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7100 U.2 NVMe PCIe SSD

MTFDHAK400MCG, MTFDHAK800MCG, MTFDHAK1T6MCG, MTFDHAK480MCH, MTFDHAK960MCH, MTFDHAK1T9MCH

Features

- Micron® 16nm MLC NAND Flash
- PCIe Gen3: U.2 x4
- NVMe 1.2a
- Capacity[1]
  - 7100 ECO: 480GB, 960GB, 1.92TB
  - 7100 MAX: 400GB, 800GB, 1.6TB
- Endurance (total bytes written)
  - 400GB/480GB: Up to 5.84PB
  - 800GB/960GB: Up to 11.6PB
  - 1.6TB/1.92TB: Up to 23.3PB
- Industry-standard 512-byte and 4096-byte sector size support
- Power: 9W average, selectable 12.5, 8.25, 6 or 4W MAX
- Surprise insertion/surprise removal (SISR) and hot-plug capable
- Power-backed cache
- Steady state performance[2] (varies by capacity)
  - Sequential 128KB read: 2.5 GB/s
  - Sequential 128KB write: 900 MB/s
  - Random 4KB read: 235,000 IOPS
  - Random 4KB write: 40,000 IOPS
  - 70/30 random 4KB read/write: 85,000 IOPS
- Latency to media performance, typical (QD = 1)
  - READ: 110µs, WRITE: 40µs
- Security
  - Signed firmware
  - TCG Opal 2.0-compliant self-encrypting drive (SED) (optional)
  - Compatible with Microsoft eDrive® (optional)
  - Cryptographic erase support (optional)
- Reliability
  - MTBF: 2 million hours[3]
  - Field-upgradable firmware
  - UBER: <1 sector per 10^{17} bits read
- NVMe-MI 1.0 Basic Management Command and Vital Product Data (VPD) over SMBus for drive management
- SMART command set support
- Temperature[4]
  - 0°C to 70°C operating temperature
  - –40°C to 85°C non-operating
  - Temperature protection
- Mechanical/electrical
  - 69.85 x 7.00 x 100.45mm, 12V (±10%)
- Shock: 1500G at 0.5ms
- Vibration: 3.08 G_{RMS} 7–800Hz

Controller Features

- NVMe controller
  - Number of queues: 16 IO SQ/CQ pairs
  - Round robin arbitration
- Interrupt support coalescing
- NVMe command set attributes
  - Completion queue entry size: 64 bytes
  - Submission queue entry size: 64 bytes

Native Drivers

- Microsoft Windows® Server 2016
- Red Hat® Enterprise Linux 6.5+
- CentOS 6.5+
- SUSE® Linux Enterprise Server 11 SP4, 12+
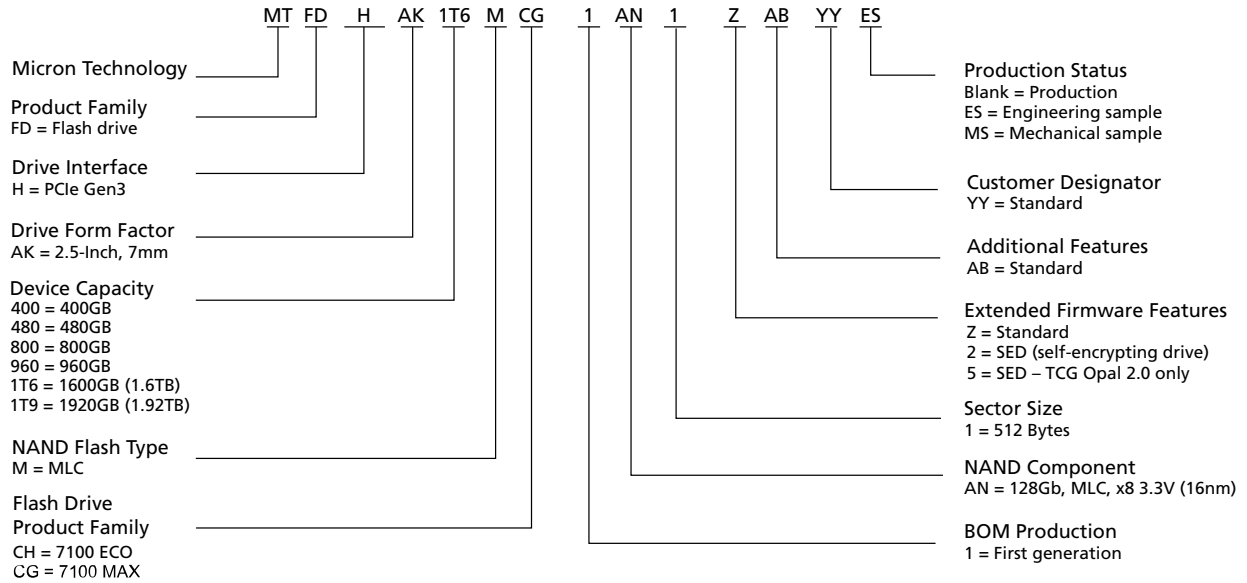- Ubuntu® 14.04+
- VMware® 5.5, 6.0+

