



# HP SSD EX920 M.2

## Product Specification

Capacity: 256GB, 512GB, 1TB, 2TB

Components: 3D NAND/ DRAM Cache

## Read and Write IOPS

(Iometer\* Queue Depth 32)

—256 GB

Random 4 KB reads: Up to 180K IOPS

Random 4 KB writes: Up to 250 K IOPS

— 512 GB

Random 4 KB reads: Up to 340K IOPS

Random 4 KB writes: Up to 260 K IOPS

—1TB

Random 4 KB reads: Up to 350 K IOPS

Random 4 KB writes: Up to 250K IOPS

—2TB

Random 4 KB reads: Up to 300 K IOPS

Random 4 KB writes: Up to 270K IOPS

## Bandwidth Performance

— 256 GB

Sustained sequential read: Up to 3200 MB/s

Sustained sequential write: Up to 1200 MB/s

— 512 GB

Sustained sequential read: Up to 3200 MB/s

Sustained sequential write: Up to 1600 MB/s

— 1TB

Sustained sequential read: Up to 3200 MB/s

Sustained sequential write: Up to 1800 MB/s

— 2TB

Sustained sequential read: Up to 3200 MB/s

Sustained sequential write: Up to 1600 MB/s

PCIe Gen 3(8Gb/s) x 4, NVMe 1.3 interface

— Compliant with PCI-Express 3.1

— Dual ARM Cortex R5 CPU @ 5000Hz

— NVMe 1.3 register interface and command set

— Data set management command

Trim attribute

Form Factor: Full-sized M.2 2280 SSD

— Dimensions: 80 mm x 22 mm

— Thickness: <=3.8 mm

— Weight: <=5.4 grams

## Power Management

— 3.3V M.2 SSD power supply

—M.2 SSD interface power management

Power (Mobile Mark\* 2007 Workload)

— Idle: 730 mW (TYP)

— max: 6.23W (TYP)

## Temperature

— Operating: 0°C to 70°C

— Non-Operating: -40°C to 85°C

Shock (operating and non-operating)

— 100 G/6 msec

Vibration(operating and non-operating)

—3.1G RMS (2-500 Hz)



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## Latency

— 256 GB

Read: 0.028ms (TYP)

Write: 0.029ms (TYP)

—512 GB

Read: 0.024ms (TYP)

Write: 0.026ms (TYP)

—1TB

Read: 0.020ms (TYP)

Write: 0.022ms (TYP)

—2TB

Read: 0.020ms (TYP)

Write: 0.015ms (TYP)

## Reliability

— Uncorrectable Bit Error Rate (UBER):

1 sector in  $10^{16}$  bits read

— Mean Time Between Failures (MTBF):

2,000,000 hours

## Certifications and Declarations

— CB

— cTUVus & FCC

— CE & RoHS

— BSMI & KCC & VCCI



# HP SSD EX920 M.2

## Order Information

Country/Region	PN	Capacity
APJ	2YY45AA#UUF	256GB
	2YY46AA#UUF	512GB
	2YY47AA#UUF	1TB
	4ND71AA#UUF	2TB
NA	2YY45AA#ABC	256GB
	2YY46AA#ABC	512GB
	2YY47AA#ABC	1TB
	4ND71AA#ABC	2TB
EURO	2YY45AA#ABB	256GB
	2YY46AA#ABB	512GB
	2YY47AA#ABB	1TB
	4ND71AA#ABB	2TB
LA	2YY45AA#ABL	256GB
	2YY46AA#ABL	512GB
	2YY47AA#ABL	1TB
	4ND71AA#ABL	2TB



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## 1.0 Overview

HP SSD EX920 M.2 Series delivers compact storage and optimized performance for traditional and innovative small-form-factor and embedded platforms in 4 capacity sizes: 256GB, 512GB, 1TB, and 2TB.

