Seagate® Nytro® XM1440

PCIe® Gen 3 x4 - NVMe SSD

100790305, Rev. A
June 2016

Document Revision History

Revision	Date	Pages affected and description of change
Rev. A	June, 2016	Initial release.

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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1.0 Scope

Nytro XM1440 SSD is a PCIe Gen 3 SSD designed with the NVMe (Non-Volatile Memory express) interface that delivers leading performance, low latency, and world class reliability and endurance.

- **Interface***:*
  - PCIe® Gen 3 x4 - NVMe SSD
  - Out of Band Management (SMBus) management support
- **Capacities**:
  - 400GB, 480GB, 800GB, 960GB
- **Components**:
  - eMLC NAND Flash Memory
- **Form Factor**:
  - Industry standard 22110mm dimensions
- **Power**
  - Lower power than current Enterprise class products (<8.25W)
  - Power Loss Data Protection (PLDP)
- **Shock**
  - Op/Non Op: 1500G @ 0.5ms
- **Vibration**
  - Op/Non Op: 3.08 Grms (7-800hz)
  - Op/Non Op: 16.3 Grms (20-2000hz)
- **Certifications**
  - CE, BSMI, KCC, C-Tick, FCC, IC, UL, TUV, CB
- **Reliability:**
  - Mean Time Between Failure (MTBF): 2 Million hours
  - Data Retention: 3 months @ 40C
  - Sector Size: 512 and 4096 bytes
- **Endurance**
  - Certain models support up to 3 Drive Writes/day
  - Certain models support up to 0.3 Drive Writes/day
- **Temperature**
  - Operating: 0 to 70C (as measured by SMART)
  - Non Operating: -40 to 85C
- **Airflow**
  - 690 Linear Feet per Minute (LFM). See Section 2.7 for details.
- **Performance**
  - Varies by capacity and endurance. See Section 2.2 for details.
- **Security**
  - Self encryptions available
- **Product Compliance**
  - RoHS
- **Warranty**
  - 5 years limited

2.0 Product Specifications

2.1 Models and Capacity

Table 1 Models

Standard Models		SED Models
512 sectors	**4096 sectors**	**512 sectors**
ST400KN0021	ST400HM0031	ST400KN0031
ST480KN0021	ST480HM0011	ST480KN0031
ST800KN0021	ST800HM0031	ST800KN0031
ST960KN0021	ST960HM0011	ST960KN0031

Table 2 Formatted Capacity

XM1440 Series	512 Formatted Capacity	4K Formatted Capacity
400GB	781,422,768	97,778,846
480GB	937,703,088	117,212,886
800GB	1,562,824,268	195,353,046
960GB	1,876,385,008	234,423,126

2.2 Performance

Table 3 Performance

Specification	800GB	400GB	960GB	480GB
Sequential Read (MB/s) 128k, QD=32	2500	2400	2500	2400
Sequential Write (MB/s) 128k, QD=32	600	475	600	475
Random Read (kIOPS) 4k, QD=64	240	220	240	220
Random Write (kIOPS) 4k, QD=64	33	25	12	8
70/30 Mixed Workload Random Read/Write (kIOPS) 4k, QD=64	75	55	35	22

NOTE Here is more information on Performance:

- **Random Read and Sequential Write:** 400GB and 480GB capacities are limited to 32x 128Gb die active.
- **IOMeter:** Performance results are based on IOMeter. IOMeter is available at http://sourceforge.net/projects/iometer/. IOMeter is licensed under the Intel Open Source License and the GNU General Public License.
- **Response times:** Typical response times are measured under nominal conditions of temperature and voltage as measured on a representative sample of drives.
- **Measurements:** Measurements are performed on the drive after the workload reaches steady state, including all background activities required for normal operations.

2.3 Power Consumption

The M.2 drive receives DC power (+3.3V) through the standard M.2 interface.

Table 4 DC Requirements

Supply Voltage	XM1440 Series
Voltage Tolerances - nominal (%)	3.3V ± 5%
DC Ripple/Noise	100mVpp max: 10Hz – 30MHz
Rise Time (Max*/Min) *(0 ~ 100% Nominal Voltage)	5ms/100µs
Fall Time (Min)	100µs @ 1A max discharge
Minimum Off Time	100µs
Inrush Current (Typical Peak)	500mA < 1s

Table 5 Power

Specification	XM1440 Series
Max Operating Power (W)	8.25
Power State 1 (W)	6.0
Power State 2 (W)	4.0

NOTE Here is more information on Power:

- NVMe Autonomous Power States are not supported.
- Typical power measurements are based on an average of drives tested under nominal conditions.
- Maximum power is defined as RMS over 100ms.