Custom Drivers

- Microsoft Windows Server 2012 R2, Hyper-V (recommended)
- RHEL 6.1–6.4
- CentOS 6.2–6.4
- SUSE Linux Enterprise Server 11 SP3
- Ubuntu 12.04

Notes:
1. User capacity: 1GB = 1 billion bytes; 1TB = 1 trillion bytes.
2. Steady state as defined by SNIA Solid State Storage Performance Test Specification Enterprise v1.1.
3. See functional description section for more details.
4. Operating temperature is the drive case temperature as measured by the SMART temperature. See airflow recommendations.

Products and specifications discussed herein are subject to change by Micron without notice.

Part Numbering Information

The Micron® 7100 SSD is available in different configurations and capacities. Visit www.micron.com for a list of valid part numbers.

Figure 1: Part Number Chart

MT FD H AK 1T6 M CG 1 AN 1 Z AB YY ES

Micron Technology

Product Family
FD = Flash drive

Drive Interface
H = PCIe Gen3

Drive Form Factor
AK = 2.5-Inch, 7mm

Device Capacity
400 = 400GB
480 = 480GB
800 = 800GB
960 = 960GB
1T6 = 1600GB (1.6TB)
1T9 = 1920GB (1.92TB)

NAND Flash Type
M = MLC

Flash Drive
Product Family
CH = 7100 ECO
CG = 7100 MAX

Production Status
Blank = Production
ES = Engineering sample
MS = Mechanical sample

Customer Designator
YY = Standard

Additional Features
AB = Standard

Extended Firmware Features
Z = Standard
2 = SED (self-encrypting drive)
5 = SED – TCG Opal 2.0 only

Sector Size
1 = 512 Bytes

NAND Component
AN = 128Gb, MLC, x8 3.3V (16nm)

BOM Production
1 = First generation

Warranty: Contact your Micron sales representative for further information regarding the product, including product warranties.

General Description

Micron's 7100 is a family of low-power NVMe solid state drives (SSDs). The 7100 utilizes a PCIe Gen3 interface, the innovative Non-Volatile Memory Express protocol and Micron's own high-speed NAND to provide exceptional throughput, very low latency, and consistent quality of service within a much lower power envelope than traditional PCIe storage. Its ultra-thin 7mm z-height enables denser system design or greater airflow. Reliability assurance measures include cyclic redundancy checks (CRC), capacitor-backed power loss protection and extensive validation, quality and reliability testing. It features thermal monitoring and protection, SMART attributes for status polling, hot-plug capability and optional self encryption with TCG Opal 2.0.

The device comes in two form factors: 2.5-inch U.2 (small form factor 8639) and M.2 M-Key, both of which utilize a PCIe x4 Gen3 host interface. This document covers the U.2 form factor only.

