self-Test 15-9 0 = Reserved 8-5 0 = Not supported 4 1 = Device Self-test command is supported 3 0 = no support for the Namespace Management and Namespace Attachment commands 2 1 = Firmware Commit and Firmware Image Download commands are supported 1 1 = Format NVMe command is supported 0 1 = Security Send and Security Receive commands are supported

Bytes	Field	Value	Comments
258	Abort Command Limit (ACL)	4h	5 Abort commands supported
259	Asynchronous Event Request Limit (AERL)	7h	8 AERs supported
260	Firmware Updates (FRMW)	14h	7-5 Reserved 4 1 = firmware activation without a reset is supported 3-1 010 = 2 firmware slots are supported 0 1 = slot 1 is read only / 0 = slot 1 is read/write
261	Log Page Attributes (LPA)	1Eh	Command Effects log page supported 4 1 = Supports the Persistent Event Log 3 1 = Telemetry Host-Initiated and Telemetry Controller-Initiated log pages and sending Telemetry Log Notices 2 1 = support for extended data for Get Log Page 1 1 = Command Effects Log page is supported 0 0 = no support for SMART/Health information log page on a per namespace basis
262	Error Log Page Entries (ELPE)	FFh	256 entries supported
263	Number of Power States Support (NPSS)	4h	
264	Admin Vendor Specific Command Configuration (AVSCC)	1h	7-1 Reserved 0 1 = All Admin Vendor Specific Commands use the format as defined by NVMe standard
265	Autonomous Power State Transition Attributes (APSTA)	1h	Autonomous power state transitions supported
267:266	Warning Composite Temperature Threshold	161h	353°K (79.85°C)

Bytes	Field	Value	Comments
	(WCTEMP)		
269:268	Critical Composite Temperature Threshold (CCTEMP)	166h	358°K (84.85°C)
271:270	Maximum Time for Firmware Activation (MTFA)	32h	5 seconds
275:272	Host Memory Buffer Preferred Size (HMPRE)	C800h	200MB
279:276	Host Memory Buffer Minimum Size (HMMIN)	337h	3MB
295:280	Total NVMe Capacity (TNVMCAP)	256GB: 3B9E656000 512GB: 773C256000 1024GB: EE77A56000	
311:296	Unallocated NVM Capacity (UNVMCAP)	0h	
315:312	Replay Protected Memory Block Support (RPMBS)	0h	
317:316	Extended Device Self-test Time (EDSTT)	256GB: 2Ch 512GB: 39h 1024GB: 46h	
318	Device Self-test Options (DSTO)	1h	
319	Firmware Update Granularity (FWUG)	1h	
321:320	Keep Alive Support (KAS)	0h	
322:323	Host Controlled Thermal Management Attributes (HCTMA)	1h	
324:325	Minimum Thermal Management	111h	

Bytes	Field	Value	Comments
	Temperature (MNTMT)		
326:327	Maximum Thermal Management Temperature (MXTMT)	166h	
328:331	Sanitize Capabilities (SANICAP)	40000002h	
332:335	Host Memory Buffer Minimum Descriptor Entry Size (HMMINDS)	0h	
336:337	Host Memory Maximum Descriptors Entries (HMMAXD)	8h	
511:338	Reserved	0h	
NVM Command Set Attributes			
512	Submission Queue Entry Size (SQES)	66h	7-4 0110 = Maximum Submission Queue entry size is 6 3-0 0110 = Required Submission Queue entry size is 6
513	Completion Queue Entry Size (CQES)	44h	7-4 0100 = Maximum Completion Queue entry size is 4 3-0 0100 = Required Completion Queue entry size is 4
515:514	Maximum Outstanding Commands (MAXCMD)	0h	
519:516	Number of Namespaces (NN)	1h	Supporting one Namespace
521:520	Optional NVM Command Support (ONCS)	5Fh	15-7 Reserved 7 0 = Verify command supported 6 1 = Timestamp feature 5 0 = Reservations are not supported 4 1 = Save field in the Set Features