2.4 Power Loss Data Protection

If power is interrupted, at any time while data is being programmed into the NAND, it is possible that data loss may occur. This can cause drive errors to be reported to the host. To prevent these errors from occurring, XM1440 implements an energy storage solution called Power Loss Data Protection. This is a circuit that maintains power to the NAND while it is being programmed, even if power to the system is interrupted. By supporting Power Loss Data Protection, the drive assures data integrity in the drive is preserved, preventing the loss of data and the reporting of drive errors to the host.

2.5 Out of Band Management (SMBus)

XM1440 provides out of band management by means of SMBUS interface.

2.6 Basic Management Command

SMBUS accesses an NVM Express Basic Management Command page as listed below through address 0x6A.

XM1440 provides out of band management through SMBUS interface, accessing the NVMe Basic Management Command page through address 0x6A, complies with the *PCI-SIG SMBus Interface for SSD Socket 2 and Socket 3* ECN.

Table 6 Out of Band Management (SMBus) Protocol

Command Code	Offset (byte)	Description
0	00	**Length of Status:** Indicates number of additional bytes to read before encountering PEC. This value should always be 6 (06h) in implementations of this version of the spec.
	01	**Status Flags (SFLGS):** This field indicates the status of the NVM subsystem. **SMBus Arbitration** – Bit 7 is set '1' after a SMBus block read is completed all the way to the stop bit without bus contention and cleared to '0' if a SMBus Send Byte FFh is received on this SMBus slave address. **Drive Not Ready** – Bit 6 is set to '1' when the subsystem cannot process NVMe management commands, and the rest of the transmission may be invalid. If cleared to '0', then the NVM subsystem is fully powered and ready to respond to management commands. This logic level intentionally identifies and prioritizes powered up and ready drives over their powered off neighbors on the same SMBus segment. **Drive Functional** – Bit 5 is set to '1' to indicate an NVM subsystem is functional. If cleared to '0', then there is an unrecoverable failure in the NVM subsystem and the rest of the transmission may be invalid. **Reset Not Required** - Bit 4 is set to '1' to indicate the NVM subsystem does not need a reset to resume normal operation. If cleared to '0' then the NVM subsystem has experienced an error that prevents continued normal operation. A controller reset is required to resume normal operation. **Port 0 PCIe Link Active** - Bit 3 is set to '1' to indicate the first port's PCIe link is up (i.e., the Data Link Control and Management State Machine is in the DL_Active state). If cleared to '0', then the PCIe link is down. **Port 1 PCIe Link Active** - Bit 2 is set to '1' to indicate the second port's PCIe link is up. If cleared to '0', then the second port's PCIe link is down or not present. Bits 1-0 shall be set to '1'.
	02	**SMART Warnings:** This field shall contain the Critical Warning field (byte 0) of the NVMe SMART / Health Information log. Each bit in this field shall be inverted from the NVMe definition (i.e., the management interface shall indicate a '0' value while the corresponding bit is '1' in the log page). See the NVMe specification for bit definitions. If there are multiple controllers in the NVM subsystem, the management endpoint shall combine the Critical Warning field from every controller such that a bit in this field is: Cleared to '0' if any controller in the subsystem indicates a critical warning for that corresponding bit. Set to '1' if all controllers in the NVM subsystem do not indicate a critical warning for the corresponding bit.
	03	**Composite Temperature (CTemp):** This field indicates the current temperature in degrees Celsius. If a temperature value is reported, it should be the same temperature as the Composite Temperature from the SMART log of hottest controller in the NVM subsystem. The reported temperature range is vendor specific, and shall not exceed the range -60 to +127°C. The 8 bit format of the data is shown below. This field should not report a temperature when that is older than 5 seconds. If recent data is not available, the NVMe management endpoint should indicate a value of 80h for this field. **Value** — **Description** 00h-7Eh — Temperature is measured in degrees Celsius (0 to 126C) 7Fh — 127C or higher 80h — No temperature data or temperature data is more the 5 seconds old. 81h — Temperature sensor failure 82h-C3h — Reserved C4 — Temperature is -60C or lower C5-FFh — Temperature measured in degrees Celsius is represented in twos complement (-1 to -59C)
	04	**Percentage Drive Life Used (PDLU):** Contains a vendor specific estimate of the percentage of NVM subsystem NVM life used based on the actual usage and the manufacturer's prediction of NVM life. If an NVM subsystem has multiple controllers the highest value is returned. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed, but may not indicate an NVM subsystem failure. The value is allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value should be updated once per power-on hour and equal the Percentage Used value in the NVMe SMART Health Log Page.
	06 : 05	**Reserved:** Shall be set to 0000h.
	07	**PEC:** An 8 bit CRC calculated over the slave address, command code, second slave address and returned data. Algorithm is in SMBus Specifications.

