

# UD info Corp.

Industrial PCIe BGA SSD

MPC-11DE Series

Product DataSheet

Preliminary version



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## Revision History

Revision	Draft Date	History	Author
Preliminary	2022/5/4	Preliminary version	Golden Lee



## Product Overview

- **Capacity**
  - 128GB up to 512GB
- **Form Factor**
  - BGA SSD 1113
- **PCIe Interface**
  - NVMe PCIe Gen3 x2
- **Compliance**
  - NVMe 1.3d
  - PCI Express Base 3.1
- **Flash Structure**
  - 128GB = 64GB x 2 Die
  - 256GB = 64GB x 4 Die
  - 512GB = 64GB x 8 Die
- **Performance**<sup>Note1</sup>
  - Read up to 1,730 MB/s
  - Write up to 1,180 MB/s
- **Power Consumption**<sup>Note2</sup>
  - Active mode < 1800mW
  - Idle mode < 50 mW
- **ECC**
  - LDPC / RAID ECC
  - Low density parity check code  
( >120bit/KBytes )
- **Temperature Range**<sup>Note3</sup>
  - Operation (Standard): 0°C ~ 70°C
  - Operation (Wide): -40°C ~ 85°C
  - Storage: -40°C ~ 85°C
- **Reliability**
  - MTBF: 2,000,000 hours
  - UBER: < 1 sector per 10<sup>16</sup> bits
- **RoHS Compliant**
- **EMI Compliant**
  - EN55032, CISPR 32 (CE)
  - AS/NZS CISPR 32 (CE)
  - ANSI C63.4 (FCC)
  - CNS 13438 (BSMI)
  - VCCI-CISPR 32 (VCCI)
- **Safety Certification**
  - ISO 9001
  - ISO 14001
  - ISO 45001
  - ISO 27001
- **Features Support List**
  - End to end data path protection
  - Thermal throttling
  - Dynamic SLC Cache
  - Drive log
  - Support of TCG Pyrite/OPAL<sup>Note4</sup>

### Notes:

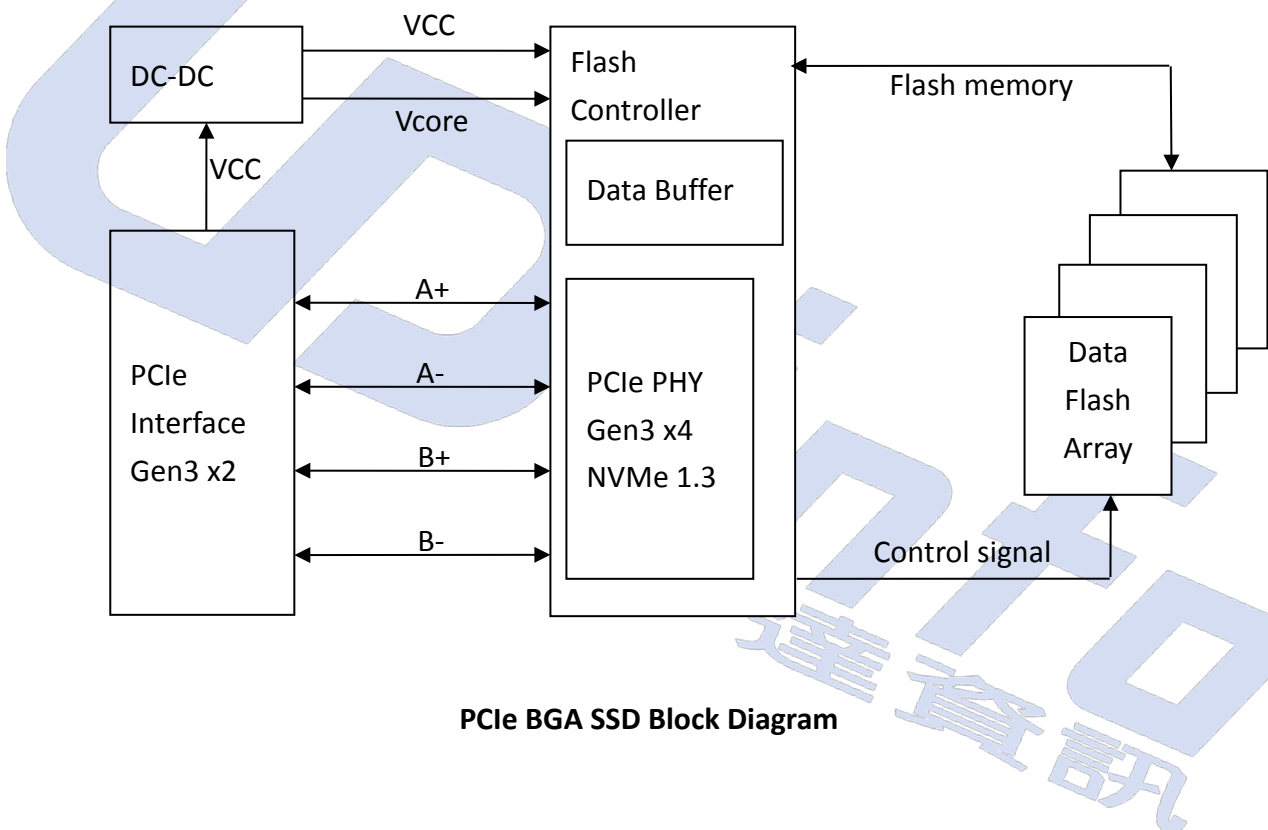
1. Refer to Chapter 2 for more details.
2. Refer to Chapter 4, section 4.2 power consumption for more details.
3. The operation temperature means the case temperature, in which can be decided via S.M.A.R.T.
4. Supported by a separate firmware version. Further information available upon request.

