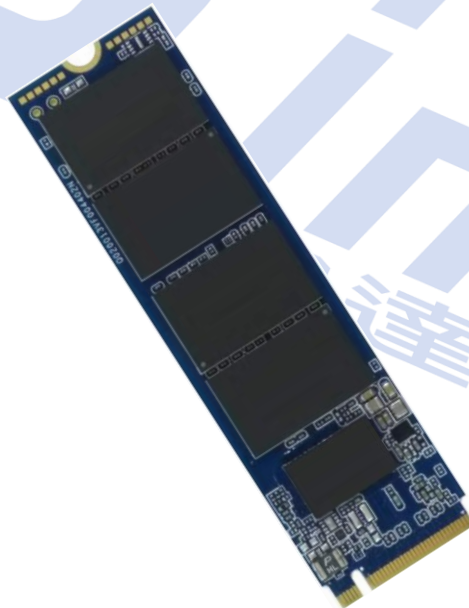


UD info Corp.

Industrial M.2 2280 PCIe SSD

M2P-80DE Series

Product DataSheet



UD info CORP.

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Revision History

Revision	Draft Date	History	Author
1.0	2020/7/17	New release	Golden Lee
1.1	2020/11/3	1. Update BiCS3 capacity support 2. Update TBW	Golden Lee



Product Overview

- **Capacity**
 - 120/128GB up to 1920GB/2TB
- **Form Factor**
 - M.2 2280-S2-M
- **PCIe Interface**
 - NVMe PCIe Gen3 x4
- **Compliance**
 - NVMe 1.3
 - PCI Express Base 3.1
- **Flash Interface**
 - Transfer rate up to 800MT/s
 - Up to 4pcs of BGA132 flash
- **Performance**^{Note1}
 - Read up to 2,500 MB/s
 - Write up to 2,100 MB/s
- **Power Consumption**^{Note2}
 - Idle mode < 70 mW
 - L1.2 < 2 mW
- **Reliability**
 - MTBF 1,500,000 hours
 - Uncorrectable Bit Error Rate (UBER)
< 1 sector per 10¹⁶ bits read
- **Advanced Flash Management**
 - Advanced Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Power Management**
 - Support APST
 - Support ASPM
 - Support L1.2
- **Temperature Range**^{Note3}
 - Operation (Standard): 0°C ~ 70°C
 - Operation (Wide): -40°C ~ 85°C
 - Storage: -40°C ~ 85°C
- **Compliant**
 - RoHS
- **Features Support List**
 - End to end data path protection
 - Thermal throttling
 - Dynamic SLC Cache
 - Drive log
 - Support HMB (Host Memory Buffer)
 - Support of TCG OPAL^{Note4}
 - Support of TCG Pyrite

Notes:

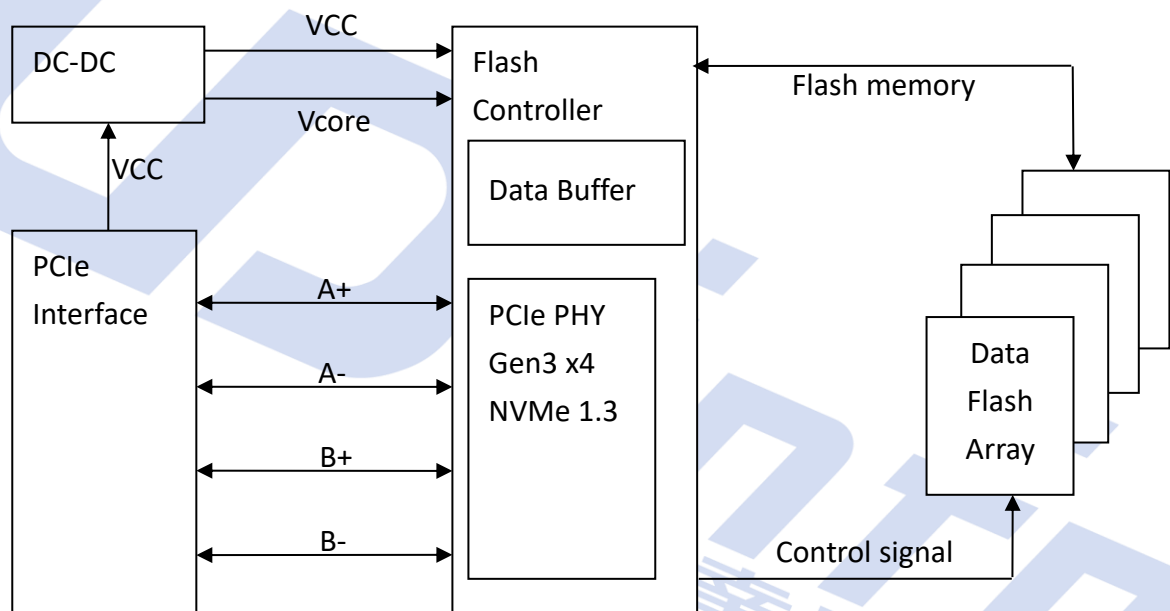
1. Refer to Chapter 2 for more details.
2. Refer to Chapter 4, section 4.2 power consumption for more details.
3. The operation temperature means the case temperature, in which can be decided via S.M.A.R.T.
4. Supported by a separate firmware version. Further information available upon request.

1. INTRODUCTION

1.1. General Description

UDinfo's M.2 2280 PCIe solid state Drive delivers all the advantages of flash disk technology with PCIe Gen3 x4 interface and is fully compliant with the standard Next Generation Form Factor (NGFF) called M.2 Card Format. The M.2 2280 could provide a wide range capacity up to 2TB and its performance can reach up to 2,500MB/s read and 2,100MB/s write based on KIOXIA/WD BiCS3/4 NAND flash. Moreover, the power consumption of the M.2 2280 is much lower than traditional hard drives, making it the best embedded solution for new platforms.