The 7100 has two endurance classes: the 7100 ECO for read-centric use at roughly 0.3 DWPD, and the 7100 MAX for mixed-use workloads at about 3 DWPD. The ECO version comes in 480GB, 960GB, and 1.92TB capacities, while the 7100 MAX comes in 400GB, 800GB, or 1.6TB.

Logical Block Address Configuration

The number of logical block addresses (LBAs) reported by the device ensures sufficient storage space for the specified capacity.

Table 1: LBA Count in Accordance with IDEMA LBA1-03

Capacity	512-Byte Sector LBA Count	4KB Sector LBA Count
400GB	781,442,768	97,677,846
480GB	937,703,088	117,212,886
800GB	1,562,824,368	195,353,046
960GB	1,875,385,008	234,423,126
1.6TB	3,125,627,568	390,703,446
1.92TB	3,516,328,368	439,541,046

Performance

Table 2: Drive Performance

Specification	7100 ECO			7100 MAX			Unit
	480GB	960GB	1.92TB	400GB	800GB	1.6TB	
Sequential read (128KB I/O size)	2.4	2.5	2.5	2.4	2.5	2.5	GB/s
Sequential write (128KB I/O size)	500	900	900	500	900	900	MB/s
Random read (4KB I/O size)	180,000	220,000	235,000	180,000	220,000	235,000	IOPS
Random write (4KB I/O size)	10,000	12,000	15,000	25,000	33,000	40,000	
70/30 mixed workload random read/write (4KB I/O size)	25,000	35,000	45,000	55,000	65,000	85,000	
Random read latency, QD = 1 (typical)	110						µs
Random write latency, QD = 1 (typical)	40						

Notes:
1. Performance is steady state as defined by SNIA Solid State Storage Performance Test Specification Enterprise v1.1.
2. Performance may vary up to 10% over life of drive.
3. Quality of service is measured using random 4KB workloads at steady state with 512B sector size.

Functional Description

Mean Time to Failure

The mean time to failure (MTTF) for the device can be calculated based on the component reliability data using the methods referenced in the Telcordia SR-322 reliability prediction procedures for electronic equipment and measured during Reliability Demonstration Test.

Table 3: MTTF

Capacity	MTTF (Operating Hours)
All	2.0 million

Note: 1. Based on population statistics that are not relevant to individual units, 8760 power on hours per year, 250 power on/off cycles per year, nominal voltages and an environment that does not exceed specified case temperature.

Endurance

SSD endurance is dependent on many factors, including: usage conditions applied to the drive, drive performance and capacity, formatted sector size, error correction codes (ECCs) in use, internal NAND PROGRAM/ERASE cycles, write amplification factor, wear-leveling efficiency of the drive, over-provisioning ratio, valid user data on the drive, drive temperature, NAND process parameters, and data retention time.

The device is designed to operate under a wide variety of conditions, while delivering the maximum performance possible and meeting enterprise market demands.

While actual endurance varies depending on conditions, the drive lifetime can be estimated based on capacity, assumed fixed-use models, ECC, and formatted sector size. Lifetime estimates for the device are shown in the following tables in total bytes written.

Table 4: Total Bytes Written

Model	Capacity	Sequential Writes	Random Writes (4KB)	Unit
7100 ECO	480GB	5.84	0.26	PB
	960GB	11.6	0.52	
	1.92TB	23.3	1.05	
7100 MAX	400GB	5.84	2.19	
	800GB	11.6	4.38	
	1.6TB	23.3	8.76	

Note: 1. Values shown are based on system modeling.

Data Retention

Data retention refers to the capability of the SSD media (that is, NAND Flash) to retain programmed data. The three primary factors that affect data retention are:

- Power-on/power-off state: Data retention generally improves when the SSD is in use (that is, not shelved in a power-off state).
- Temperature: Data retention decreases as the temperature increases.
- Number of PROGRAM/ERASE cycles on the media: When the SSD ships from the factory, it is typically able to retain user data for up to 5 years in a powered-off state.