Bytes	Field	Value	Comments
			command and the Select field in the Get Features command are supported 3 1 = Write Zeroes command is supported 2 1 = Dataset Management command is supported 1 1 = Write Uncorrectable command is supported 0 1 = Compare command is supported
523:522	Fused Operation Support (FUSES)	0h	
524	Format NVM Attributes (FNA)	0h	
525	Volatile Write Cache (VWC)	7h	7-3 Reserved 2-1 11 = Flush Behaviour 0 1 = Volatile write cache is present
527:526	Atomic Write Unit Normal (AWUN)	0h	
529:528	Atomic Write Unit Power Fail (AWUPF)	0h	
530	NVM Vendor Specific Command Configuration (NVSCC)	1h	7-1 Reserved 0 1 = All NVM Vendor Specific Commands use the format defined in NVMe standard for Vendor Specific commands
531	Reserved	0h	
533:532	Atomic Compare & Write Unit (ACWU)	0h	
535:534	Reserved	0h	
539:536	SGL Support (SGLS)	0h	
767:540	Reserved	0h	
1023:768	NVM Subsystem NVMe Qualified Name (SUBNQN)	0h	

Bytes	Field	Value	Comments
1791:1024	Reserved	0h	
2047:1792	NVMe over fabric identify	0h	
Power State Descriptors			
2079:2048	Power State 0 Descriptor (PSD0)	0 2 0 0 256GB: B4h 512GB: D2h 1024GB: 122h 0 1h 0 189Ch 0 0 0 0 0 0 0 0 0 0 0 0 256GB:15Eh 512GB:15Eh 1024GB: 15Eh	255-184 Reserved 183-182 Active Power Scale (APS) 181-179 Reserved 178-176 Active Power Workload (APW) 175-160 Active Power (ACTP) 159-152 Reserved 151-150 Idle Power Scale (IPS) 149-144 Reserved 143-128 Idle Power (IDLP) 127-125 Reserved 124-120 Relative Write Latency (RWL) 119-117 Reserved 116-112 Relative Write Throughout 111-109 Reserved 108-104 Relative Read Latency (RRL) 103-101 Reserved 100-96 Relative Read Throughput (RRT) 95-64 Exit Latency (EXLAT) 63-32 Entry Latency (ENLAT) 31-26 Reserved 25 Non-Operational State (NOPS) 24 Max Power Scale (MXPS) 23-16 Reserved 15-00 Maximum Power (MP)
2111-2080	Power State 1 Descriptor (PSD1)	0 2 0 0 256GB: A0h 512GB: A0h 1024GB: B4h 0 1h 0	255-184 Reserved 183-182 Active Power Scale (APS) 181-179 Reserved 178-176 Active Power Workload (APW) 175-160 Active Power (ACTP) 159-152 Reserved 151-150 Idle Power Scale (IPS) 149-144 Reserved

Bytes	Field	Value	Comments
		189Ch	143-128 Idle Power (IDLP)
		0	127-125 Reserved
		0	124-120 Relative Write Latency (RWL)
		0	119-117 Reserved
		0	116-112 Relative Write Throughout
		0	111-109 Reserved
		0	108-104 Relative Read Latency (RRL)
		0	103-101 Reserved
		0	100-96 Relative Read Throughput (RRT)
		0	95-64 Exit Latency (EXLAT)
		0	63-32 Entry Latency (ENLAT)
		0	31-26 Reserved
		0	25 Non-Operational State (NOPS)
		0	24 Max Power Scale (MXPS)
		0	23-16 Reserved
		256GB: F0h 512GB: F0h 1024GB: 10Eh	15-00 Maximum Power (MP)
2143-2112	Power State 2 Descriptor (PSD2)	0	255-184 Reserved
		0	183-182 Active Power Scale (APS)
		2	181-179 Reserved
		0	178-176 Active Power Workload (APW)
		96h	175-160 Active Power (ACTP)
		0	159-152 Reserved
		0	151-150 Idle Power Scale (IPS)
		0	149-144 Reserved
		189Ch	143-128 Idle Power (IDLP)
		0	127-125 Reserved
		0	124-120 Relative Write Latency (RWL)
		0	119-117 Reserved
		0	116-112 Relative Write Throughout
		0	111-109 Reserved
		0	108-104 Relative Read Latency (RRL)
		0	103-101 Reserved
		0	100-96 Relative Read Throughput (RRT)
		0	95-64 Exit Latency (EXLAT)
		0	63-32 Entry Latency (ENLAT)
		0	31-26 Reserved
		0	25 Non-Operational State (NOPS)
		0	24 Max Power Scale (MXPS)
		0	23-16 Reserved
		BEh	15-00 Maximum Power (MP)
2175:2144	Power State 3	0	255-184 Reserved
		0	183-182 Active Power Scale (APS)
		0	181-179 Reserved

