

UD info Corp.

Industrial 2.5" PCIe Solid State Drive PFD-25DC Series Product DataSheet



UD info CORP.

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Revision History

Revision	Draft Date	History	Author
1.0	2019/6/18	New release	Golden Lee



Product Overview

- **Capacity**
 - 480GB up to 7680GB
- **Form Factor**
 - U.2
- **PCIe Interface**
 - NVMe PCIe Gen3 x4
- **Compliance**
 - NVMe 1.3
 - PCI Express Base 3.1
- **Flash Interface**
 - Flash Type: 3D TLC
 - Transfer rate up to 533Mbps
 - Up to 16pcs of BGA132/152 flash
- **Performance**^{Note1}
 - Read up to 3,200 MB/s
 - Write up to 1,100 MB/s
- **Power Consumption**^{Note2}
 - Active mode: < 9500mW
- **Hardware Power Loss Protection Support**
- **Advanced Flash Management**
 - Advanced Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Temperature Range**^{Note4}
 - Operation (Standard): 0°C ~ 70°C
 - Operation (Wide): -40°C ~ 85°C
 - Storage: -40°C ~ 85°C
- **Features Support List**
 - End to end data path protection
 - Thermal throttling
 - SmartECC™
 - SmartRefresh™
 - Drive log
 - Support of AES/TCG OPAL^{Note3}
- **Compliant**
 - RoHS

Notes:

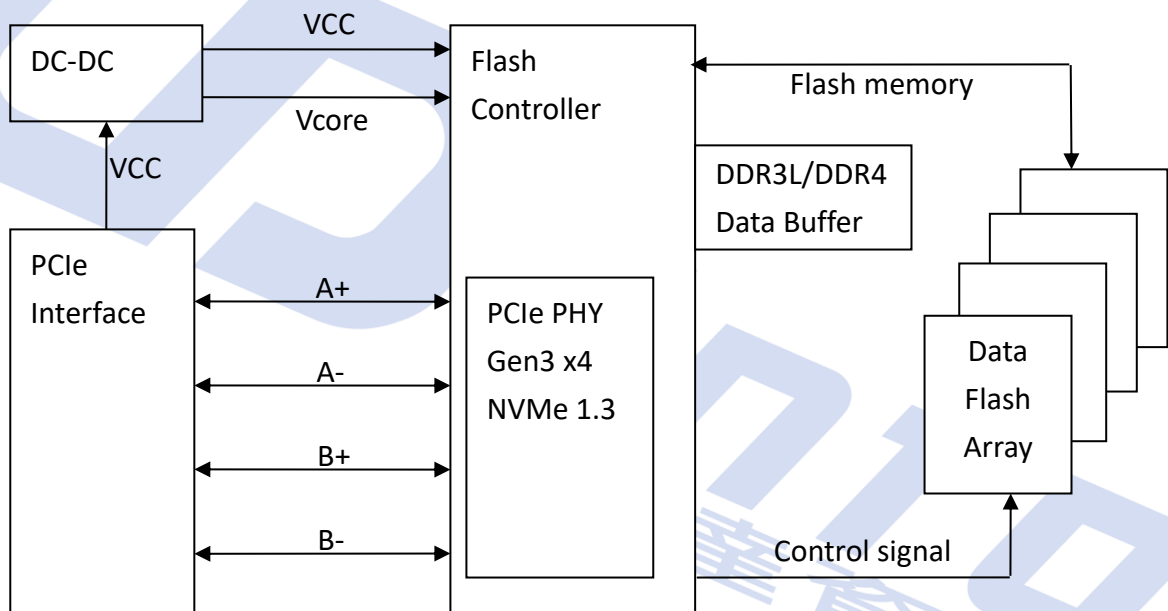
1. Refer to Chapter 2 for more details.
2. Refer to Chapter 4, section 4.2 power consumption for more details.
3. Support by a separate firmware version. Further information available upon request.
4. Operation temperature is measured by device temperature sensor.

1. INTRODUCTION

1.1. General Description

UDinfo's 2.5" PCIe SSD delivers all the advantages of flash disk technology with PCIe Gen3 x4 interface, including being compliant with standard 2.5-inch form factor and SFF-8639 connector, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. The device is designed based on the standard 38-pin interface for data segment and 15-pin for power segment, as well as operating at a maximum operating frequency of 400MHz with 25MHz external crystal. Its capacity could provide a wide range up to 7,680GB(8TB). Moreover, it can reach up to 3,200MB/s read as well as 1,100MB/s write high performance based on Toshiba's Bics3 TLC flash.