1.2. Block Diagram



M.2 2280 PCIe SSD Block Diagram

2. PRODUCT SPECIFICATIONS



2.1. Product Specifications

- **Capacity**
 - 120/128GB up to 1920GB/2TB
- **Electrical/Physical Interface**
 - PCI Express Base Ver 3.1 & Compliant with NVMe 1.3
 - PCIe Gen3 x 4 lane & backward compatible to PCIe Gen2 and Gen1
 - Support up to QD 128 with queue depth of up to 64K.
 - Support power management
- **Supported NAND Flash**
 - Support up to 16 Chip Enables (CE) within a single design and up to 4pcs of BGA132 flash
 - Support KIOXIA BiCS3/BiCS4 TLC/QLC & WD BiCS3/BiCS4 TLC
 - Support Micron / Intel 3D NAND
- **ECC Scheme**
 - Applies LDPC of ECC algorithm
- **Sector Size Support**
 - 512Bytes
 - 4KB
- **UART / GPIO**
- **Support SMART and TRIM commands**

- **LBA Range**

- IDEMA standard

Capacity	Total Sectors (LBA)	User Data Size
120GB	234,441,648	Depended on file management
128GB	250,069,680	
240GB	468,862,128	
256GB	500,118,192	
480GB	937,703,088	
512GB	1,000,215,216	
960GB	1,875,385,008	
1TB	2,000,409,264	
1920GB	3,750,748,848	
2TB	4,000,797,360	

- **Performance**

- KIOXIA BiCS3 TLC (533Mbps)

Capacity	Flash Structure	CE#	Flash Type	Sequential (CDM)		Random (IOMeter)	
				Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
120/128GB	64GB x 2	4	TLC, BGA	1,500	500	70K	100K
240/256GB	128GB x 2	8	TLC, BGA	1,730	1,000	130K	190K
480/512GB	128GB x 4	16	TLC, BGA	1,730	1,560	200K	260K
960GB/1TB	256GB x 4	16	TLC, BGA	TBD	TBD	TBD	TBD
1920GB/2TB	512GB x 4	16	TLC, BGA	TBD	TBD	TBD	TBD

- KIOXIA BiCS4 TLC (533Mbps)

Capacity	Flash Structure	CE#	Flash Type	Sequential (CDM)		Random (IOMeter)	
				Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
120/128GB	64GB x 2	4	TLC, BGA	1,550	550	70K	120K
240/256GB	128GB x 2	8	TLC, BGA	1,700	1,100	130K	230K
480/512GB	128Gb x 4	16	TLC, BGA	1,700	1,550	210K	295K

■ KIOXIA BiCS4 TLC (800Mbps)

Capacity	Flash Structure	CE#	Flash Type	Sequential (CDM)		Random (IOMeter)	
				Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
120/128GB	64GB x 2	4	TLC, BGA	2,200	600	85K	130K
240/256GB	128GB x 2	8	TLC, BGA	2,300	1,200	150K	250K
480/512GB	128GB x 4	16	TLC, BGA	2,500	2,100	210K	400K
960GB/1TB	256GB x 4	16	TLC, BGA	2,500	2,100	215K	400K
1920GB/2TB	512GB x 4	16	TLC, BGA	2,500	2,100	230K	400K

■ KIOXIA BiCS4 pTLC (667Mbps)

Capacity	Flash Structure	CE#	Flash Type	Sequential (CDM)		Random (IOMeter)	
				Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
480/512GB	340GB x 2	4	QLC, BGA	1,835	585	50K	125K
960GB/1TB	680GB x 2	8	QLC, BGA	1,980	1,175	90K	240K
1920GB/2TB	680GB x 4	16	QLC, BGA	2,050	1,810	140K	320K

■ WD BiCS4 TLC (800Mbps)

Capacity	Flash Structure	CE#	Flash Type	Sequential (CDM)		Random (IOMeter)	
				Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
120/128GB	64GB x 2	4	TLC, BGA	2,250	550	90K	120K
240/256GB	128GB x 2	8	TLC, BGA	2,500	1,100	170K	230K
480/512GB	128GB x 4	16	TLC, BGA	2,500	2,100	215K	350K
960GB/1TB	256GB x 4	16	TLC, BGA	2,500	2,100	215K	350K
1920GB/2TB	512GB x 4	16	TLC, BGA	2,500	2,100	220K	350K

Notes:

1. The performance was estimated based on BiCS3/4 TLC/QLC NAND flash.
2. Performance may differ according to flash configuration and platform.
3. The table above is for reference only. Any criteria for accepting goods shall be discussed based on different flash configurations.
4. Performance is measured with the follow conditions
 - (a) CrystalDiskMark 6.0, 1GB range, QD=32T1
 - (b) IOMeter, 1GB range, 4K data size, QD=32T8
 - (c) OS: Win10 64bit, version 1709

- **TBW (Terabytes Written)**

Capacity	Flash Type	TBW
120/128GB	3D TLC BiCS3	TBD
240/256GB	3D TLC BiCS3	TBD
480/512GB	3D TLC BiCS3	TBD
960GB/1TB	3D TLC BiCS3	TBD
1920GB/2TB	3D TLC BiCS3	TBD
120/128GB	3D TLC BiCS4	117
240/256GB	3D TLC BiCS4	328
480/512GB	3D TLC BiCS4	853
960GB/1TB	3D TLC BiCS4	1717
1920GB/2TB	3D TLC BiCS4	2922

Notes:

1. Samples were built using 3D TLC NAND flash.
2. The test followed JEDEC218/219A client endurance workload.
3. TBW may differ according to flash configuration and platform.
4. The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

2.2. Thermal Throttling

The purpose of thermal throttling is to prevent any components in a SSD from over-heating during read and write operations. The controller is designed with an on-die thermal sensor and with its accuracy, firmware can apply different levels of throttling to achieve the purpose of protection efficiently and proactively via S.M.A.R.T. reading.

- **Purpose of Thermal Throttling:**

- In order to keep the optimal performance in the safe range of the temperature.

- **Thermal sensors:**

- We have external thermal sensor & on-die thermal sensor (internal controller) to detect temperature. There is 1pcs external thermal sensor on PCB, the position depends on different form factor (The thermal sensor is shown below. The picture is for reference only).
- External thermal sensor would detect flash temperature; On-die thermal sensor detect controller temperature.