Table 6 Out of Band Management (SMBus) Protocol *(continued)*

Command Code	Offset (byte)	Description
8	08	**Length of identification:** Indicates number of additional bytes to read before encountering PEC. This value should always be 22 (16h) in implementations of this version of the spec.
	10 : 09	**Vendor ID:** The 2 byte vendor ID, assigned by the PCI SIG. Should match VID in the Identify Controller command response. MSB is transmitted first.
	30 : 11	**Serial Number:** 20 characters that match the serial number in the NVMe Identify Controller command response. Note first character is transmitted first.
	31	**PEC:** An 8 bit CRC calculated over the slave address, command code, second slave address and returned data. The algorithm is defined in SMBus Specifications.
32+	255 : 32	**Vendor Specific:** This data structure shall not exceed the maximum read length of 255 specified in the SMBus version 3 specification. Preferably length is not greater than 32 for compatibility with SMBus 2.0, additional blocks shall be on 8 byte boundaries.

2.7 Environmental Conditions

Table 7 Temperature and Humidity

Specification		XM1440 Series
Temperature (degrees C)	Operating (as measured by SMART) Non-Operating	0 to 70 -40 to 85
Temperature Gradient Maximum (C per hour)	Operating Non-Operating	30°C/hr 30°C/hr
Humidity	Operating Non-Operating	5%-95% 5%-95%

Table 8 Shock

Specification		XM1440 Series
Shock - Maximum	Operating / Non Operating	1500 G's at 0.5 ms

NOTE Specification does not cover connection issues that might result from testing at this level.

- **Operating shock:** The drive, as installed for normal operation, operates error free while subjected to intermittent shock not exceeding the specification. Shock may be applied in the X, Y, or Z-axis. Shock is not to be repeated more than once every 2 seconds.
- **Non-Operating shock:** The limits of non-operating shock apply to all conditions of handling and transportation. This includes isolated drive and integrated drives. Shock may be applied in the X, Y, or Z-axis.

Table 9 Vibration

Specification		XM1440 Series
Vibration Profiles	Operating / Non Operating	3.08 Grms (7-800 Hz), 16.3 Grms (20-2000 Hz)

NOTE Here is more information on Vibration:

- **Operating vibration:** The drive, as installed for normal operation, shall operate error free while subjected to specified vibration not exceeding specification. Vibration may be applied in the X, Y, or Z-axis.
- **Non-Operating vibration:** The limits of non-operating vibration shall apply to all conditions of handling and transportation. This includes both

isolated drive and integrated drives. Vibration may be applied in the X, Y, or Z-axis.

Table 10 Airflow Requirements

Airflow Definition	Unit	Ambient Temperature	400GB/480GB 800GB/960GB
Airflow Along Drive	LFM	35°C	690

NOTE Here is more information on Airflow:

- **Airflow approach** is from thermal ground screw to M-key connector. No heat sinks are used in this specification.
- **Thermal throttling** is activated to protect critical components from damage. The host observes a reduction in power and therefore performance until PCB temperature lowers. When the PCB temperature decreases to an acceptable temperature, thermal throttling deactivates, and performance returns to normal.

2.8 Reliability

Table 11 Reliability

Specification	XM1440 Series
Mean Time Between Failures (MTBF)	2,000,000 Hours
Data Retention	3 months @ 40°C

NOTE Here is more information on MTBF:

- **MTBF** specification is based on these assumptions for Enterprise Storage System environments: 8760 power on hours per year, 250 power on/off cycles per year, and nominal voltages. The drive achieves specified MTBF when operating in an environment that ensures the case temperatures do not exceed the temperature specifications.
- **Data Retention** is the time that NAND retains data at maximum rated endurance

2.9 Endurance

Table 12 Endurance

XM1440 Series	400GB	480GB	800GB	960GB
Endurance Drive Writes per Day	3		3	
		0.3		0.3

NOTE Endurance rating is the expected amount of host data that can be written by product when subjected to a specified workload at a specified operating and storage temperature over the specified product life. For the specific workload to achieve this level of endurance, *please refer to JEDEC Specification JESD218.* Terabyte Writes is defined as 1x1012 Bytes.