Data retention is guaranteed for three months at 40ºC (max), which assumes worst-case power and media wear (the SSD remains in a powered-off state and has reached end of life).

Wear Leveling

The device uses sophisticated wear-leveling algorithms to maximize endurance by distributing PROGRAM/ERASE cycles uniformly across all blocks in the array. Both static and dynamic wear leveling are utilized to optimize the drive's lifespan.

Both types of wear leveling aim to distribute "hot" data away from blocks that have experienced relatively heavy wear. Static wear leveling accomplishes this by moving data that has not been modified for an extended period of time out of blocks which have seen few P/E cycles and into more heavily worn blocks. This frees up fresher blocks for new data while reducing expected wear on tired blocks. Dynamic wear leveling, by contrast, acts on in-flight data to ensure it is preferentially written to the least-worn free blocks rather than those closer to the end of their rated life. These techniques are used together within the controller to optimally balance the wear profile of the NAND array.

Firmware Update Capability

The SSD supports firmware updates as defined by the NVMe specification. Once a download operation completes, an ACTIVATE command must be issued.

Power Loss Subsystem and Rebuild

The SSD supports an unexpected power loss with a power-backed write cache. No user data is lost during an unexpected power loss.

SMBus Sideband Management

The SSD uses the SMBus interface for presenting product data, monitoring drive health, checking drive status before power-up, and error posting.

Two protocols are supported: NVMe Basic Management Command revision 1.0 and Vital Product Data (VPD).

Management data and vital product data may be accessed at fixed addresses with +3.3V_{AUX} prior to powering up the drive completely. This data continues to be available at this fixed address when the drive is fully powered up.

Table 5: Out of Band Management Details

Out of Band Protocol	SMBus Address	Data	Detailed Structure
Vital Product Data	0xA6	Vital Product Data (VPD)	See the VPD table
NVMe Management Interface 1.0	0x6A	Basic Management Command	See the Basic Management Command table

Note: 1. SMBus addresses will appear at an alternate address in certain tools due the inclusion of direction bit in the SMBus spec.

Electrical Characteristics

Stresses greater than those listed may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Table 6: Power Consumption

Specification	Value
Max active power	12.5W
Average power	9.0W
Power State 1 max	8.25W
Power State 2 max	6.0W
Power State 3 max	4.0W

Notes: 1. Power varies significantly depending on IO workload.
2. Maximum power is RMS measured over 1ms.

Table 7: Operating Voltage

Electrical Characteristic	Value
Operating voltage	12Vdc (±10%)
Max/min rise time	100ms/0s (hot-plug capable)
Fall time	100µs @ 1A discharge
Inrush current (typical peak)	2A < 2ms
Minimum off time	150ms

Environmental Conditions

Table 8: Temperature and Airflow

Temperature and Airflow	Value	Notes
Operating temperature (as indicated by the SMART temperature attribute)	0°C to 70°C	1
Operating ambient temperature	Ambient: 0°C to 35°C	2
Operating airflow	400GB/480GB: 110 LFM at 35°C ambient All other capacities: 412 LFM at 35°C ambient	3, 4
Storage temperature	–40°C to 85°C	

Notes:
1. If NAND temperature exceeds 80°C, performance will be throttled.
2. Temperature of air impinging on the SSD.
3. Airflow must flow along the length of the drive.
4. Airflow is measured upstream of the drive before any acceleration as the air goes around the drive.

Table 9: Shock and Vibration

Shock and Vibration	Value
Shock (non-operational)	1500G at 0.5ms half-sine
Vibration (non-operational)	3.08 G_{RMS} 7–800Hz

Note:
1. Shock and vibration ratings refer to ability to withstand stress events only. Prolonged or repeated exposure to conditions listed or greater stresses may result in permanent damage to the device. Functional operation of the device under these conditions is not implied. See warranty for more information.