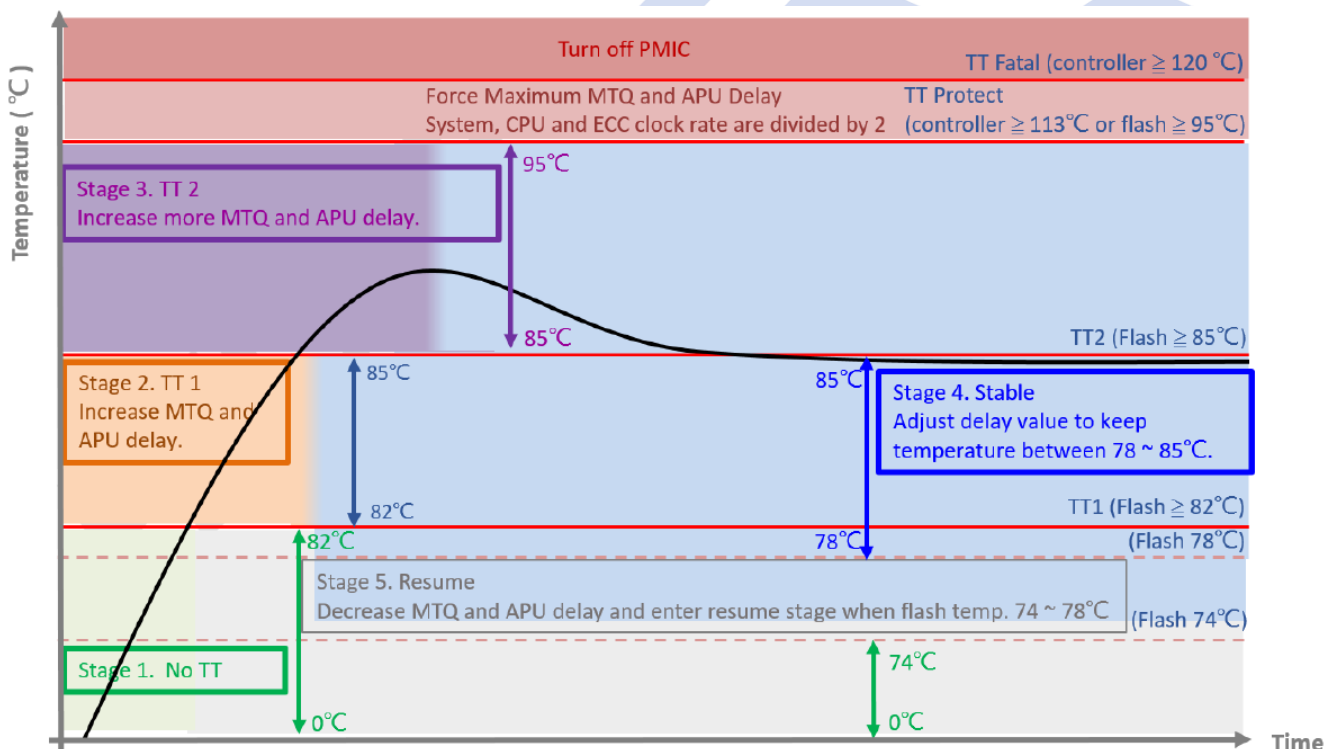


Figure 2-1 Thermal Throttling Schematic

Notes:

1. TT shown on Figure 2-1 means "Thermal Throttling".
2. CE = Chip Enable.
3. temp. = temperature



3. ENVIRONMENTAL SPECIFICATIONS



3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- ◆ Operational (Standard grade): 0°C to 70°C
- ◆ Operational (Wide grade): -40°C to 85°C
- ◆ Storage: -40°C to 85°C

■ High Temperature Test Condition

	Temperature	Humidity
Operation	70°C/85°C	0% RH
Storage	85°C	0% RH

■ Low Temperature Test Condition

	Temperature	Humidity
Operation	0°C/-40°C	0% RH
Storage	-40°C	0% RH

■ High Humidity Test Condition

	Temperature	Humidity
Operation	40°C	90% RH
Storage	40°C	93% RH

■ Temperature Cycle Test

	Temperature
Operation	0°C/-40°C
	70°C/85°C
Storage	-40°C
	85°C

Notes:

1. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

3.1.2. Shock

■ Shock Specification

	Acceleration Force
Non-Operational	1500G
Operational	1500G

3.1.3. Vibration

■ Vibration Specification

	Condition	
	Frequency/Displacement	Frequency/Acceleration
Non-Operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G

3.1.4. Drop

■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	80cm free fall	6 face of each unit

3.1.5. Bending

■ Bending Specification

	Force	Action
Non-operational	≥ 20N	Hold 1min/5times

3.1.6. Electrostatic Discharge (ESD)

Specification	+/- 4KV
EN 55024, CISPR 24 EN 61000-4-2 and IEC 61000-4-2	Device functions are affected, but EUT will be back to its normal or operational state automatically.

3.1.7. EMI Compliance

Specification
EN 55032, CISPR 32 (CE) AS/NZS CISPR 32 (CE) ANSI C63.4 (FCC) VCCI-CISPR 32 (VCCI) CNS 13438 (BSMI)

3.2. MTBF

MTBF, Mean Time Between Failures, is a measure of reliability a device. Its value represents the average time between a repair and the next failure. The unit of MTBF is in hours. The higher the MTBF value, the higher the reliability of the device.

Our MTBF result is based on Telcorida methodology. Please note that a lower MTBF should be expected for higher capacity drives, and we apply the lowest MTBF all capacities.



4. ELECTRICAL SPECIFICATIONS



4.1. Supply Voltage

Parameter	Rating
Operating Voltage	Min = 3.14V Max = 3.47V
Rise Time (Max/Min)	100ms / 0.1ms
Fall Time (Max/Min)	5s / 10ms
Min. off Time ^{Note1}	1s

Note:

1. Minimum time between power removed from SSD ($V_{cc} < 100mW$) and power re-applied to the drive.

4.2. Power Consumption

■ KIOXIA Bics3 TLC (533Mbps)

Capacity	Flash Sturcture	CE#	Read (Max.)	Write (Max.)
120/128GB	64GB x 2	4	3,000	2,000
240/256GB	128GB x 2	8	3,300	2,600
480/512GB	128GB x 4	16	3,500	3,200
960GB/1TB	256GB x 4	16	TBD	TBD
1920GB/2TB	512GB x 4	16	TBD	TBD

Unit: mW

■ KIOXIA Bics4 TLC (533Mbps)

Capacity	Flash Sturcture	CE#	Read (Max.)	Write (Max.)
120/128GB	64GB x 2	4	2,400	1,900
240/256GB	128GB x 2	8	2,900	2,800
480/512GB	128GB x 4	16	3,100	3,100

Unit: mW

■ KIOXIA Bics4 TLC (800Mbps)

Capacity	Flash Sturcture	CE#	Read (Max.)	Write (Max.)
120/128GB	64GB x 2	4	3,300	1,900
240/256GB	128GB x2	8	3,600	2,700
480/512GB	128GB x 4	16	3,600	3,300
960GB/1TB	256GB x 4	16	3,800	3,700
1920GB/2TB	512GB x 4	16	3,900	3,800

Unit: mW

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■ KIOXIA Bics4 pTLC (667Mbps)