3.0 Mechanical Information

3.1 M.2 Mechanical Dimensions and Weight

Weight: 0.49 ounces, 14 grams

Z-Height: Top side z-height is 2.0mm maximum

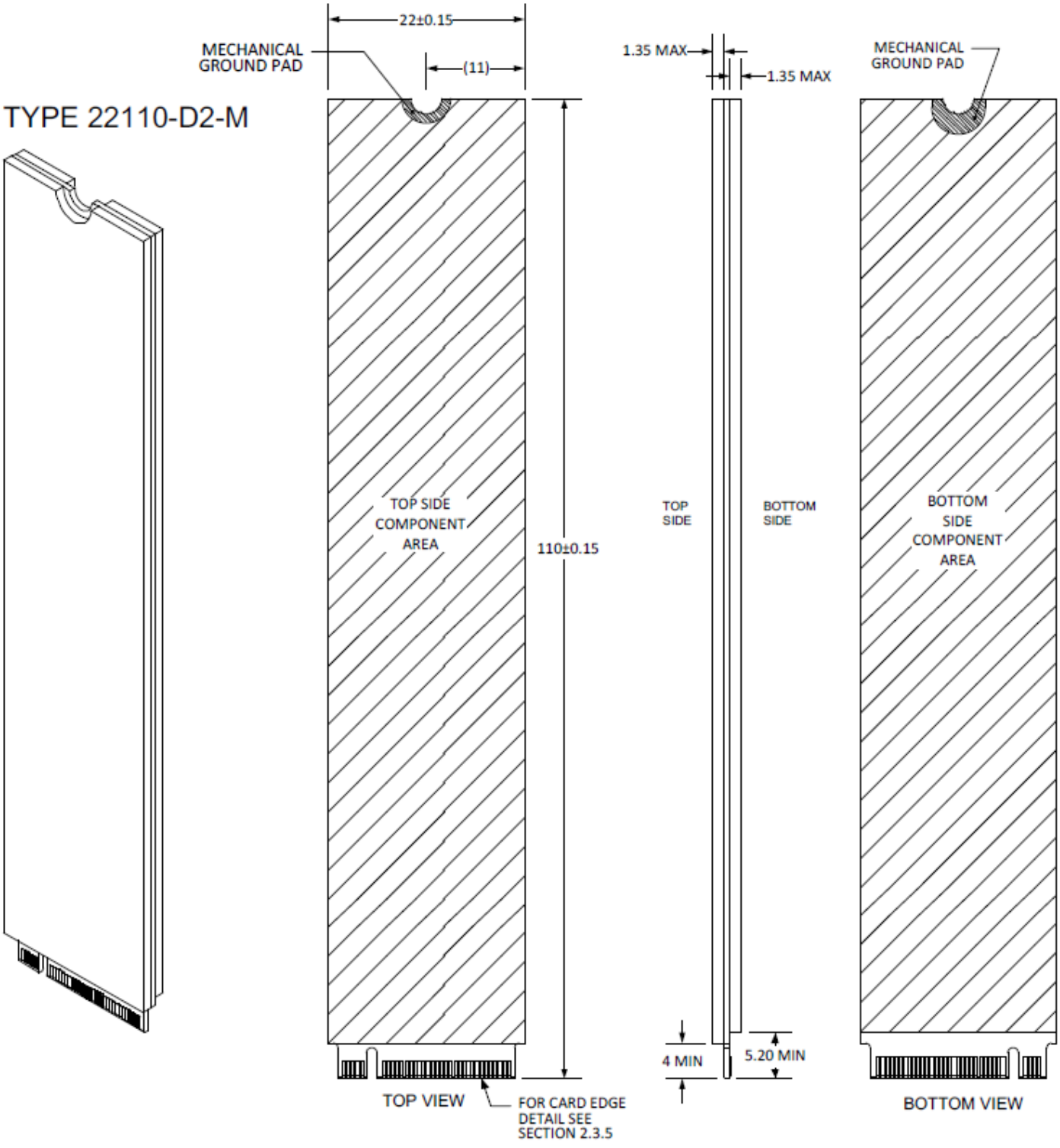

Figure 1. M.2 device plug dimensions

3.1.1 M.2 Device Plug Descriptions

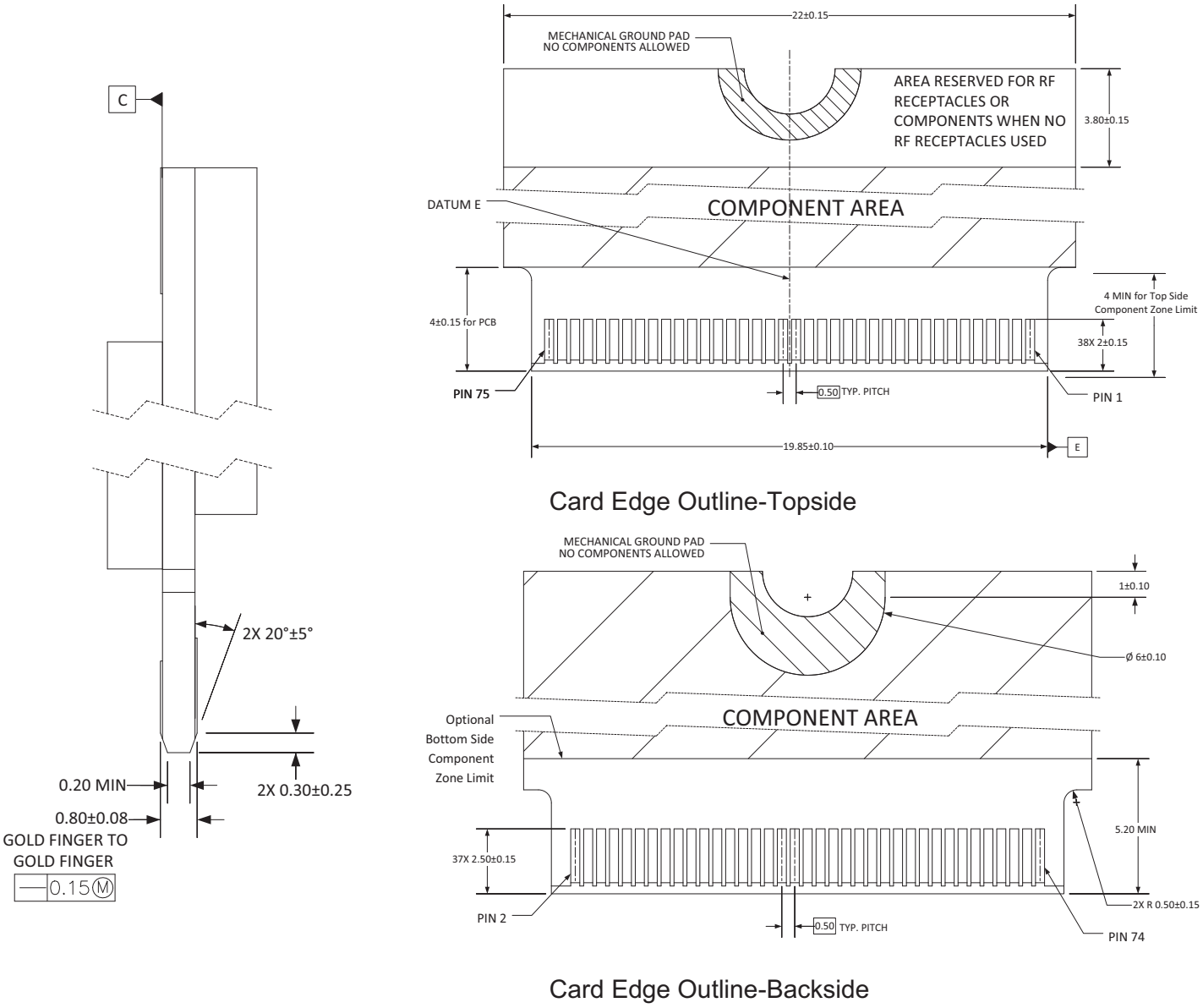

Figure 2. M.2 device plug dimension (detail)

3.1.2 SMBus Pin-out

This section provides a pin-out of the M.2 device and a description of the functions provided by the pins.

Table 13 M.2 (M-Key) pin descriptions.

Pin	Description	Description	Pin
74	3.3V	GND	75
72	3.3V	GND	73
70	3.3V	GND	71
68	N/C	N/C	69
66	Module Key	N/C	67
64		Module Key	65
62			63
60			61
58	MFG reserved		59
56	MFG reserved	GND	57
54	N/C	RefClkp	55
52	CLKREQ# (I/O)(0/3.3V)	RefClkn	53
50	PERST#(I)(0/3.3V)	GND	51
48	N/C	PERp0	49
46	N/C	PERn0	47
44	ALERT# (O)	GND	45
42	SMB_DATA (I/O)	PETp0	43
40	SMB_CLK (I/O)	PETn0	41
38	N/C	GND	39
36	N/C	PERp1	37
34	N/C	PERn1	35
32	N/C	GND	33
30	N/C	PETp1	31
28	N/C	PETn1	29
26	N/C	GND	27
24	N/C	PERp2	25
22	N/C	PERn2	23
20	N/C	GND	21
18	3.3V	PETp2	19
16	3.3V	PETn2	17
14	3.3V	GND	15
12	3.3V	PERp3	13
10	LED1#	PERn3	11
8	N/C	GND	9
6	N/C	PETp3	7
4	3.3V	PETn3	5
2	3.3V	GND	3
		GND	1

NOTE Image above taken from PCI Express M.2 Specification Rev. 1.0 and used with permissions.