## 1. INTRODUCTION

### 1.1. General Description

UDinfo's PCIe BGA SSD delivers all the advantages of flash disk technology with PCIe Gen3 x2 interface. The PCIe BGA SSD could provide the capacity range from 128GB to 512GB. Moreover, it can reach up to 1730 MB/s read as well as 1180 MB/s write high performance. Its lower power consumption makes it an ideal storage choice for high performance embedded platforms.

### 1.2. Block Diagram



PCIe BGA SSD Block Diagram

## 2. PRODUCT SPECIFICATIONS



### 2.1. Product Specifications

- **Capacity**
  - 128GB up to 512GB
- **Electrical/Physical Interface**
  - PCI Express Base Ver 3.1
  - Compliant with NVMe 1.3d
  - PCIe Gen3 x 4 lane & backward compatible to PCIe Gen2 and Gen1
  - Support up to QD 128 with queue depth of up to 64K.
- **Sector Size Support**
  - 512Bytes
- **LBA Range**
  - IDEMA standard

Capacity	Total Sectors (LBA)	User Data Size
128GB	250,069,680	Depended on file management
256GB	500,118,192	
512GB	1,000,215,216	

- **Performance**

Capacity	Flash Configuration	Sequential (CDM)		Random (IOMeter)	
		Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
128GB	Kioxia 3D NAND, DDP	1,600	800	100K	130K
256GB	Kioxia 3D NAND, QDP	1,730	1,180	195K	245K
512GB	Kioxia 3D NAND, ODP	1,730	1,180	195K	245K

**Notes:**

1. Performance is measured based on the follow conditions:
  - (a) Full Speed Mode
  - (b) OS Version: Win10 (64bit), version 1809
  - (c) CrystalDiskMark 6.0, 1GB range, QD=32T1
  - (d) IOMeter, 1GB range, 4K data size, QD=32T8

● **TBW (Terabytes Written)**

Capacity	Flash Configuration	TBW
128GB	Kioxia 3D NAND, DDP	110
256GB	Kioxia 3D NAND, QDP	240
512GB	Kioxia 3D NAND, ODP	520

**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:**
  - There is an on-die thermal sensor (internal controller) to detect temperature.