Capacity	Flash Sturcture	CE#	Read (Max.)	Write (Max.)
480/512GB	340GB x 2	4	3,100	1,900
960GB/1TB	680GB x 2	8	3,600	2,700
1920GB/2TB	680GB x 4	16	3,700	3,300

Unit: mW

■ WD Bics4 TLC (800Mbps)

Capacity	Flash Sturcture	CE#	Read (Max.)	Write (Max.)
120/128GB	64GB x 2	4	3,200	1,800
240/256GB	128GB x 2	8	3,500	2,900
480/512GB	128GB x 4	16	3,500	3,300
960GB/1TB	256GB x 4	16	3,600	3,500
1920GB/2TB	512GB x 4	16	3,800	3,600

Unit: mW

Notes

1. Based on EDFM0xxx-series under ambient temperature.
2. Use IO Meter with the setting of 1GB. Sequentially read and write the disk for 5 times, and measure power consumption during sequential Read.
3. Power Consumption may differ according to flash configuration and platform.
4. The measured power voltage is 3.3V.

■ Power State Power Consumption with KIOXIA BiCS3 (533Mbps)

Capacity	Flash Structure	CE#	Active			PS3	PS4
			PS0	PS1	PS2		
120/128GB	64GB x 2	4	2850	1550	1200	70	2
240/256GB	128GB x 2	8	3190	1890	1470	70	2
480/512GB	128GB x 4	16	3390	1970	1570	70	2

Unit: mW

■ Power State Power Consumption with KIOXIA BiCS4 (533Mbps)

Capacity	Flash Structure	CE#	Active			PS3	PS4
			PS0	PS1	PS2		
120/128GB	64GB x 2	4	2220	1320	1050	70	2
240/256GB	128GB x 2	8	2800	1530	1200	70	2
480/512GB	128GB x 4	16	2950	1650	1300	70	2

Unit: mW

■ Power State Power Consumption with KIOXIA BiCS4 (800Mbps)

Capacity	Flash Structure	CE#	Active			PS3	PS4
			PS0	PS1	PS2		
120/128GB	64GB x 2	4	3150	1830	1370	70	2
240/256GB	128GB x 2	8	3450	1960	1550	70	2
480/512GB	128GB x 4	16	3520	2060	1600	70	2
960GB/1TB	256GB x 4	16	3680	2150	1690	70	2
1920GB/2TB	512GB x 4	16	3750	2190	1740	70	2

Unit: mW

■ Power State Power Consumption with KIOXIA BiCS4 pTLC (667Mbps)

Capacity	Flash Structure	CE#	Active			PS3	PS4
			PS0	PS1	PS2		
480/512GB	340GB x 2	4	2900	1720	1150	70	2
960GB/1TB	680GB x 2	8	3360	1740	1230	70	2
1920GB/2TB	680GB x 4	16	3560	2070	1550	70	2

Unit: mW

■ Power State Power Consumption with WD BiCS4 (800Mbps)

Capacity	Flash Structure	CE#	Active			PS3	PS4
			PS0	PS1	PS2		
120/128GB	64GB x 2	4	3100	1830	1370	70	2
240/256GB	128GB x 2	8	3350	1960	1550	70	2
480/512GB	128GB x 4	16	3400	2040	1600	70	2
960GB/1TB	256GB x 4	16	3500	2110	1690	70	2
1920GB/2TB	512GB x 4	16	3650	2190	1740	70	2

Unit: mW

Notes

1. Based on EDFM0xxx-series under ambient temperature.
2. The average value of power consumption is achieved based on 100% conversion efficiency.
3. The measured power voltage is 3.3V.
4. The temperature of a storage device in PS1 should remain constant or should slightly decrease for all workloads so the actual power in PS1 should be lower than PS0.
5. The temperature of a storage device in PS2 should decrease sharply for all workloads so the actual power in PS2 should be lower than PS1.

■ Mobile Mark 2014 Average Power consumption with KIOXIA BiCS3 (533Mbps)

Capacity	Flash Structure	CE#	Primary
120/128GB	64GB x 2	4	TBD
240/256GB	128GB x 2	8	TBD
480/512GB	128GB x 4	16	TBD

Unit: mW

■ Mobile Mark 2014 Average Power consumption with KIOXIA BiCS4 (533Mbps)

Capacity	Flash Structure	CE#	Primary
120/128GB	64GB x 2	4	TBD
240/256GB	128GB x 2	8	TBD
480/512GB	128GB x 4	16	TBD

Unit: mW

■ Mobile Mark 2014 Average Power consumption with KIOXIA BiCS4 (800Mbps)

Capacity	Flash Structure	CE#	Primary
120/128GB	64GB x 2	4	TBD
240/256GB	128GB x 2	8	TBD
480/512GB	128GB x 4	16	TBD
960GB/1TB	256GB x 4	16	TBD
1920GB/2TB	512GB x 4	16	TBD

Unit: mW

■ Mobile Mark 2014 Average Power consumption with KIOXIA BiCS4 pTLC (667Mbps)

Capacity	Flash Structure	CE#	Primary
480/512GB	340GB x 2	4	TBD
960GB/1TB	680GB x 2	8	TBD
1920GB/2TB	680GB x 4	16	TBD

Unit: mW

■ Mobile Mark 2014 Average Power consumption with WD BiCS4 (800Mbps)

Capacity	Flash Structure	CE#	Primary
120/128GB	64GB x 2	4	TBD
240/256GB	128GB x 2	8	TBD
480/512GB	128GB x 4	16	TBD
960GB/1TB	256GB x 4	16	TBD
1920GB/2TB	512GB x 4	16	TBD

Unit: mW

Notes

1. Based on EDFM0xxx-series under ambient temperature.

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2. The measured power voltage is 3.3V.
3. The average value of power consumption is achieved based on 100% conversion efficiency.



5. INTERFACE



5.1. Pin Assignment and Descriptions

The follow table defines the signal assignment of the internal NGFF connector for SSD usage, described in the PCI Express M.2 Specification version 1.1 of the PCI-SIG.