4.0 Interface requirements

4.1 PCIe features

The Seagate Nytro SSD supports NVMe spec 1.2a. The following table shows the supported Features, Op-code, and whether vendor specific, mandatory, or optional:

Table 14 PCIe Features

Feature ID	M/O	Description	Supported
01h	M	Arbitration	Yes
02h	M	Power Management	Yes
03h	O	LBA Range Type	No
04h	M	Temperature Threshold	Yes
05h	M	(Time limited) Error Recovery	Yes
06h	O	Volatile Write Cache	No
07h	M	Number of Queues	Yes
08h	M	Interrupt Coalescing	Yes
09h	M	Interrupt Vector Configuration	Yes
0Ah	O	Write Atomicity	No
0Bh	M	Asynchronous Event Configuration	Yes
0Ch	O	Autonomous Power State Transition	No
0Dh	O	Host Memory Buffer	No
80h	O	Software Progress Marker	No
81h	O	Host Identifier	No
82h	O	Reservation Notification Mask	No
83h	O	Reservation Persistence	No
C0h	VS	System Time	Yes
C1h	VS	Test Unit Ready	Yes
C2h	VS	Media Life Left Threshold	Yes

4.2 Interface Commands Supported:

The Seagate Nytro SSD supports all the mandatory NVMe Admin and I/O command-sets in NVMe spec 1.2a. In addition, several optional commands are also supported. Below are tables showing the Commands, Op-code, whether Admin or IO and mandatory or optional:

Table 15 Supported I/O Commands

Feature ID	M/O	Command	Supported
00h	M	Flush	Yes
01h	M	Write	Yes
02h	M	Read	Yes
04h	O	Write Uncorrectable	Yes
05h	O	Compare	No
08h	O	Write Zones	Yes
09h	O	Dataset Management - Trim	Yes
		Dataset Management - IDW	No
		Dataset Management - IDR	No

Table 15 Supported I/O Commands *(continued)*

Feature ID	M/O	Command	Supported
0Dh	O	Reservation Register	No
0Eh	O	Reservation Report	No
11h	O	Reservation Acquire	No
12h	O	Reservation Release	No

Table 16 Supported Admin Commands

Op-code	M/O	Command	Supported
00h	M	Delete I/O SQ	Yes
01h	M	Create I/O SQ	Yes
02h	M	Get log Page	Yes
04h	M	Delete I/O CQ	Yes
05h	M	Create I/O CQ	Yes
06h	M	Identify	Yes
08h	M	Abort	Yes
09h	M	Set Features	Yes
0Ah	M	Get Features	Yes
0Ch	M	Async Event Request	Yes
0Dh	O	Namespace Management	No
10h	M	Firmware Commit	Yes
11h	M	Firmware Image Download	Yes
15h	O	Namespace Attachment	No
80h	O	Format NVM	Yes
81h	O	Security Send	Yes
82h	O	Security Receive	Yes
C0h	VS	Diagnostic Send	Yes
C1h	VS	Diagnostic Receive	Yes

4.3 Log Page Support

The Seagate Nytro SSD supports the following mandatory log pages defined in NVMe 1.2a specification:

Table 17 Log Page Support

Log Page	M/O	Description	Supported
01h	M	Error Information	Yes
02h	M	SMART / Health Information	Yes
03h	M	Firmware Slot Information	Yes
05h	O	Commands Supported and Effects Log	Yes
C0h	VS	Extended SMART Attributes	Yes
C1h	VS	Debug Log 1	Yes
C2h	VS	Debug Log 2	Yes
C3h	VS	Reserved	No
C4h	VS	Reserved	No

Table 17 Log Page Support *(continued)*

Log Page	M/O	Description	Supported
C5h	VS	List of Supported Log Pages	Yes
C6h	VS	Power Monitor Log Page	Yes
C7h	VS	Reserved	No
C8h	VS	Recent history Log Page	Yes
C9h	VS	Security Error log	Yes
CAh	VS	Lifetime Drive History Log Page	Yes

4.4 SMART Attributes

The following table lists the supported SMART attributes.