Supported Commands

NVMe Features

The 7100 supports the following mandatory NVMe features, as described in the NVMe specification:

- 01h - Arbitration
- 02h - Power management
- 04h - Temperature threshold
- 05h - (Time limited) error recovery
- 07h - Number of queues
- 08h - Interrupt coalescing
- 09h - Interrupt vector configuration
- 0Bh - Asynchronous event configuration

The following vendor-specific NVMe admin features are also supported:

- C0h - System time
- C1h - Test unit ready
- C2h - Media life left threshold

NVMe Admin Command Set

The 7100 supports the following mandatory NVMe admin commands, as described in the NVMe specification:

- Delete I/O submission queue
- Create I/O submission queue
- Get log page
- Delete I/O completion queue
- Create I/O completion queue
- Identify
- Abort
- Set features
- Get features
- Asynchronous event request
- Firmware activate
- Firmware image download

The following optional NVMe admin commands are also supported:

- Format NVM
- Security send
- Security receive
- Diagnostic send (vendor specific)
- Diagnostic receive (vendor specific)

NVMe I/O Command Set

The 7100 supports the following mandatory NVMe I/O commands, as described in the NVMe specification:

- Flush
- Write
- Read
- Compare

The following optional NVMe I/O commands are also supported:

- Write uncorrectable
- Write zones
- Dataset management (de-allocate/trim only)

Log Pages

The Get Log Page command can be used to retrieve the following mandatory logs:

- 01h - Error information
- 02h - SMART / health information
- 03h - Firmware slot information

The following optional or vendor-specific logs are also supported:

- 05h - Commands supported and effects log
- C0h - Extended SMART attributes

SMART and Health Information

The SSD supports SMART/Health log information as defined in the NVMe specification as well as extended health information. These logs persist through power cycles and reflect lifetime data.

Table 10: SMART/Health Information (Log Identifier 02h)

Bytes	Name	Description
0	Critical warning	Indicates critical warnings for the state of the controller. Each bit corresponds to a critical warning type; multiple bits may be set. If a bit is cleared to 0, the critical warning does not apply. Critical warnings may result in an asynchronous event notification to the host. • Bit 00: If set to 1, the available spare space has fallen below the threshold. • Bit 01: If set to 1, the temperature has exceeded a critical threshold. • Bit 02: If set to 1, the device reliability has been degraded due to significant media-related errors or any internal error that degrades device reliability. • Bit 03: If set to 1, the media has been placed in read-only mode. • Bit 04: If set to 1, the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution. • Bits 07:05 Reserved
2:1	Temperature	Contains the temperature of the overall device (controller and NVM included) in units of Kelvin. If it exceeds the temperature threshold, an asynchronous event may be issued to the host. For the 7100, the value reported is the case temperature.
3	Available spare	Contains a normalized percentage (0–100%) of the remaining available spare capacity, beginning at 100% and decreasing.
4	Available spare threshold	When the available spare falls below the threshold indicated in this field, an asynchronous event may be issued to the host. The value is indicated as a normalized percentage (0–100%). Threshold is set to 10%.
5	Percentage used	Contains a vendor-specific estimate of the percentage of the device life used based on the actual device usage and the manufacturer's prediction of device life. A value of 100 indicates that the estimated endurance of the device has been consumed, but may not indicate a device failure. Refer to the JEDEC JESD218 standard for SSD device life and endurance measurement techniques.
31:6	Reserved	Reserved
47:32	Data units read	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 (that is, 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 10: SMART/Health Information (Log Identifier 02h) (Continued)

Bytes	Name	Description
63:48	Data units written	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 (that is, 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.
79:64	Host read commands	Contains the number of read commands issued to the controller.
95:80	Host write commands	Contains the number of write commands issued to the controller.
111:96	Controller busy time	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 via 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.
127:112	Power cycles	Contains the number of power cycles.
143:128	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.
159:144	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.
175:160	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.
191:176	Number of error info log entries	Contains the number of error information log entries over the life of the controller.
511:192	Reserved	Reserved

Out of Band Management

The 7100 allows sideband management using the SMBus and two protocols:

Table 11: Basic Management Command (Address 0x6A)

Command Code	Bytes	Description
0	00	**Length of Status:** Indicates number of additional bytes to read before encountering PEC. Always 6 (06h) in 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). Refer to 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.