Pin #	SATA Pin	Description
1	GND	Ground
2	3.3V	3.3V source
3	GND	Ground
4	3.3V	3.3V source
5	PETn3	PCIe TX Differential signal defined by the PCI Express M.2 spec
6	N/C	No connect
7	PETp3	PCIe TX Differential signal defined by the PCI Express M.2 spec
8	N/C	No connect
9	GND	Ground
10	LED1#	Open drain, active low signal. These signals are used to allow the add-in card to provide status indicators via LED devices that will be provided by the system.
11	PERn3	PCIe RX Differential signal defined by the PCI Express M.2 spec
12	3.3V	3.3V source
13	PERp3	PCIe RX Differential signal defined by the PCI Express M.2 spec
14	3.3V	3.3V source
15	GND	Ground
16	3.3V	3.3V source
17	PETn2	PCIe RX Differential signal defined by the PCI Express M.2 spec
18	3.3V	3.3V source
19	PETp2	PCIe RX Differential signal defined by the PCI Express M.2 spec
20	N/C	No connect
21	GND	Ground
22	N/C	No connect
23	PERn2	PCIe RX Differential signal defined by the PCI Express M.2 spec
24	N/C	No connect
25	PERp2	PCIe RX Differential signal defined by the PCI Express M.2 spec
26	N/C	No connect
27	GND	Ground
28	N/C	No connect

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Pin #	SATA Pin	Description
29	PETn1	PCIe TX Differential signal defined by the PCI Express M.2 spec
30	N/C	No connect
31	PETp1	PCIe TX Differential signal defined by the PCI Express M.2 spec
32	N/C	No connect
33	GND	Ground
34	N/C	No connect
35	PERn1	PCIe RX Differential signal defined by the PCI Express M.2 spec
36	N/C	No connect
37	PERp1	PCIe RX Differential signal defined by the PCI Express M.2 spec
38	N/C	No connect
39	GND	Ground
40	SMB_CLK (I/O)(0/1.8V)	SMBus Clock; Open Drain with pull-up on platform.
41	PETn0	PCIe TX Differential signal defined by the PCI Express M.2 spec
42	SMB_DATA (I/O)(0/1.8V)	SMBus Data; Open Drain with pull-up on platform.
43	PETp0	PCIe TX Differential signal defined by the PCI Express M.2 spec
44	ALERT#(O)(0/1.8V)	Alert notification to master; Open Drain with pull-up on platform; Active low.
45	GND	Ground
46	N/C	No connect
47	PERn0	PCIe RX Differential signal defined by the PCI Express M.2 spec
48	N/C	No connect
49	PERp0	PCIe RX Differential signal defined by the PCI Express M.2 spec
50	PERST#(I)(0/3.3V)	PE-Reset is a functional reset to the card as defined by the PCIe Mini CEM specification.
51	GND	Ground
52	CLKREQ#(I/O)(0/3.3V)	Clock Request is a reference clock request signal as defined by the PCIe Mini CEM specification; Also used by L1 PM Sub-states.
53	REFCLKn	PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec.
54	PEWAKE#(I/O)(0/3.3V)	PCIe PME Wake. Open Drain with pull up on platform; Active Low.
55	REFCLKp	PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec.
56	Reserved for MFG DATA	Manufacturing Data line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.

Pin #	SATA Pin	Description
57	GND	Ground
58	Reserved for MFG CLOCK	Manufacturing Clock line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.
59	Module Key M	Module Key
60	Module Key M	
61	Module Key M	
62	Module Key M	
63	Module Key M	
64	Module Key M	
65	Module Key M	
66	Module Key M	
67	N/C	No Connect
68	SUSCLK(32KHz) (I)(0/3.3V)	32.768 kHz clock supply input that is provided by the platform chipset to reduce power and cost for the module.
69	N/C	No Connect for PCIe.
70	3.3V	3.3V source
71	GND	Ground
72	3.3V	3.3V source
73	GND	Ground
74	3.3V	3.3V source
75	GND	Ground

6. SUPPORTED COMMANDS



6.1. NVMe Command List

Table 6-1 Admin Commands

Op-Code	Command Description
00h	Delete I/O Submission Queue
01h	Create I/O Submission Queue
02h	Get Log Page
04h	Delete I/O Completion Queue
05h	Create I/O Completion Queue
06h	Identify
08h	Abort
09h	Set Features
0Ah	Get Features
0Ch	Asynchronous Event Request
10h	Firmware Activate
11h	Firmware Image Download
14h	Device Self-test
15h	Namespace Attachment
18h	Keep Alive

Table 6-2 Admin Commands – NVM Command Set Specific

Op-Code	Command Description
80h	Format NVM
81h	Security Send
82h	Security Receive
84h	Sanitize

Table 6-3 NVM Commands

Op-Code	Command Description
00h	Flush
01h	Write
02h	Read
04h	Write Uncorrectable
05h	Compare
08h	Write Zeroes
09h	Dataset Management

6.2. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command.

■ Identify Controller Data Structure

Bytes	O/M	Default Value	Description
01:00	M	0x1987	PCI Vendor ID (VID)
03:02	M	0x1987	PCI Subsystem Vendor ID (SSVID)
23:04	M	TBD	Serial Number (SN)
63:24	M	TBD	Model Number (MN)
71:64	M	TBD	Firmware Revision (FR)
72	M	0x01	Recommended Arbitration Burst (RAB)
75:73	M	TBD	IEEE OUI Identifier (IEEE)
76	O	0x00	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)
77	M	0x09	Maximum Data Transfer Size (MDTS)
79:78	M	0x0000	Controller ID (CNTLID)
83:80	M	0x00010300	Version (VER)
87:84	M	0x124F80	RTD3 Resume Latency (RTD3R)
91:88	M	0x2191C0	RTD3 Entry Latency (RTD3E)
95:92	M	0x00000100	Optional Asynchronous Events Supported (OAES)
99:96	M	0x00	Controller Attributes (CTRATT)
239:100	-	0x00	Reserved
255:240	-	0x00	Refer to the NVMe Management Interface Specification for definition
257:256	M	0x001F	Optional Admin Command Support (OACS)
258	M	0x00	Abort Command Limit (ACL)
259	M	0x03	Asynchronous Event Request Limit (AERL)
260	M	0x12	Firmware Updates (FRMW)
261	M	0x0E	Log Page Attributes (LPA)
262	M	0x0F	Error Log Page Entries (ELPE)
263	M	0x04	Number of Power States Support (NPSS)
264	M	0x01	Admin Vendor Specific Command Configuration (AVSCC)
265	O	0x01	Autonomous Power State Transition Attributes (APSTA)
267:266	M	0x0155	Warning Composite Temperature Threshold (WCTEMP)
269:268	M	0x0157	Critical Composite Temperature Threshold (CCTEMP)
271:270	O	0x2710	Maximum Time for Firmware Activation (MTFA)
275:272	O	0x00	Host Memory Buffer Preferred Size (HMPRE)
279:276	O	0x00	Host Memory Buffer Minimum Size (HMMIN)