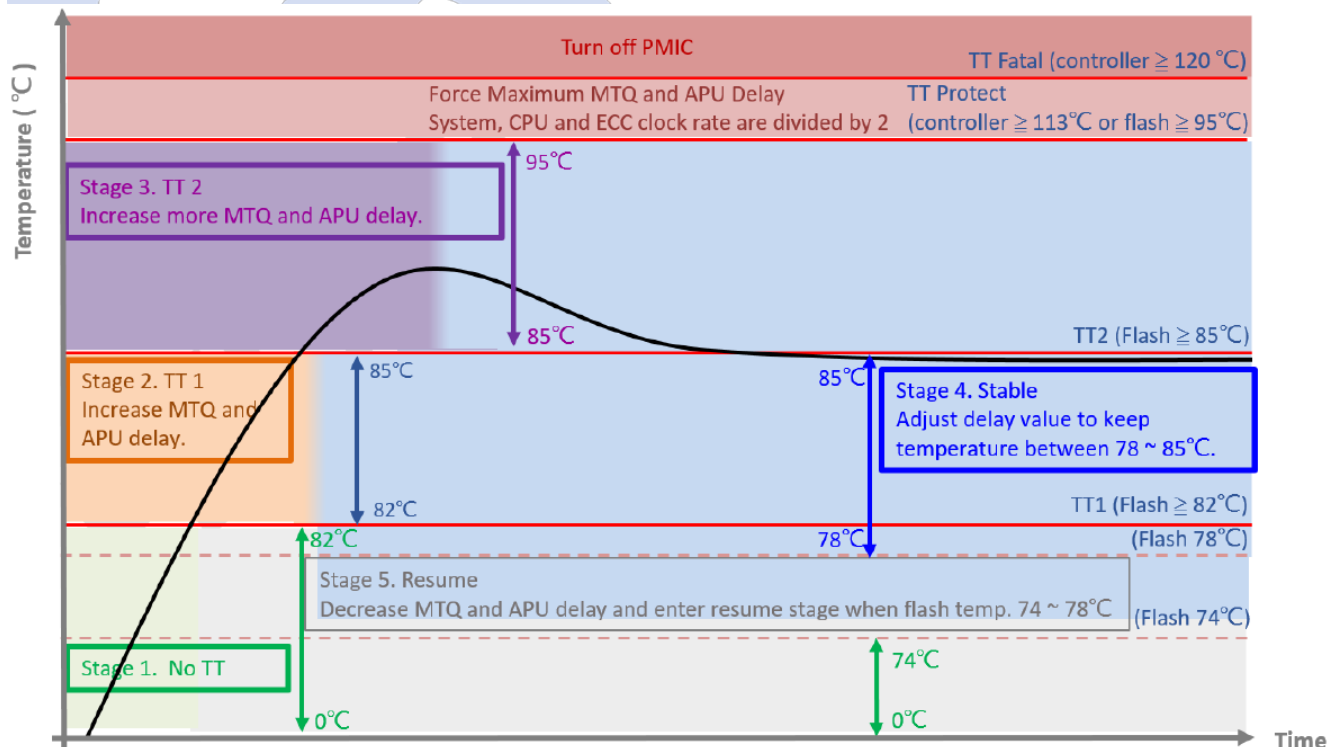


Figure 2-1 Thermal Throttling Schematic

**Notes:**

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



## 2.3. TCG Opal 2.0

The Opal specification is a set of specifications for self-encrypting drives published by the Trusted Computing Group (TCG), a non-profit organization that develops, defines, and promotes standards and specifications for secure computing. The Opal Security Subsystem Class(SSC) 2.0 defines the details of data management in storage devices and the classes authority for data access, and secures data from theft and tampering by unauthorized persons who are able to gain access to the storage device or host system.

### TCG Opal 2.0 Main Features:

- AES 256-bit Hardware Self Encryption
- Deploy Storage Device & Take Ownership:  
The Storage Device is integrated into its target system and ownership transferred by setting or changing the Storage Device's owner credential.
- Activate or Enroll Storage Device:  
LBA ranges are configured and data encryption and access control credentials (re)generated and/or set on the Storage Device. Access control is configured for LBA range unlocking.
- Lock & Unlock Storage Device:  
Unlocking of one or more LBA ranges by the host and locking of those ranges under host control via either an explicit lock or implicit lock triggered by a reset event. MBR shadowing provides a mechanism to boot into a secure pre-boot authentication environment to handle device unlocking.
- Repurpose & End-of-Life:  
Erasure of data within one or more.

### 3. ENVIRONMENTAL SPECIFICATIONS



#### 3.1. Environmental Conditions

##### 3.1.1. Temperature Specification

	Mode	Min.	Max.	Unit
Temperature Ranges	Operation (Standard)	0	70	°C
	Operation (Wide)	-40	85	°C
	Storage	-40	85	°C
Humidity	Operation	0	90	%
	Storage	0	93	%
Temperature Cycle Test	Operation	-40	85	°C
	Storage	-40	85	°C

**Notes:**

- The operation temperature means the case temperature, in which can be detected via the S.M.A.R.T. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