By combining advanced NAND Flash controller with PCIe Gen 3(8Gb/s) x 4, NVMe 1.3 interface and 3D NAND Flash, PCIe M.2 delivers sequential read speed up to 3200MB/s and sequential write speed up to 1800MB/s, which makes it an ideal solution for computing devices, such as, notebook, thin-and-light systems, mini- and sub-notebooks, all-in-one computers, and embedded platforms.

As compared to standard mobile HDDs, HP SSD EX920 M.2 Series offers these key features:

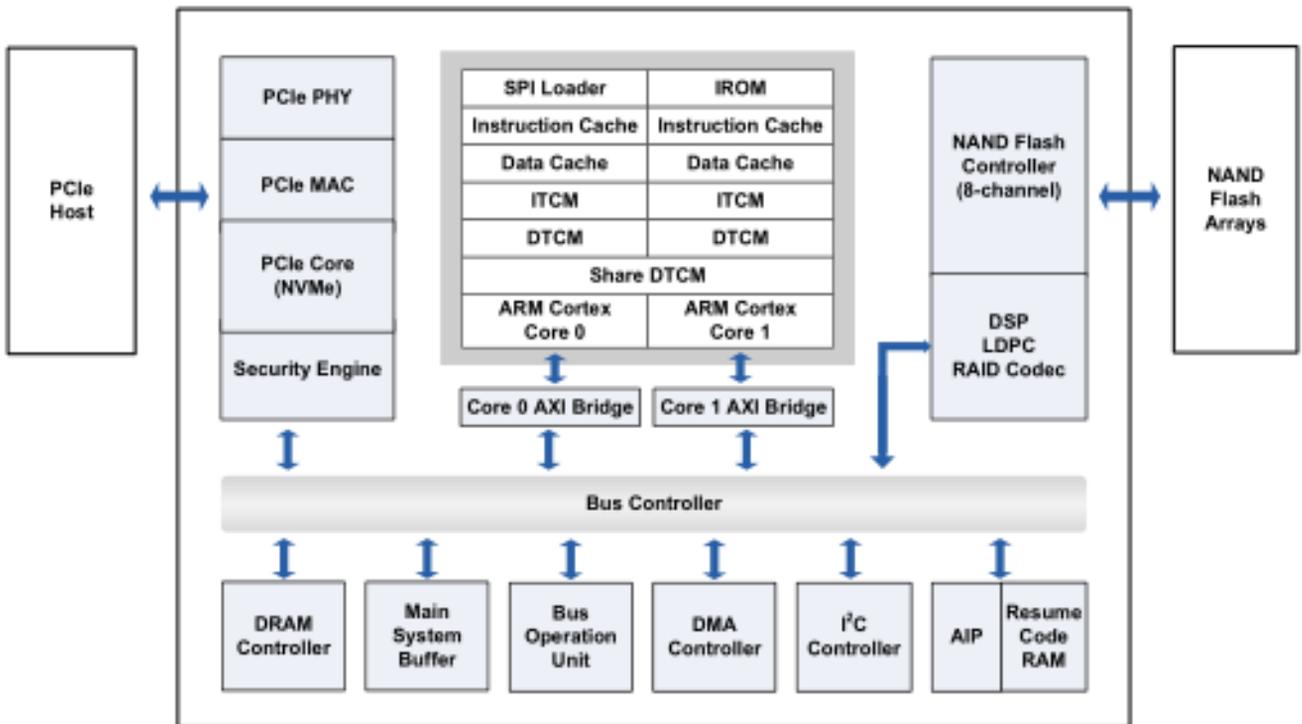
- High performance
- Low power
- Increased system responsiveness
- High reliability
- Small form-factor
- Minimum weight
- Enhanced ruggedness
- High data Integrity and Security



## 2.0 Architecture

HP SSD EX920 M.2 Series utilizes a cost-effective, high-performance HP PCIe-to-NAND controller to manage a full PCIe Gen 3(8Gb/s) x 4 bandwidth with the host while managing multiple NAND flash memory devices on 8 channels.