Table 11: Basic Management Command (Address 0x6A) (Continued)

Command Code	Bytes	Description
0	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.
8	08	**Length of identification:** Indicates number of additional bytes to read before encountering PEC. Always 22 (16h) in 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. First character is transmitted first.
	31	**PEC:** An 8 bit CRC calculated over the slave address, command code, second slave address and returned data. Algorithm is in SMBus Specifications.
32+	255:32	Vendor Specific

Table 12: Vital Product Data (VPD) (Address 0xA6)

Address	Function	Type	Size (B)	Description
0	Class Code	RO	3	Device type and programming interface
3	ID	RO	2	PCI-SIG Vendor ID
5			20	Serial Number
25			40	Model Number (ASCII string)
65	PCIe Port 0 Capabilities	RO	2	Maximum Link Speed
66				Maximum Link Width
67	PCIe Port 1 Capabilities	RO	2	Maximum Link Speed
68				Maximum Link Width
69	Initial Power Requirements	RO	3	12V power rail initial power requirement (W)
70				Reserved
71				Reserved
72	Maximum Power Requirements	RO	3	12V power rail maximum power requirement (W)
73				Reserved
74				Reserved
75	Capability List Pointer	RO	2	16-bit address pointer to start of capability list (zero means no capability list)

Interface Connectors

U.2 Pin Assignments

The U.2, 2.5-inch form factor follows the SFF-8639 specification.

Table 13: PCIe Interface Connector Pin Assignments (U.2 Form Factor)

Pin	Name	Description	Pin	Name	Description
S1	GND	Ground	E7	REFCLK0+	PCIe REFCLK 0 p
S2		DNC	E8	REFCLK0-	PCIe REFCLK 0 p
S3		DNC	E9	GND	Ground
S4	GND	Ground	E10	PETp0	PCIe TX Lane 0 p
S5		DNC	E11	PETn0	PCIe TX Lane 0 n
S6		DNC	E12	GND	Ground
S7	GND	Ground	E13	PERn0	PCIe RX Lane 0 n
E1	REFCLK1+	DNC	E14	PERp0	PCIe RX Lane 0 p
E2	REFCLK1-	DNC	E15	GND	Ground
E3	3.3Vaux	3.3V auxiliary power	E16	RSVD	Reserved
E4	PERST1#	DNC	S8	GND	Ground
E5	PERST0#	PCIe Fundamental Reset	S9		DNC
E6	RSVD	Reserved	S10		DNC
P1		DNC	S11	GND	Ground
P2		DNC	S12		DNC
P3	CLKREQ#	Clock request	S13		DNC
P4	IfDet_N	Interface detect	S14	GND	Ground
P5	GND	Ground	S15	RSVD	Reserved
P6	GND	Ground	S16	GND	Ground
P7		DNC	S17	PETp1	PCIe TX Lane 1 p
P8		DNC	S18	PETn1	PCIe TX Lane 1 n
P9		DNC	S19	GND	Ground
P10	PRSNT_N	Presence detect	S20	PERn1	PCIe RX Lane 1 n
P11	Activity	Activity signal from the drive	S21	PERp1	PCIe RX Lane 1 p
P12	Hot-Plug	Ground	S22	GND	Ground
P13	+12V_pre	12V power	S23	PETp2	PCIe TX Lane 2 p
P14	+12V	12V power	S24	PETn2	PCIe TX Lane 2 n
P15	+12V	12V power	S25	GND	Ground
			S26	PERn2	PCIe RX Lane 2 n
			S27	PERp2	PCIe RX Lane 2 p
			S28	GND	Ground
			E17	PETp3	PCIe TX Lane 3 p
			E18	PETn3	PCIe TX Lane 3 n
			E19	GND	Ground