##### 3.1.2. Mechanical Specification

Items		Condition	
Shock	Non-operational	Acceleration Force	1500G 0-p with half sine wave (0.5ms)
Vibration	Non-operational	Frequency/Displacement	20Hz~80Hz/1.52mm
		Frequency/Acceleration	80Hz~2000Hz/20G p-p with sine wave
Drop	Non-operational	Height of Drop	80cm free fall
		Number of Drop	6 face of each unit
		Conflicting Material	Concrete floor
Bending	Non-operational	≥ 20N	Hold 1min/5times

##### 3.1.3. 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.

### 3.1.4. EMI Compliance & Safety Certification

EMI Compliance	Safety Certification
EN 55032, CISPR 32 (CE)	ISO 9001
AS/NZS CISPR 32 (CE)	ISO 14001
ANSI C63.4 (FCC)	ISO 45001
VCCI-CISPR 32 (VCCI)	ISO 27001
CNS 13438 (BSMI)	

### 3.2. UBER

Capacity	UBER
128GB	< 1 sector per 10 <sup>16</sup> bits read
256GB	
512GB	

**Notes:**

1. UBER (Uncorrectable Bit Error Rates) means the uncorrectable error per bits read.
2. UBER = FER (fail rate) / Data Size (user data bit).
3. FER = uncorrectable ECC frame number / total ECC frame number.
4. IDR-300 LDPC for Kioxia 3D NAND TLC ECC capability = 138bit/1KB.

### 3.3. MTBF

MTBF, an acronym for Mean Time between Failures, is a measure of reliability of 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 simulation software (Relex 7.3). Please note that a lower MTBF should be expected for higher capacity drives, and we apply the lowest MTBF for all capacities.

Capacity	MTBF
128GB	2 million hours
256GB	
512GB	

## 4. ELECTRICAL SPECIFICATIONS



### 4.1. Supply Voltage

Parameter	Rating			
	Specification	Min.	Typ.	Max.
Operating Voltage	Flash Core	+2.45V	+2.5V	+2.75V
	Flash IO supply	+1.18V	+1.2V	+1.26V
	Controller Core	+0.86V	+0.9V	+0.98V
Rise Time (Max/Min)	100ms / 0.1ms			
Fall Time (Max/Min)	5s / 1ms			
Min. off Time <sup>Note1</sup>	1s			
Maximum Ripple	10mV (Peak to Peak)			

Note:

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

### 4.2. Power Consumption

Capacity	Flash Configuration	Read (Max.)	Write (Max.)
128GB	Kioxia 3D NAND, DDP	1,580	1,150
256GB	Kioxia 3D NAND, QDP	1,670	1,640
512GB	Kioxia 3D NAND, ODP	1,710	1,740

Unit: mW

Capacity	Flash Configuration	Read (Max.)			Write (Max.)		
		P1	P2	P3	P1	P2	P3
128GB	Kioxia 3D NAND, DDP	640	615	750	730	425	825
256GB	Kioxia 3D NAND, QDP	700	540	700	920	400	730
512GB	Kioxia 3D NAND, ODP	730	620	715	940	435	755