Figure 1. Block Diagram





## 3.0 Product Specifications

This section provides details on HP SSD EX920 M.2 Series product specifications.

### 3.1 Capacity

**Table 1. User Addressable Sectors**

Unformatted Capacity	256GB	512GB	1TB	2TB
Total User Addressable Sectors	500,118,192	1,000,215,216	1,953,511,000	3,907,022,000

Notes: LBA count shown represents total user storage capacity and will remain the same throughout the life of the drive.

The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is reserved for NAND flash management and maintenance purposes.

1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.

### 3.2 Performance

**Table 2. Read/Write IOPS, Bandwidth, Latency**

Performance	256GB	512GB	1TB	2TB
Random Read/Write IOPS (Input / Output Operations per Second)(1)				
4K Read (Up to )	180,000	340,000	350,000	300,000
4K Write (Up to )	250,000	260,000	250,000	270,000
Maximum Sustained Read and Write Bandwidth(2)				
Sequential Read (Up to )	3200 MB/s	3200 MB/s	3200 MB/s	3200 MB/s
Sequential Write (Up to )	1200 MB/s	1600 MB/s	1800 MB/s	1600 MB/s
Latency(3)				
Read	0.028 ms	0.024 ms	0.020 ms	0.020 ms
Write	0.029 ms	0.026 ms	0.022 ms	0.015 ms



**Notes:**

(1). Performance measured using Iometer with queue depth set to 32; Measurements are performed on 8 GB of LBA range. Write Cache enabled.

(2). Performance measured using Iometer with queue depth equal to 32.

Sequential performance measurements assume 1 MB/sec = 1,048,576 bytes/sec.

(3). Device measured using Iometer; Read/Write latency measured on sequential 4 K transfers with queue depth set to 1.

Write Cache Enabled.

Power On To Ready time measured from power rail rising edge to the first DRDY issued from the drive.



### 3.3 Electrical

Table 3. Operating Voltage and Power Consumption

Electrical Characteristics	256GB	512GB	1TB	2TB
Operating Voltage for 3.3V (+/- 5%)				
Min	3.14V			
Max	3.47V			
Power Consumption (Typical)				
Active1	4.29W	5.61 W	6.23 W	6.69W
Idle	0.73 W	0.73W	0.73W	0.73W

**Notes:**

1. Active power measured during execution of MobileMark\* 2007 with DIPM (Device Initiated Power Management) enabled.
2. Idle power defined as SSD at idle with DIPM enabled.



### 3.4 Environmental Conditions

Table 4. Temperature, Shock, Vibration

Temperature	Range
Ambient Temperature	
Operating	0 to 70 °C
Non-operating	-40 to 85 °C
Temperature Gradient(1)	
Operating	20 (Typical) °C/hr
Non-operating	30 (Typical) °C/hr
Humidity	
Operating	5 - 95 %
Non-operating	5 - 95 %
Shock, Vibration, Acoustics	Range
Shock(2)	
Operating	100 G/6 msec
Non-operating	100 G/6 msec
Vibration(3)	
Operating	3.1 GRMS (2-500 Hz)
Non-operating	3.1 GRMS (2-500 Hz)

**Notes:**

(1). Temperature gradient measured without condensation.

(2). Shock specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws. Stimulus may be applied in the X, Y or Z axis. Shock specification is measured using root mean square (RMS) value.

(3). Vibration specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws.

Stimulus may be applied in the X, Y or Z axis. The measured specification is in root mean squared form. Vibration specification is measured using RMS value.