Table 13: PCIe Interface Connector Pin Assignments (U.2 Form Factor) (Continued)

Pin	Name	Description	Pin	Name	Description
			E20	PERn3	PCIe RX Lane 3 n
			E21	PERp3	PCIe RX Lane 3 p
			E22	GND	Ground
			E23	SMCLK	SMBus clock
			E24	SMDAT	SMBus data
			E25	DualPortEn_N	Dual port enable (not used)

Note: 1. PRSNT_N is open and IfDet_N is grounded to indicate PCIe support.

PCIe Header
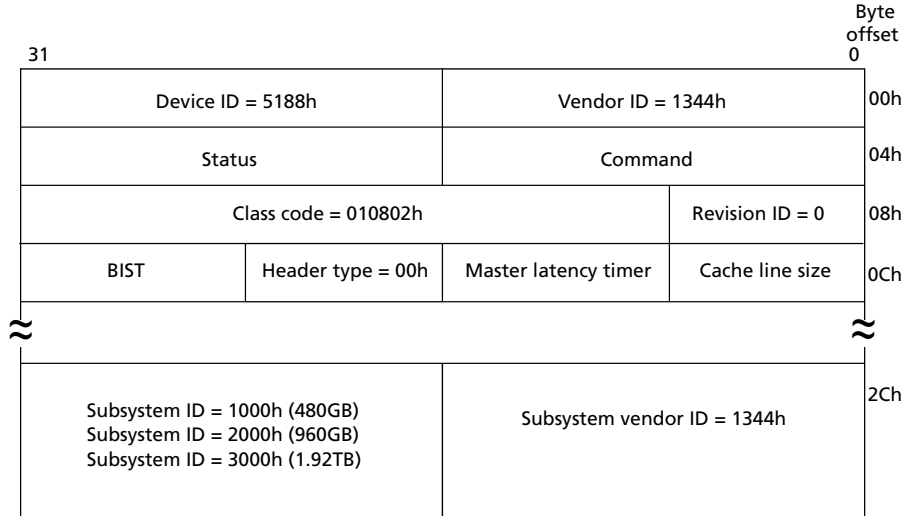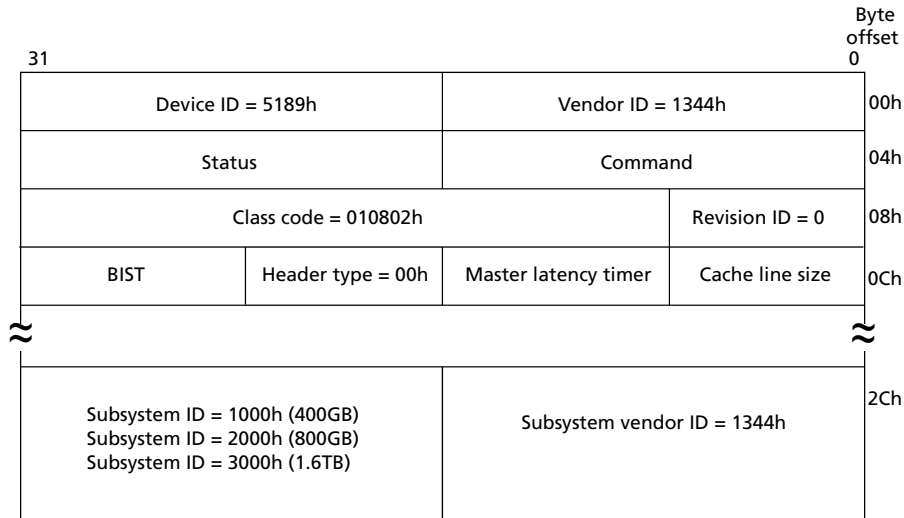
Figure 2: 7100 ECO PCIe Header