Table 18 SMART Attributes (Log Identifier 02h)

Byte	# of Bytes	Attribute	Description
0	1	**Critical Warning:** These bits, if set, flag various warning sources. Bit 0: Available Spare is below Threshold Bit 1: Temperature has exceeded Threshold Bit 2: Reliability is degraded due to excessive media or internal errors Bit 3: Media is placed in Read- Only Mode Bit 4: Volatile Memory Backup System has failed (e.g., enhanced power loss capacitor test failure) Bits 5-7: Reserved	Any of the critical warning can be tied to asynchronous event notification. Drive Health Indicator defined under bytes 3095-3076 of Identify Controller may still indicate "healthy" status when the critical warning flag is set.
1	2	Temperature: Overall Device current temperature in Kelvin	For AIC, this reports the NAND temperature, this reports the case temperature,
3	1	Available Spare: Contains a normalized percentage (0 to 100%) of the remaining spare capacity available	Starts from 100 and decrements.
4	1	Available Spare Threshold	Threshold is set to 10%.
5	1	Percentage Used Estimate (Value allowed to exceed 100%)	A value of 100 indicates that the estimated endurance of the device has been consumed, but may not indicate a device failure. The value is allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value shall be updated once per power-on hour (when the controller is not in a sleep state).
32	16	Data Units Read (in LBAs)	Contains the number of 512 byte data units the host has read from the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes read) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data read to 512-byte units.

Table 18 SMART Attributes (Log Identifier 02h) *(continued)*

Byte	# of Bytes	Attribute	Description
48	16	Data Units Write (in LBAs)	Contains the number of 512 byte data units the host has written to the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512-byte units. For the NVM* command set, logical blocks written as part of Write operations shall be included in this value. Write Uncorrectable commands shall not impact this value.
64	16	Host Read Commands	Contains the number of read commands issued to the controller.
80	16	Host Write Commands	Contains the number of write commands issued to the controller.
96	16	Controller Busy Time (in minutes)	Contains the amount of time the controller is busy with I/O commands. The controller is busy when there is a command outstanding to an I/O Queue (specifically, a command was issued by way of an I/O Submission Queue Tail doorbell write and the corresponding completion queue entry has not been posted yet to the associated I/O Completion Queue). This value is reported in minutes.
112	16	Power Cycles	Contains the number of power cycles.
128	16	Power On Hours	Contains the number of power-on hours. This does not include time that the controller was powered and in a low power state condition.
144	16	Unsafe Shutdowns	Contains the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power.
160	16	Media Errors	Contains the number of occurrences where the controller detected an unrecovered data integrity error. Errors such as uncorrectable ECC, CRC checksum failure, or LBA tag mismatch are included in this field.
176	16	Number of Error Information Log Entries	Contains the number of Error Information log entries over the life of the controller.

5.0 Standards and Reference Documents

5.1 Standards

The Seagate® Nytro® XM1440 family complies with Seagate standards as noted in the appropriate sections of this manual.

The drives are recognized in accordance with UL 60950-1 as tested by UL, CSA 60950-1 as tested by CSA, and EN60950-1 as tested by TUV.

The security features of Self-Encrypting Drive models are based on the "TCG Storage Architecture Core Specification" and the "Storage Work Group Storage Security Subsystem Class: Opal, Version 2.00".

5.1.1 Electromagnetic compatibility

The drive, as delivered, is designed for system integration and installation into a suitable enclosure prior to use. The drive is supplied as a subassembly and is not subject to Subpart B of Part 15 of the FCC Rules and Regulations nor the Radio Interference Regulations of the Canadian Department of Communications.

The design characteristics of the drive serve to minimize radiation when installed in an enclosure that provides reasonable shielding. The drive is capable of meeting the Class B limits of the FCC Rules and Regulations of the Canadian Department of Communications when properly packaged; however, it is the user's responsibility to assure that the drive meets the appropriate EMI requirements in their system. Shielded I/O cables may be required if the enclosure does not provide adequate shielding. If the I/O cables are external to the enclosure, shielded cables should be used, with the shields grounded to the enclosure and to the host controller.

5.1.1.1 Electromagnetic susceptibility

As a component assembly, the drive is not required to meet any susceptibility performance requirements. It is the responsibility of those integrating the drive within their systems to perform those tests required and design their system to ensure that equipment operating in the same system as the drive or external to the system does not adversely affect the performance of the drive.

5.1.2 Electromagnetic compliance

Seagate uses an independent laboratory to confirm compliance with the directives/standards for CE Marking and C-Tick Marking. The drive was tested in a representative system for typical applications and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. The selected system represents the most popular characteristics for test platforms. The system configurations include:

- Typical current use microprocessor
- Keyboard
- Monitor/display
- Printer
- Mouse

Although the test system with this Seagate model complies with the directives/standards, we cannot guarantee that all systems will comply. The computer manufacturer or system integrator shall confirm EMC compliance and provide the appropriate marking for their product.