### 3.5 Reliability

**Table 5. Reliability Specifications**

Parameter	Value
<p>Uncorrectable Bit Error Rate (UBER)</p> <p>Unrecoverable read bit error rate will not exceed one sector in the specified number of bits read. In the extremely unlikely event of a no recoverable read error, the SSD will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host.</p>	1 sector in $10^{16}$ bits read, max
<p>Mean Time Between Failure (MTBF)</p> <p>Mean time between failures (MTBFs) for the SSD can be predicted based on the component reliability data using the methods referenced in the Telcordia SR-332 reliability prediction procedures for electronic equipment.</p>	2,000,000 hours
<p>Power On/Off Cycles</p> <p>Power On/Off Cycles is defined as power being removed from HP SSD EX920 M.2, and then restored. Most host systems remove power from the SSD when entering suspend and hibernate as well as on a system shutdown.</p>	10,000 cycles
<p>Minimum Useful Life</p> <p>HP SSD EX920 M.2 will have a minimum of three years of useful life under typical client workloads with up to 80% of the full capacity of host writes per day.</p>	5 years



## 4.0 Mechanical Information

Figure 2 shows the physical dimension of HP SSD EX920 M.2 Series.

All dimensions are in millimeters.

**Figure 2. HP SSD EX920 M.2 Dimensions**

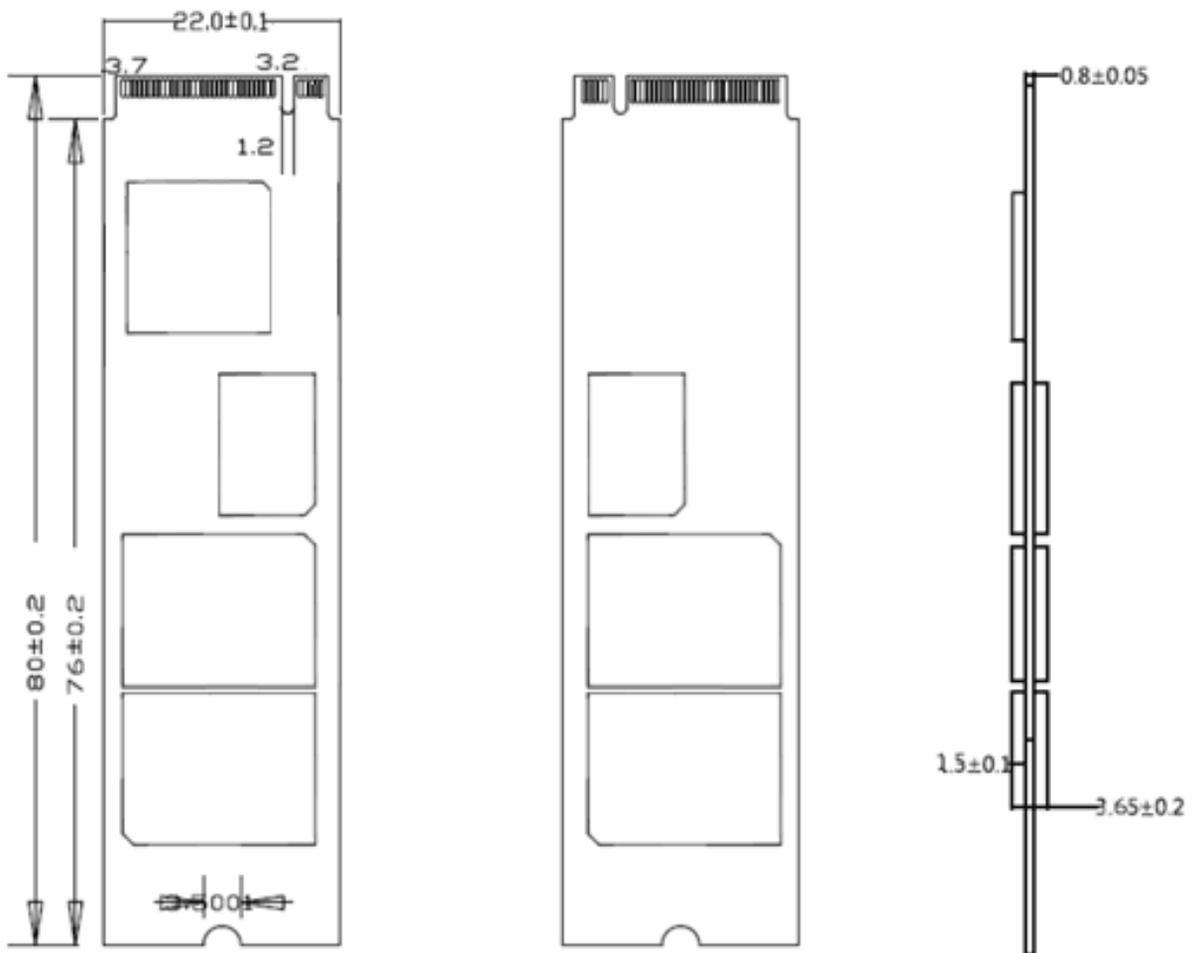
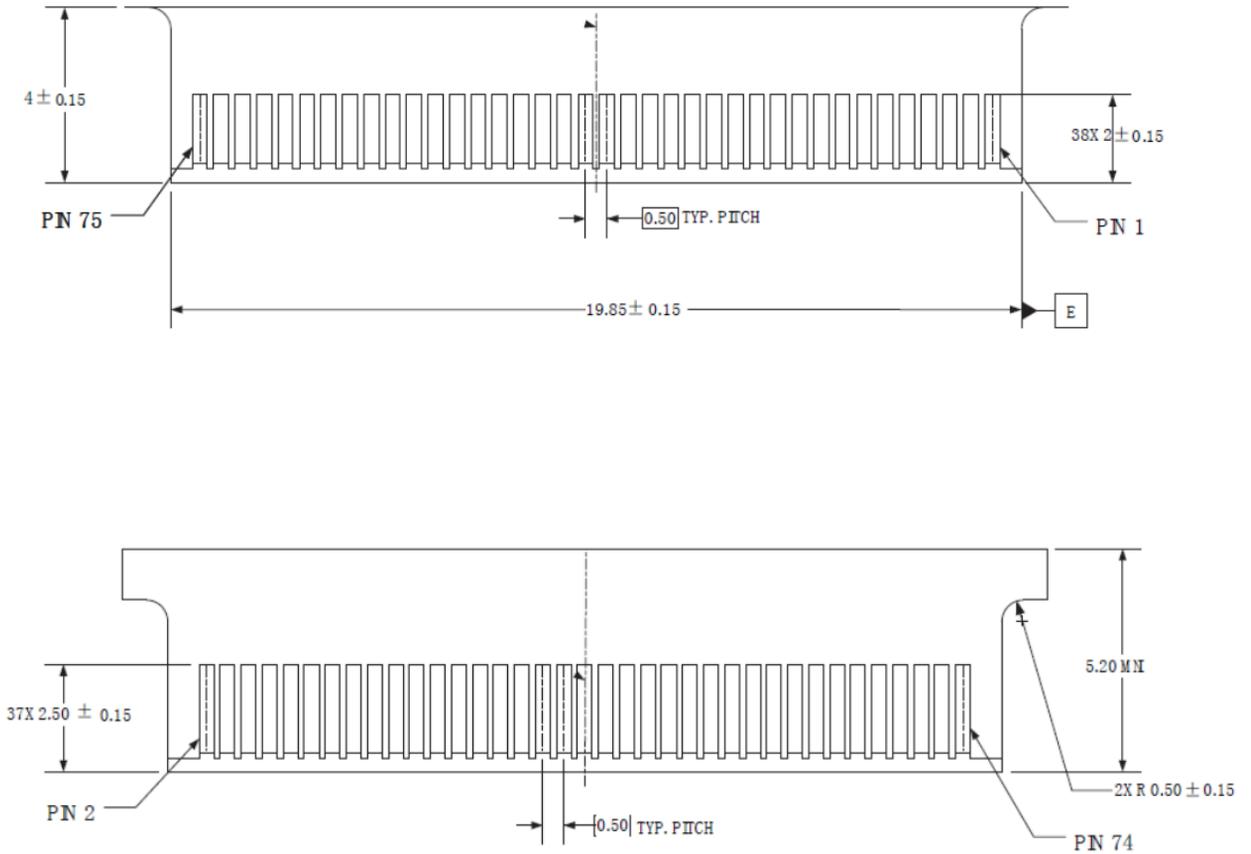