	Byte offset
31	0

31		0	Byte offset
Device ID = 5188h		Vendor ID = 1344h	00h
Status		Command	04h
Class code = 010802h		Revision ID = 0	08h
BIST	Header type = 00h	Master latency timer / Cache line size	0Ch
≈		≈	
Subsystem ID = 1000h (480GB) Subsystem ID = 2000h (960GB) Subsystem ID = 3000h (1.92TB)		Subsystem vendor ID = 1344h	2Ch

Figure 3: 7100 MAX PCIe Header

31		0	Byte offset
Device ID = 5189h		Vendor ID = 1344h	00h
Status		Command	04h
Class code = 010802h		Revision ID = 0	08h
BIST	Header type = 00h	Master latency timer / Cache line size	0Ch
≈		≈	
Subsystem ID = 1000h (400GB) Subsystem ID = 2000h (800GB) Subsystem ID = 3000h (1.6TB)		Subsystem vendor ID = 1344h	2Ch

Physical Configuration

Micron's 7100 conforms to SFF-8639 specifications.

Figure 4: Nominal Dimensions

Weight

Product mass: 90 grams.

Compliance

The device complies with the following specifications, if noted on the product label:

- CE (Europe): EN 55032 Class B, RoHS
- FCC: CFR Title 47, Part 15 Class B
- UL/cUL: approval to UL-60950-1, 2nd Edition, IEC 60950-1:2005 (2nd Edition); EN 60950-1 (2006) + A11:2009+ A1:2010 + A12:2011 + A2:2013
- BSMI (Taiwan): approval to CNS 13438 Class B
- RCM (Australia, New Zealand): AS/NZS CISPR32 Class B
- KC RRL (Korea): approval to KN32 Class B, KN 35 Class B

  B 급 기기   이 기기는 가정용으로 전자파적합등록을한 기기로서 주거

  (가정용 정보통신기기)   지역에서는 물론 모든지역에서 사용할 수 있습니다.

- W.E.E.E.: compliance with EU WEEE directive 2012/19/EC. Additional obligations may apply to customers who place these products in the markets where WEEE is enforced.
- TUV (Germany): approval to IEC60950/EN60950
- VCCI (Japan): 2015-04 Class B

  この装置は、クラス B 情報技術装置です。この装置は、家庭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

- IC (Canada): ICES-003 Class B
  - This Class B digital apparatus complies with Canadian ICES-003.
  - Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

FCC Rules

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 the 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.

References

- PCI Express Specification V3.0
- PCI Express CEM Specification V1.1
- SFF-8639
- JESD218
- JESD219
- TCG Storage Architecture Core Specification, Rev. 1.0
- TCG Storage Security Subsystem Class Opal Specification, Rev. 2.00
- NVM Express Specification revision 1.2a

Revision History

Rev. G – 03/17

- Updated TCG Opal references and MPN options.
- Modified power state values.
- Fixed typo on 400GB 4096-byte LBA count in Logical Block Address Configuration table.
- Added product mass.
- Changes to Compliance section.

Rev. F – 07/16

- Fixed typo on 960GB 512-byte LBA count in Logical Block Address Configuration table.

Rev. E – 06/16

- Changes to compliance section.

Rev. D – 05/16

- Corrected typo regarding number of IO SQ/CQ pairs.

Rev. C – 05/16

- Corrected typo in product family section of part number chart.

Rev. B – 04/16

- Updated performance specs
- NVMe spec changed from 1.1b to 1.2a
- Added part numbers and number scheme information
- Replaced TCG Enterprise reference with TCG Opal
- Latency measurement are taken with 512B sector sizes rather than 4K.
- Noted definition of max power.
- Added clock request pin to interface connector table.
- Added SMBus out-of-band management details.
- Updated lists of supported NVMe admin commands, NVMe I/O commands, and log pages. Added NVMe features list.

Rev. A – 03/16

- Initial release