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Bytes	O/M	Default Value	Description
295:280	O	Non-zero	Total NVM Capacity (TNVMCAP)
311:296	O	0x00	Unallocated NVM Capacity (UNVMCAP)
315:312	O	0x00	Replay Protected Memory Block Support (RPMBS)
317:316	O	0x001E	Extended Device Self-test Time (EDSTT)
318	O	0x01	Device Self-test Options (DSTO)
319	M	0x04	Firmware Update Granularity (FWUG)
321:320	M	0x0001	Keep Alive Support (KAS)
323:322	O	1	Host Controlled Thermal Management Attributes (HCTMA)
325:324	O	0x111	Minimum Thermal Management Temperature (MNTMT)
327:326	O	0x157	Maximum Thermal Management Temperature (MXTMT)
331:328	O	0x00000006	Sanitize Capabilities (SANICAP)
511:316	-	0	Reserved
NVM Command Set Attributes			
512	M	0x66	Submission Queue Entry Size (SQES)
513	M	0x44	Completion Queue Entry Size (CQES)
515:514	-	0x0000	Reserved
519:516	M	0x00000001	Number of Namespaces (NN)
521:520	M	0x005F	Optional NVM Command Support (ONCS)
523:522	M	0x0000	Fused Operation Support (FUSES)
524	M	0x01	Format NVM Attributes (FNA)
525	M	0x01	Volatile Write Cache (VWC)
527:526	M	0x00FF	Atomic Write Unit Normal (AWUN)
529:528	M	0x0000	Atomic Write Unit Power Fail (AWUPF)
530	M	0x01	NVM Vendor Specific Command Configuration (NVSCC)
531	-	0x00	Reserved
533:532	O	0x0000	Atomic Compare & Write Unit (ACWU)
535:534	-	0x0000	Reserved
539:536	O	0x00000000	SGL Support (SGLS)
703:540	-	0x00	Reserved
IO Command Set Attributes			
2047:704	-	0x00	Reserved
2079:2048	M	TBD	Power State 0 Descriptor (PSD0)
2111:2080	O	0x00	Power State 1 Descriptor (PSD1)
2143:2112	O	0x00	Power State 2 Descriptor (PSD2)
2175:2144	O	0x00	Power State 3 Descriptor (PSD3)

Bytes	O/M	Default Value	Description
2207:2176	O	0x00	Power State 4 Descriptor (PSD4)
2239:2208	O	0x00	Power State 5 Descriptor (PSD5)
2271:2240	O	0x00	Power State 6 Descriptor (PSD6)
2303:2272	O	0x00	Power State 7 Descriptor (PSD7)
2335:2304	O	0x00	Power State 8 Descriptor (PSD8)
2367:2336	O	0x00	Power State 9 Descriptor (PSD9)
2399:2368	O	0x00	Power State 10 Descriptor (PSD10)
2431:2400	O	0x00	Power State 11 Descriptor (PSD11)
2463:2432	O	0x00	Power State 12 Descriptor (PSD12)
2495:2464	O	0x00	Power State 13 Descriptor (PSD13)
2527:2496	O	0x00	Power State 14 Descriptor (PSD14)
2559:2528	O	0x00	Power State 15 Descriptor (PSD15)
2591:2560	O	0x00	Power State 16 Descriptor (PSD16)
2623:2592	O	0x00	Power State 17 Descriptor (PSD17)
2655:2624	O	0x00	Power State 18 Descriptor (PSD18)
2687:2656	O	0x00	Power State 19 Descriptor (PSD19)
2719:2688	O	0x00	Power State 20 Descriptor (PSD20)
2751:2720	O	0x00	Power State 21 Descriptor (PSD21)
2783:2752	O	0x00	Power State 22 Descriptor (PSD22)
2815:2784	O	0x00	Power State 23 Descriptor (PSD23)
2847:2816	O	0x00	Power State 24 Descriptor (PSD24)
2879:2848	O	0x00	Power State 25 Descriptor (PSD25)
2911:2880	O	0x00	Power State26 Descriptor (PSD26)
2943:2912	O	0x00	Power State 27 Descriptor (PSD27)
2975:2944	O	0x00	Power State 28 Descriptor (PSD28)
3007:2976	O	0x00	Power State 29 Descriptor (PSD29)
3039:3008	O	0x00	Power State 30 Descriptor (PSD30)
3071:3040	O	0x00	Power State 31 Descriptor (PSD31)
Vendor Specific			
4095:3072	O	Vendor Reserved	Vendor Specific (VS)

■ Identify Namespace Data Structure & NVM Command Set Specific

Bytes	O/M	Default Value	Description
7:0	M	TBD*	Namespace Size (NSZE)
15:8	M	TBD*	Namespace Capacity (NCAP)
23:16	M	TBD*	Namespace Utilization (NUSE)
24	M	0x00	Namespace Features (NSFEAT)
25	M	0x01	Number of LBA Formats (NLBAF)
26	M	0x00	Formatted LBA Size (FLBAS)
27	M	0x00	Metadata Capabilities (MC)
28	M	0x00	End-to-end Data Protection Capabilities (DPC)
29	M	0x00	End-to-end Data Protection Type Settings (DPS)
30	O	0x00	Namespace Multi-path I/O and Namespace Sharing Capabilities (NMIC)
31	O	0x00	Reservation Capabilities (RESCAP)
32	O	0x00	Format Progress Indicator (FPI)
33	-	0x00	Reserved
35:34	O	0x0000	Namespace Atomic Write Unit Normal (NAWUN)
37:36	O	0x0000	Namespace Atomic Write Unit Power Fail (NAWUPF)
39:38	O	0x0000	Namespace Atomic Compare & Write Unit (NACWU)
41:40	O	0x0000	Namespace Atomic Boundary Size Normal (NABSN)
43:42	O	0x0000	Namespace Atomic Boundary Offset (NABO)
45:44	O	0x0000	Namespace Atomic Boundary Size Power Fail (NABSPF)
47:46	-	0x0000	Reserved
63:48	O	0x00	NVM Capacity (NVMCAP)
103:64	-	0x00	Reserved
119:104	O	TBD **	Namespace Globally Unique Identifier (NGUID)
127:120	O	TBD **	IEEE Extended Unique Identifier (EUI64)
131:128	M	0x02090000	LBA Format 0 Support (LBAF0)
135:132	O	0x00000000	LBA Format 1 Support (LBAF1)
139:136	O	0x00000000	LBA Format 2 Support (LBAF2)
143:140	O	0x00000000	LBA Format 3 Support (LBAF3)
147:144	O	0x00000000	LBA Format 4 Support (LBAF4)
151:148	O	0x00000000	LBA Format 5 Support (LBAF5)
155:152	O	0x00000000	LBA Format 6 Support (LBAF6)
159:156	O	0x00000000	LBA Format 7 Support (LBAF7)
163:160	O	0x00000000	LBA Format 8 Support (LBAF8)
167:164	O	0x00000000	LBA Format 9 Support (LBAF9)