Figure 3. HP SSD EX920 M.2 Interface Description





## 5.0 Pin and Signal Descriptions

### 5.1 Pin Locations

Pin#	Assignment	Description	Pin#	Assignment	Description
1	CONFIG_3	Defines module type	21	CONFIG_0	Defines module type
2	+3.3V	3.3V source	22	NA	NA
3	GND	Return Current Path	23	NA	NA
4	+3.3V	3.3V source	24	NA	NA
5	NA	NA	25	NA	NA
6	NA	NA	26	NA	NA
7	NA	NA	27	GND	Return Current Path
8	NA	NA	28	NA	NA
9	NA	NA	29	NA	NA
10	NA	NA	30	NA	NA
11	NA	NA	31	NA	NA
12	(removed for key)	Mechanical Notch B	32	NA	NA
13	(removed for key)	Mechanical Notch B	33	GND	Return Current Path
14	(removed for key)	Mechanical Notch B	34	NA	NA
15	(removed for key)	Mechanical Notch B	35	NA	NA
16	(removed for key)	Mechanical Notch B	36	NA	NA
17	(removed for key)	Mechanical Notch B	37	NA	NA
18	(removed for key)	Mechanical Notch B	38	DEVSLP	Device Sleep, Input
19	(removed for key)	Mechanical Notch B	39	GND	Return Current Path
20	NA	NA	40	NA	NA

**Table 6.Connector Pin Signal Definitions**



## 5.2 Signal Descriptions

Pin#	Assignment	Description	Pin#	Assignment	Description
41	PCIe-B+/PERn0	Host receiver differential signal pair	61	NOTCH	Mechanical Notch M
42	NA	NA	62	NOTCH	Mechanical Notch M
43	PCIe-B-/PERp0	Host receiver differential signal pair	63	NOTCH	Mechanical Notch M
44	NA	NA	64	NOTCH	Mechanical Notch M
45	GND	Return Current Path	65	NOTCH	Mechanical Notch M
46	NA	NA	66	NOTCH	Mechanical Notch M
47	PCIe-A-/PETn0	Host transmitter differential signal pair	67	NA	NA
48	NA	NA	68	NA	NA
49	PCIe-A+/PETp0	Host transmitter differential signal pair	69	CONFIG_1	Defines module type
50	NA	NA	70	+3.3V	3.3V source
51	GND	Return Current Path	71	GND	Return Current Path
52	NA	NA	72	+3.3V	3.3V source
53	NA	NA	73	GND	Return Current Path
54	NA	NA	74	+3.3V	3.3V source
55	NA	NA	75	CONFIG_2	Defines module type
56	NA	NA			
57	GND	Return Current Path			
58	NA	NA			
59	NOTCH	Mechanical Notch M			
60	NOTCH	Mechanical Notch M			



## 6.0 Supported Command Sets

HP SSD EX920 M.2 Series supports PCIe (PCI-express) commands described in this section.