Unit: mW

#### Notes

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

## 5. INTERFACE



### 5.1. Pin Assignment and Descriptions

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
A	GN	GN	GN			GN			GN			GN			GN			GN	GN	GN	A	
B	GN	GN	GN	DN	DN	DN			GN			GN			GN	NC	XSPI08_SPI_CLK	XSPI07_SPI_CS#	GN	GN	B	
C	GN	GN	GN	DN	DN	PWR_ID0	PWR_ID2	PWR_ID4	RFU	PLN#	XSPI04_SMB_DATA	NC	XSPI08_UART_TX	DN	XSPI00	XSPI06_SPI_MOSI	XSPI05_SPI_MISO	GN	GN	GN	C	
D		PWR_2_IN	PWR_2_IN	DN	DN	PWR_ID1	PWR_ID3	RFU	RFU	PLA_S3#	XSPI05_SMB_CLK	XSPI07_UART_RX	NC	DN	RFU	NC	NC	PWR_2_IN	PWR_2_IN		D	
E	GN	PWR_2_IN	PWR_2_IN	GN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	PWR_2_IN	PWR_2_IN	GN	E
F		PWR_2_IN	PWR_2_IN	GN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	PWR_2_IN	PWR_2_IN		F
G		GN	GN	GN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	GN		G
H	GN	PWR_1	PWR_1	HSB	HSB	HSB	HSB								HSB	HSB	GN	PWR_1	PWR_1	GN	H	
J		PWR_1	PWR_1	GN	HSB	HSB		HSB	HSB	HSB	HSB	HSB	HSB		HSB	HSB	HSB	PWR_1	PWR_1		J	
K		GN	PWR_1	HSB	HSB	HSB		HSB					HSB		HSB	HSB	GN	PWR_1	GN		K	
L	GN	FLASH_RZQ	GN	GN	HSB	HSB		HSB					HSB		HSB	HSB	HSB	GN	CTL_RZQ	GN	L	
M	GN	GN	+0.9V_PWR_3	HSB	HSB	HSB		HSB					HSB		HSB	HSB	GN	+0.9V_PWR_3	GN	GN	M	
N		+0.9V_PWR_3	+0.9V_PWR_3	GN	HSB	HSB		HSB					HSB		HSB	HSB	HSB	+0.9V_PWR_3	+0.9V_PWR_3		N	
P		+0.9V_PWR_3	+0.9V_PWR_3	HSB	HSB	HSB		HSB	HSB	HSB	HSB	HSB	HSB		HSB	HSB	GN	+0.9V_PWR_3	+0.9V_PWR_3		P	
R	GN	GN	GN	GN	HSB	HSB									HSB	HSB	HSB	GN	GN	GN	R	
T		PWR_2_IN	PWR_2_IN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	PWR_2_IN	PWR_2_IN		T	
U		PWR_2_IN	PWR_2_IN	GN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	PWR_2_IN	PWR_2_IN		U	
V	GN	GN	GN	GN	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	HSB	GN	GN	GN	GN	V	
W		NC	XLARGE08	XPERSTN	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	RFU	NC	DN	DN		W	
Y	GN	LED	GN	GN	GN	GN	PERP0	PERN0	GN	PEIP0	PEIN0	GN	PERP1	PERN1	GN	GN	GN	GN	NC	GN	Y	
AA	GN	GN	GN	REFCLKP	REFCLKN	GN			GN			GN			GN	PEIP1	PEIN1	GN	GN	GN	AA	
AB	GN	GN	GN			GN			GN			GN			GN			GN	GN	GN	AB	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		

## ■ Pin Assignment and Descriptions

Pin Name	Pin Type	Description	Power Domain
XGPIO0	I	Debug only	1.8V
XGPIO1_UART_RX	I	Debug only	1.8V
XGPIO2_SPI_MISO	I/O	General Purpose Input/output Pins	1.8V
XGPIO3_UART_TX	O	Debug only	1.8V
XGPIO4_SMB_DATA	I/O	Debug only	1.8V
XGPIO5_SMB_CLK	I/O	Debug only	1.8V
XGPIO6_SPI_MOSI	I/O	General Purpose Input/output Pins	1.8V
XGPIO7_SPI_CS#	I/O	General Purpose Input/output Pins	1.8V
XGPIO8_SPI_CLK	I/O	General Purpose Input/output Pins	1.8V
PERP0	I/O	PCIe TX/RX Differential signals defined by the PCI Express Card Electromechanical Specification.	--
PERN0			
PERP1			
PERN1			
PETP0			
PETN0			
PETP1			
PETN1			
REFCLKP	I	PCIe Reference Clock signals (100 MHz) defined by the PCI Express Card Electromechanical Specification.	--
REFCLKN	I		--
XPERSTN	I	PE-Reset is a functional reset to the card as defined by the PCI Express Mini Card Electromechanical Specification	1.8V
XCLKREQB	I/O	--	1.8V
FLASH_RZQ	--	Flash Calibration REF RESISTENCE	1.2V
CTL_RZQ	--	Control Calibration REF RESISTENCE	1.2V
PLA_S3#	O	--	1.8V
PLN#	I	Power Loss Notification	1.8V
DAS	O	Open drain, active low signal. This signal is used to allow the Adapter to provide status indication via LED device that will be provided by the system.	3.3V
PWR_1	I	+2.5 V source	--
PWR_2	I	+1.8 V source	--
PWR_3	I	+0.9 V source	--

Pin Name	Pin Type	Description	Power Domain
NC	--	Not Connect	--
RFU	--	Reserved for future use	--
Power ID	--	Reserved for power ID	--
GND	--	Return current path	--
DNU	--	Do not use. Manufacturing purpose only	--
HSB	--	Host specific balls	--
REG_01	O	VCC_NAND_1	--
REG_02	O	VCC_NAND	--
REG_03	O	+1V8_LDO	--