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Bytes	O/M	Default Value	Description
171:168	O	0x00000000	LBA Format 10 Support (LBAF10)
175:172	O	0x00000000	LBA Format 11 Support (LBAF11)
179:176	O	0x00000000	LBA Format 12 Support (LBAF12)
183:180	O	0x00000000	LBA Format 13 Support (LBAF13)
187:184	O	0x00000000	LBA Format 14 Support (LBAF14)
191:188	O	0x00000000	LBA Format 15 Support (LBAF15)
383:192	-	0x00	Reserved
4095:384	O	0x00	Vendor Specific (VS)

■ List of Identify Namespace Data Structure for Each Capacity

Capacity (GB)	Byte[7:0]: Namespace Size (NSZE)
120	DF94BB0h
128	EE7C2B0h
240	1BF244B0h
256	1DCF32B0h
480	37E436B0h
512	3B9E12B0h
960	6FC81AB0h
1024	773BD2B0h
1920	DF8FE2B0h
2048	EE7752B0h

6.3. SMART Attributes

■ SMART Attributes (Log Identifier 02h)

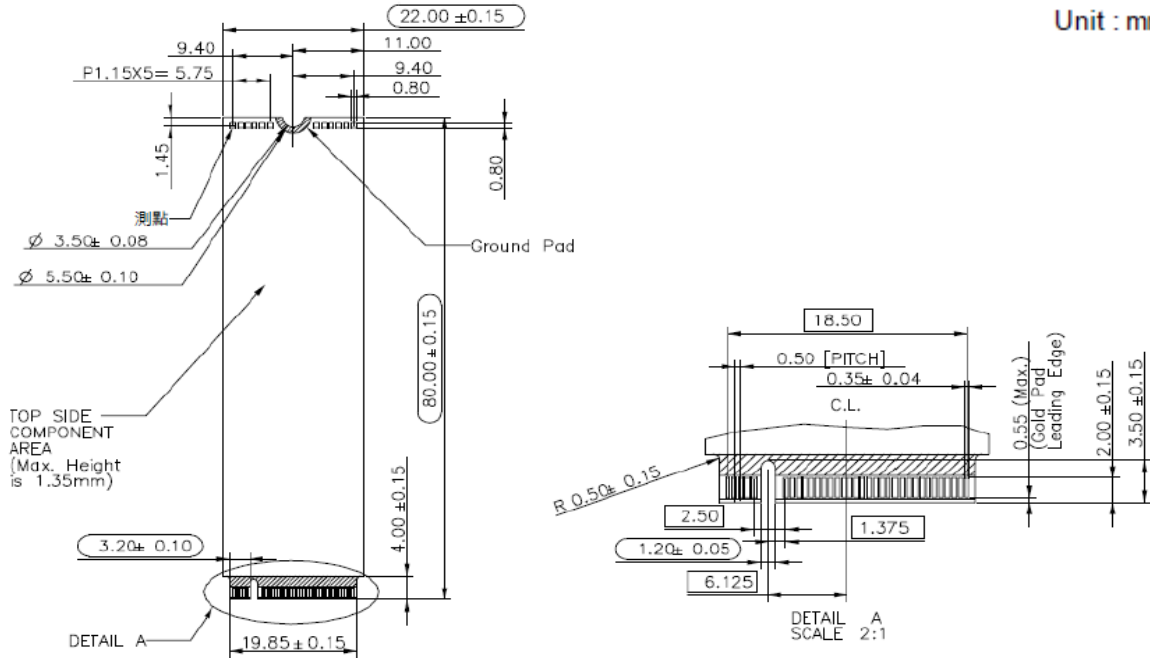
Bytes Index	Bytes	Description
[0]	1	Critical Warning
[2:1]	2	Composite Temperature
[3]	1	Available Spare
[4]	1	Available Spare Threshold
[5]	1	Percentage Used
[31:6]	26	Reserved
[47:32]	16	Data Units Read
[63:48]	16	Data Units Written
[79:64]	16	Host Read Commands
[95:80]	16	Host Write Commands
[111:96]	16	Controller Busy Time
[127:112]	16	Power Cycles
[143:128]	16	Power On Hours
[159:144]	16	Unsafe Shutdowns
[175:160]	16	Media and Data Integrity Errors
[191:176]	16	Number of Error Information Log Entries
[195:192]	4	Warning Composite Temperature Time
[199:196]	4	Critical Composite Temperature Time
[201:200]	2	Temperature Sensor 1 (Current Temperature)
[203:202]	2	Temperature Sensor 2 (N/A)
[205:204]	2	Temperature Sensor 3 (N/A)
[207:206]	2	Temperature Sensor 4 (N/A)
[209:208]	2	Temperature Sensor 5 (N/A)
[211:210]	2	Temperature Sensor 6 (N/A)
[213:212]	2	Temperature Sensor 7 (N/A)
[215:214]	2	Temperature Sensor 8 (N/A)
[511:216]	296	Reserved