Bytes	Field	Value	Comments	
	Descriptor (PSD3)	0	178-176	Active Power Workload (APW)
		0	175-160	Active Power (ACTP)
		0	159-152	Reserved
		0	151-150	Idle Power Scale (IPS)
		0	149-144	Reserved
		0	143-128	Idle Power (IDLP)
		0	127-125	Reserved
		3	124-120	Relative Write Latency (RWL)
		0	119-117	Reserved
		3	116-112	Relative Write Throughout
		0	111-109	Reserved
		3	108-104	Relative Read Latency (RRL)
		0	103-101	Reserved
		3	100-96	Relative Read Throughput (RRT)
		2AF8h	95-64	Exit Latency (EXLAT)
		F3Ch	63-32	Entry Latency (ENLAT)
		0	31-26	Reserved
		1	25	Non-Operational State (NOPS)
		1	24	Max Power Scale (MXPS)
		0	23-16	Reserved
		FAh	15-00	Maximum Power (MP)
2207:2176	Power State 4 Descriptor (PSD4)	0	255-184	Reserved
		0	183-182	Active Power Scale (APS)
		0	181-179	Reserved
		0	178-176	Active Power Workload (APW)
		0	175-160	Active Power (ACTP)
		0	159-152	Reserved
		0	151-150	Idle Power Scale (IPS)
		0	149-144	Reserved
		0	143-128	Idle Power (IDLP)
		0	127-125	Reserved
		4	124-120	Relative Write Latency (RWL)
		0	119-117	Reserved
		4	116-112	Relative Write Throughout
		0	111-109	Reserved
		4	108-104	Relative Read Latency (RRL)
		0	103-101	Reserved
		4	100-96	Relative Read Throughput (RRT)
		9858h	95-64	Exit Latency (EXLAT)
		1388h	63-32	Entry Latency (ENLAT)
		0	31-26	Reserved
		1	25	Non-Operational State (NOPS)
		1	24	Max Power Scale (MXPS)
		0	23-16	Reserved
		32h	15-00	Maximum Power (MP)

Bytes	Field	Value	Comments
3071:2208	Power State Descriptors 5-31 (PSD5 – PSD31)	0h	N/A
Vendor Specific (VS)			
4095-3072	Vendor Specific (VS)	0h	

Table 22: Western Digital PC SN530 NVMe SSD Identify Data Values

OF SUCH DAMAGE.

15. Ordering Information

Refer to the examples below as reference for ordering SKUs.

SDG(I/F)FCT-CCCC-YYYY	
SD	Western Digital
G	Generation: B
(I/F)	Interface P- PCI Express (non-secure version) Q- PCI Express (secure version)
F	Form Factor: T – M.2 2230 M – M.2 2242 N – M.2 2280
C	Controller: P – Western Digital Polaris
T	NAND Technology: Z – Western Digital BICS4 512Gb X3
CCCC	Capacity: 256G: 256GB 512G: 512GB 1T00: 1TB
YYYY	Customer code reference

Table 23: Western Digital PC SN530 NVMe SSD Ordering Information

The table below lists the Western Digital PC SN530 NVMe SSD ordering SKUs:

SKU #	Details
SDBPTPZ-256G	PC SN530 SSD 256GB, M.2 2230 form factor (Non-SED)
SDBPTPZ-512G	PC SN530 SSD 512GB, M.2 2230 form factor (Non-SED)
SDBPTPZ-1T00	PC SN530 SSD 1024GB, M.2 2230 form factor (Non-SED)
SDBPMPZ-256G	PC SN530 SSD 256GB, M.2 2242 form factor (Non-SED)
SDBPMPZ-512G	PC SN530 SSD 512GB, M.2 2242 form factor (Non-SED)
SDBPMPZ-1T00	PC SN530 SSD 1024GB, M.2 2242 form factor (Non-SED)
SDBPNPZ-256G	PC SN530 SSD 256GB, M.2 2280 form factor (Non-SED)
SDBPNPZ-512G	PC SN530 SSD 512GB, M.2 2280 form factor (Non-SED)
SDBPNPZ-1T00	PC SN530 SSD 1024GB, M.2 2280 form factor (Non-SED)
SDBQNPZ-256G	PC SN530 SSD 256GB, M.2 2280 form factor, SED supported
SDBQNPZ-512G	PC SN530 SSD 512GB, M.2 2280 form factor, SED supported
SDBQNPZ-1T00	PC SN530 SSD 1024GB, M.2 2280 form factor, SED supported

Table 24: Western Digital PC SN530 NVMe SSD Ordering SKUs

16. Contact Information

Vist https://www.westerndigital.com/products/internal-drives

For further product information, contact your Western Digital Sales representative, or send inquiries to OEMProducts@wdc.com