## 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
<b>NVM Command Set Attributes</b>			
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
<b>IO Command Set Attributes</b>			
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)
<b>Vendor Specific</b>			
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)
128	EE7C2B0h
256	1DCF32B0h
512	3B9E12B0h



### 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)

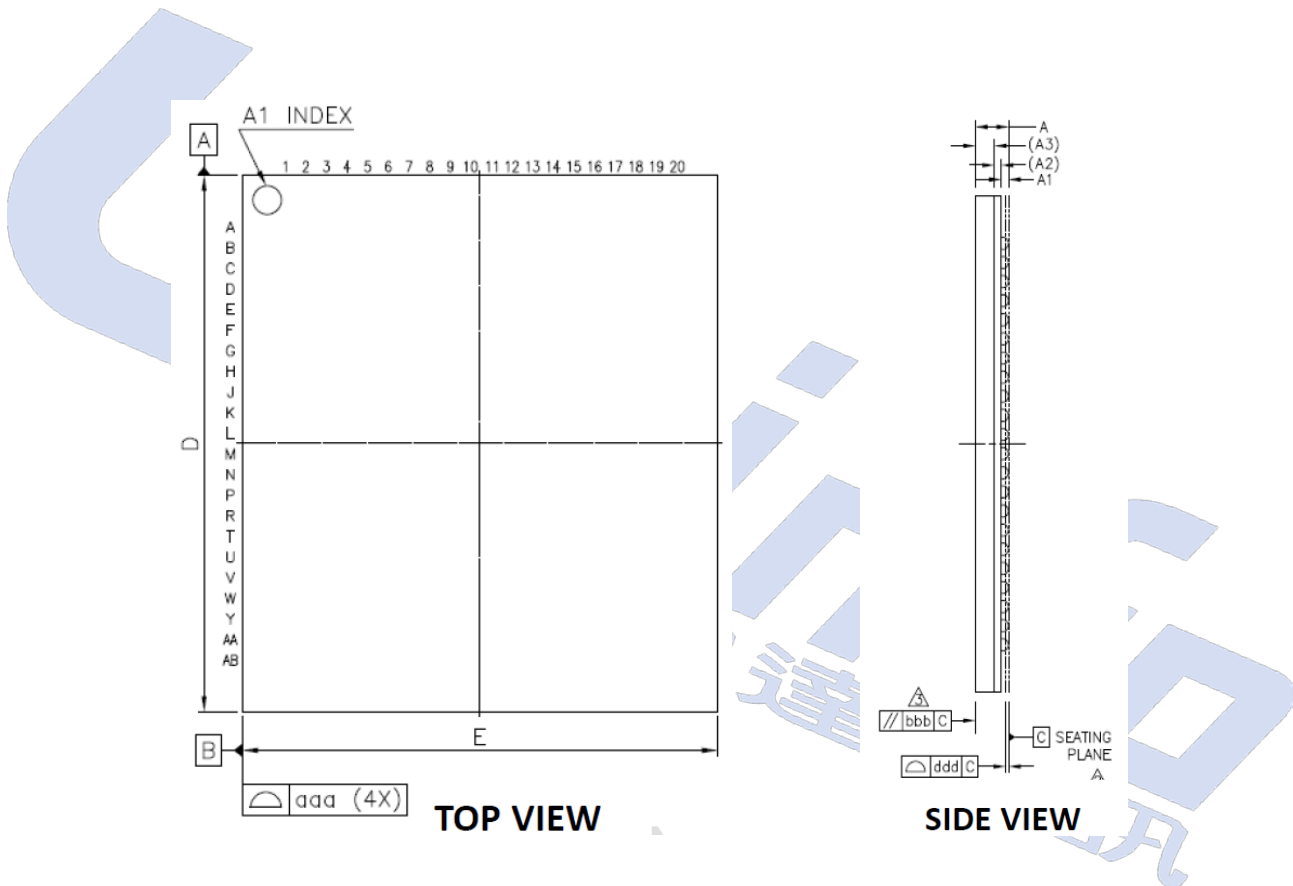
## 7. PHYSICAL DIMENSION



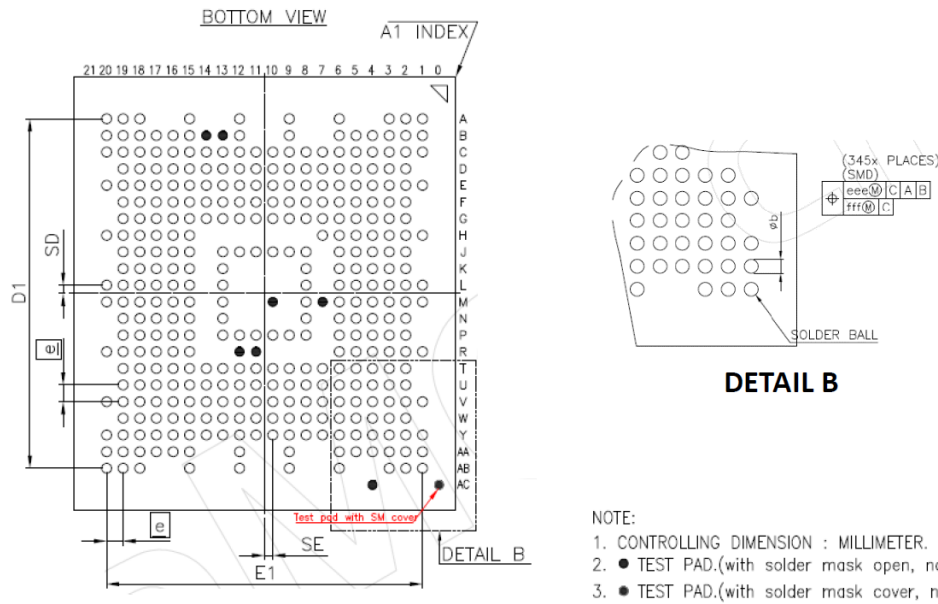
Package: 11.5mm (x-axis) x 13mm (y-axis) / 0.5mm (Ball Pitch)

**Table 7-1 BGA SSD Physical Dimensions and Weight**

Capacity	Height (mm)	Width (mm)	Length (mm)	Weight (gram)
64GB	1	11.5	13	Up to 0.5
128GB	1.15			
256GB	1.35			
512GB	1.35			







**BOTTOM VIEW**

**Table 7-2 Package Specification (8CE solution)**

	SYM.	DIMENSION (mm)		
		MIN.	NOM.	MAX.
TOTAL THICKNESS	A	1.25	1.30	1.35
STAND OFF	A1	0.17	0.22	0.27
SUBSTRATE THICKNESS	A2	—	0.18	—
MOLD THICKNESS	A3	—	0.90	—
BALL WIDTH	b	0.25	0.30	0.35
BODY SIZE	D	12.90	13.00	13.10