7. PHYSICAL DIMENSION

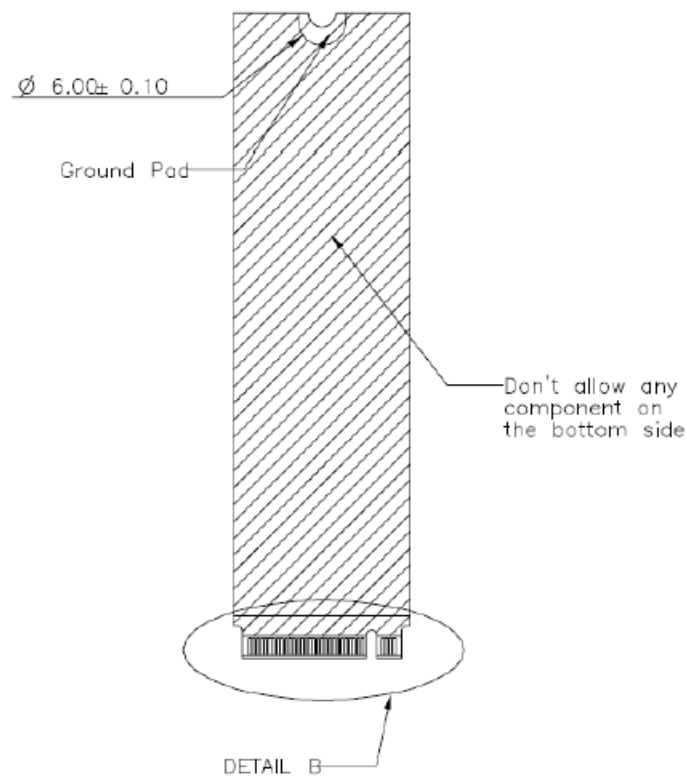
- Dimension of M.2 2280-S2-M: 80mm(L) x 22mm(W) x 2.15mm(H: Top+PCB = 1.35±0.8)

Top View

Unit : mm



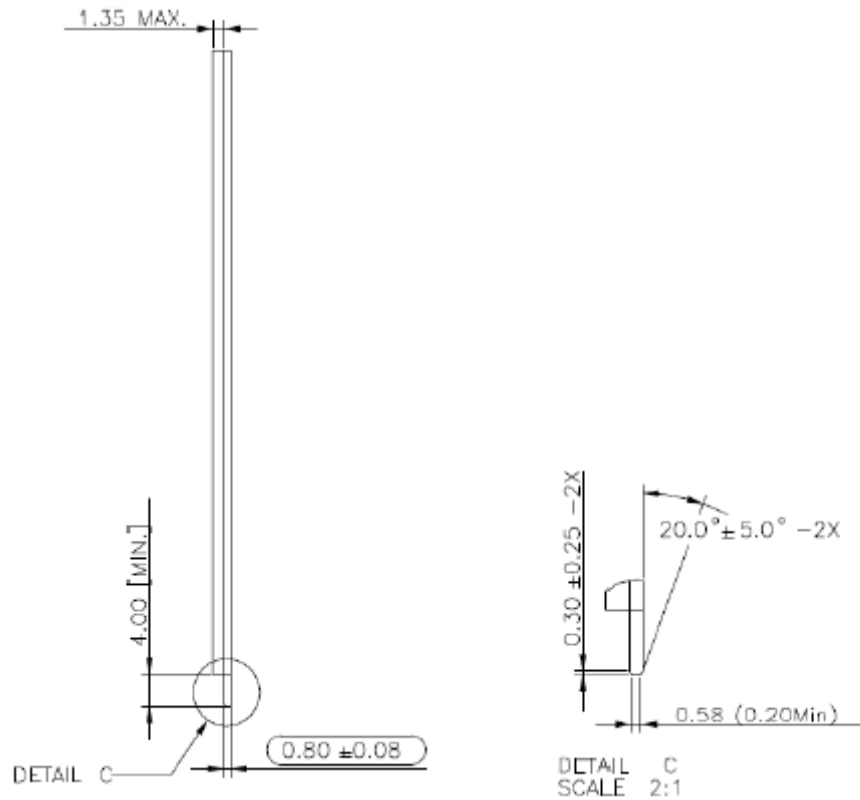
Bottom View



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Side View



***Notes:**

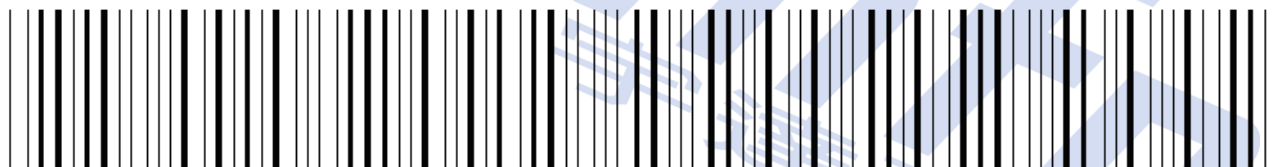
1.  =Max Component Height
2.  =No Component
3.  =No Component / Signal Vias / Signal Copper / Printing
4. General Tolerance: $\pm 0.15\text{mm}$
5.  are critical dimension

8. TERMINOLOGY

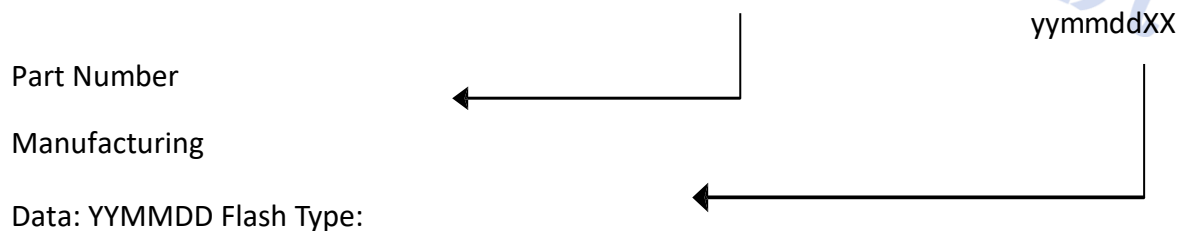
The following table is to list out the acronyms that have been applied throughout the document.

Term	Definitions
ATTO	Commercial performance benchmark application
DDR	Double data rate (SDRAM)
ASPM	Active States Power Management
APST	Autonomous Power State Transition
LBA	Logical block addressing
MTBF	Mean time between failures
PCIe	PCI Express / Peripheral Component Interconnect Express
S.M.A.R.T.	Self-monitoring, analysis and reporting technology

9. BARCODE DESCRIPTION



M 2 P 8 0 D E 9 6 0 G B A E P



10. PARTNUMBER DECODER


M2P-80DEX⁸X⁹X¹⁰X¹¹X¹²X¹³X¹⁴X¹⁵X¹⁶X¹⁷

X ¹ X ² X ³	X ⁴ X ⁵	X ⁶ X ⁷	X ⁸ X ⁹ X ¹⁰ X ¹¹ X ¹²		X ¹³	X ¹⁴	X ¹⁵	X ¹⁶ X ¹⁷
M2P	80	DE	120GB	128GB	A: 3D TLC Standard (0°C ~ +70°C) B: 3D TLC Industrial (-40°C ~ +85°C)	E	P	blank
			240GB	256GB				
			480GB	512GB				
			960GB	001TB				
			1920G	002TB				