### 6.1 PCIe General Feature Command Set

HP SSD EX920 M.2 Series supports the PCIe General Feature command set (non-PACKET), which consists of:

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE
- READ DMA
- READ SECTOR(S)
- READ VERIFY SECTOR(S)
- SEEK
- SET FEATURES
- WRITE DMA
- WRITE SECTOR(S)
- READ MULTIPLE
- SET MULTIPLE MODE
- WRITE MULTIPLE

HP SSD EX920 M.2 Series also supports the following optional commands:

- READ BUFFFER
- WRITE BUFFER
- NOP
- DOWNLOAD MICROCODE



## 6.2 Power Management Command Set

HP SSD EX920 M.2 Series supports the Power Management command set, which consists of:

- CHECK POWER MODE
- IDLE
- IDLE IMMEDIATE
- SLEEP
- STANDBY
- STANDBY IMMEDIATE

## 6.3 Security Mode Feature Set

HP SSD EX920 M.2 Series supports the Security Mode command set, which consists of:

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD



## 6.4 smart Command Set

HP SSD EX920 M.2 Series supports the SMART command set, which consists of:

- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART ENABLE/DISABLE AUTOSAVE
- SMART RETURN STATUS

HP SSD EX920 M.2 Series also supports the following optional commands:

- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ DATA
- SMART READ LOG
- SMART WRITE LOG

## 6.5 Data Set Management Command Set

HP SSD EX920 M.2 Series supports the Data Set Management command set Trim attribute, which consists of:

- DATA SET MANAGEMENT EXT



## 6.6 Host Protected Area Command Set

HP SSD EX920 M.2 Series supports the Host Protected Area command set:

- READ NATIVE MAX ADDRESS
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- SET MAX ADDRESS EXT

HP SSD EX920 M.2 Series also supports the following optional commands:

- SET MAX SET PASSWORD
- SET MAX LOCK
- SET MAX FREEZE LOCK
- SET MAX UNLOCK

## 6.7 48-Bit Address Command Set

HP SSD EX920 M.2 Series supports the 48-bit Address command set, which consists of:

- FLUSH CACHE EXT
- READ DMA EXT
- READ NATIVE MAX ADDRESS EXT
- READ SECTOR(S) EXT
- READ VERIFY SECTOR(S) EXT
- SET MAX ADDRESS EXT
- WRITE DMA EXT
- WRITE MULTIPLE EXT
- WRITE SECTOR(S) EXT
- WRITE UNCORRECTABLE EXT



## 6.8 Device Configuration Overlay Command Set

HP SSD EX920 M.2 Series supports the Device Configuration Overlay command set, which consists of:

- DEVICE CONFIGURATION FREEZE LOCK
- DEVICE CONFIGURATION IDENTITY
- DEVICE CONFIGURATION RESTORE
- DEVICE CONFIGURATION SET

## 6.9 General Purpose Log Command Set

HP SSD EX920 M.2 Series supports the General Purpose Log command set, which consists of:

- READ LOG EXT
- WRITE LOG EXT

## 6.10 Native Command Queuing

HP SSD EX920 M.2 Series supports the Native Command Queuing (NCQ) command as

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

**Note:** With a maximum queue depth equal to 32.

## 6.11 Software Settings Preservation

HP SSD EX920 M.2 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings.

## 6.12 Device Initiated Power Management (DIPM)

HP SSD EX920 M.2 Series supports the SET FEATURES parameter to enable Device Initiated Power Management.



## 7.0 Certifications and Declarations

Table 7 describes the Device Certifications supported by HP SSD EX920 M.2 .

**Table 7. Device Certifications and Declarations**

Certification	Description
CE Compliant	Indicates conformity with the essential health and safety requirements set out in European Directives Low Voltage Directive and EMC Directive.
UL Certified	Underwriters Laboratories, Inc. Component Recognition UL60950-1.
RoHS Compliant	Restriction of Hazardous Substance Directive

## 8.0 Revision History

Date	Revision	Description
Sep 2017	V1.0	Initial release
Oct 2017	V2.0	Adding Certifications
Mar 2018	V3.0	Updating the Signal Descriptions
May 2018	V4.0	Updating the "Minimum Useful Life" , from 3 years to 5 years
July 2018	V5.0	Adding the 2TB data and Order information(LA)