BALL DIAMETER (PRE-REFLOW)		0.30		
BALL OPENING		0.275		
EDGE BALL CENTER TO CENTER	D1	10.50 BSC		
BODY SIZE	E	11.40	11.50	11.60
EDGE BALL CENTER TO CENTER	E1	9.50 BSC		
BODY CENTER TO CONTACT BALL	SD	0.25 BSC		
	SE	0.25 BSC		
JEDEC(REF)		MO-276(REF.)		
BALL PITCH	e	0.50 BSC		
BALL COUNT	N	345		
PACKAGE EDGE TOLERANCE	aaa	0.10		
MOLD FLATNESS	bbb	0.10		
COPLANARITY	ddd	0.08		
BALL OFFSET(PACKAGE)	eee	0.15		
BALL OFFSET(BALL)	fff	0.05		



**8. PARTNUMBER DECODER**



MPC-11DEX<sup>8</sup>X<sup>9</sup>X<sup>10</sup>X<sup>11</sup>X<sup>12</sup>X<sup>13</sup>X<sup>14</sup>X<sup>15</sup>X<sup>16</sup>X<sup>17</sup>

X <sup>1</sup> X <sup>2</sup> X <sup>3</sup>	X <sup>4</sup> X <sup>5</sup>	X <sup>6</sup> X <sup>7</sup>	X <sup>8</sup> X <sup>9</sup> X <sup>10</sup> X <sup>11</sup> X <sup>12</sup>	X <sup>13</sup>	X <sup>14</sup>	X <sup>15</sup>	X <sup>16</sup> X <sup>17</sup>
MPC	11	DE	128GB 256GB 512GB	A: 3D TLC Standard (0°C ~ +70°C) B: 3D TLC Industrial (-40°C ~ +85°C) V: 3D pSLC Standard (0°C ~ +70°C) W: 3D pSLC Industrial (-40°C ~ +85°C)	D	P	blank