5.1.3 Electromagnetic compliance for the European Union

If this model has the CE Marking it complies with the European Union requirements of the Electromagnetic Compatibility Directive 2004/108/EC as put into place on 20 July 2007.

5.1.4 Canada ICES-003

If this model has the ICES-003 Marking it complies with the Canadian Standard Association Standard CAN/CSA-CISPR 22-10, Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement.

5.1.5 Australian RCM Mark

If this model has the RCM Marking it complies with the Australia/New Zealand Standard AS/NZ CISPR22 and meets the Electromagnetic Compatibility (EMC) Framework requirements of Australia's Radiocommunications Act.

5.1.6 Korean KCC

If these drives have the Korean Communications Commission (KCC) logo, they comply with KN22, KN 24, and KN61000.

5.1.7 Taiwanese BSMI

If this model has two Chinese words meaning "EMC certification" followed by an eight digit identification number, as a Marking, it complies with Chinese National Standard (CNS) 13438 and meets the Electromagnetic Compatibility (EMC) Framework requirements of the Taiwanese Bureau of Standards, Metrology, and Inspection (BSMI).

5.1.8 European Union Restriction of Hazardous Substances (RoHS)

The European Union Restriction of Hazardous Substances (RoHS) Directive restricts the presence of chemical substances, including Lead (Pb), in electronic products effective July 2006.

A number of parts and materials in Seagate products are procured from external suppliers. We rely on the representations of our suppliers regarding the presence of RoHS substances in these parts and materials. Our supplier contracts require compliance with our chemical substance restrictions, and our suppliers document their compliance with our requirements by providing material content declarations for all parts and materials for the disk drives documented in this publication. Current supplier declarations include disclosure of the inclusion of any RoHS-regulated substance in such parts or materials.

Seagate also has internal systems in place to ensure ongoing compliance with the RoHS Directive and all laws and regulations which restrict chemical content in electronic products. These systems include standard operating procedures that ensure that restricted substances are not utilized in our manufacturing operations, laboratory analytical validation testing, and an internal auditing process to ensure that all standard operating procedures are complied with.

5.1.9 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.

该产品具有20年的环境保护使用周期 （EPUP）。 下表包含了中国 “电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	0	0	0	0	0
Chassis	X	0	0	0	0	0

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

5.2 Reference Documents and Support

In case of conflict between this document and any referenced document, this document takes precedence.

Table 19 Reference Documents

Title	Location
PCIe specifications: PCIe - PCI Express Electromechanical specification, revision 3.0 NVMe - Non Volatile Memory Express specification 1.2a PCIe CEM - PCI Express Card Electromechanical specification, revision 1.1	www.pcisig.com
Trusted Computing Group (TCG) Documents TCG Storage Architecture Core Specification, Rev. 1.0 Storage Work Group Storage Security Subsystem Class: Opal, Version 2.00	www.trustedcomputinggroup.org
Solid State Drive Requirements and Endurance Test Methods JESD218 JESD219	www.jedec.org
Seagate NytroCLI User Guide	http://www.seagate.com/support/by-product/ssd-and-pcie-flash/

Table 20 Support

Seagate Support Services	Location
For information regarding online support and services, visit: Available services include: • Presales & Technical support • Global Support Services phone numbers & business hours • Authorized Service Centers Warranty terms vary based on type of warranty chosen: "Managed Life" or "Limited Warranty with Media Usage." Consult the Seagate sales representative for warranty terms and conditions.	http://www.seagate.com/contacts/
For information regarding data recovery services, visit:	http://www.seagate.com/services-software/seagate-recovery-services/recover/
For Nytro® Support, visit:	http://www.seagate.com/support/by-product/ssd-and-pcie-flash/
For information regarding Warranty Support, visit:For information regarding data recovery services, visit:	http://www.seagate.com/support/warranty-and-replacements/
For Seagate OEM, Distribution partner portal, and reseller portal, visit:	http://www.seagate.com/partners/

Seagate Technology LLC
AMERICAS Seagate Technology LLC 10200 South De Anza Boulevard, Cupertino, California 95014, United States, 408-658-1000
ASIA/PACIFIC Seagate Singapore International Headquarters Pte. Ltd. 7000 Ang Mo Kio Avenue 5, Singapore 569877, 65-6485-3888
EUROPE, MIDDLE EAST AND AFRICA Seagate Technology SAS 16-18 rue du Dôme, 92100 Boulogne-Billancourt, France, 33 1-4186 10 00

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