1.2. Block Diagram



2.5" PCIe SSD Block Diagram

2. PRODUCT SPECIFICATIONS



- **Capacity**
 - 480GB up to 7680GB
- **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
- **Supported NAND Flash**
 - Support Toshiba BiCS3 TLC
 - Support up to 16pcs of BGA132/152 flash
- **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
480GB	937,703,088	Depended on file management
960GB	1,875,385,008	
1920GB	3,750,748,848	
3840GB	7,501,476,528	
7680GB	15,002,931,888	

- Performance

- BiCS3 TLC

Capacity	Flash Structure	Flash Type	Sequential		Random	
			Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
480GB	64GB x 8	BiCS3, BGA	3,200	520	180K	25K
960GB	128GB x 8	BiCS3, BGA	3,200	970	360K	25K
1920GB	128GB x 16	BiCS3, BGA	3,200	1,100	360K	28K
3840GB	256GB x 16	BiCS3, BGA	3,200	980	400K	30K
7680GB	512GB x 16	BiCS3, BGA	3,200	970	400K	30K

Notes:

1. The performance was estimated based on Toshiba BiCS3 TLC 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 5.1.2, 1GB range, QD=32, Thread=1
 - (b) IOMeter, 8GB range, 4K data size, QD=32

- TBW (Terabytes Written)

- BiCS3 TLC

Capacity	Flash Type	TBW
480GB	BiCS3 TLC	850
960GB	BiCS3 TLC	1,665
1920GB	BiCS3 TLC	3,115
3840GB	BiCS3 TLC	6,230
7680GB	BiCS3 TLC	12,460

Notes:

1. Samples were built using Toshiba BiCS3 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.

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.
2. Operation temperature shows in case temperature not ambient temperature.

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 simulation software (Relex7.3). 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	12V

4.2. Power Consumption

- Power consumption of U.2 PCIe SSD

Capacity	Flash Type	CE#	Read (mW)	Write (mW)
480GB	64GB x8, Bics3 TLC, BGA	16	6,100	3,400
960GB	128B x8, Bics3 TLC, BGA	32	6,300	4,600
1920GB	128GB x16, Bics3 TLC, BGA	32	8,000	5,500
3840GB	256GB x16, Bics3 TLC, BGA	64	8,500	6,000
7680GB	512GB x16, Bics3 TLC, BGA	64	9,500	6,600

Unit: mW

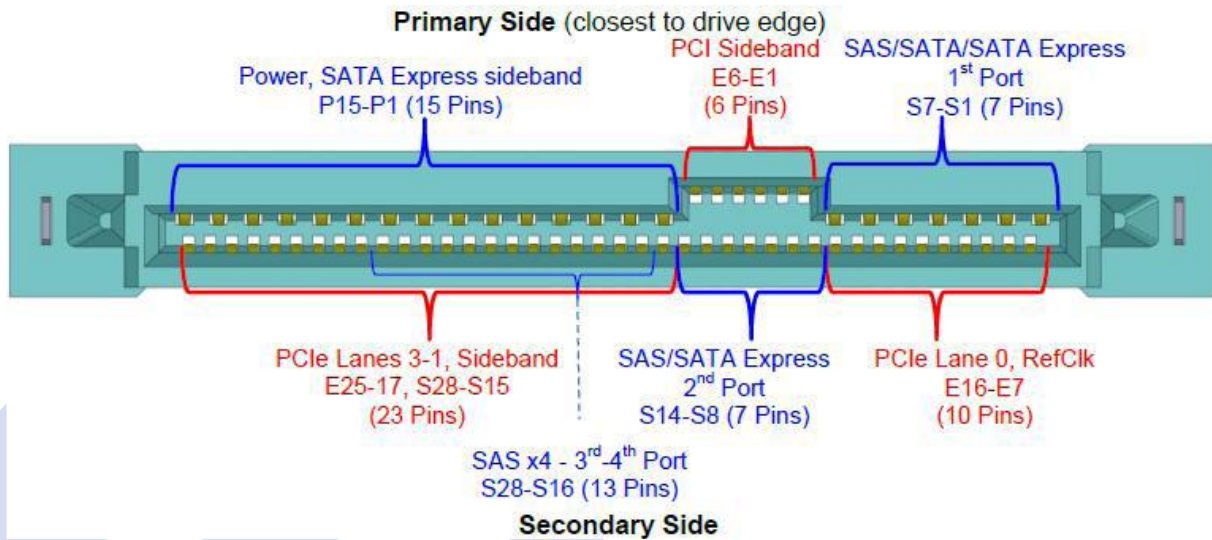
Notes

- Based on ECFM1xxx-series under ambient temperature.
- Use CrystalDiskMark 5.1.2 with the setting of 1000MB. Sequentially read and write the disk for 5 times, and measure power consumption during sequential Read [1/5]~[5/5] or sequential Write [1/5]~[5/5]
- Power Consumption may differ according to flash configuration and platform.
- The measured power voltage is 12V.

5. INTERFACE



5.1. Pin Assignment and Descriptions



The follow table defines the signal assignment of the 2.5" PCIe SSD SFF-8639 Connector Pin Assignment and Descriptions.

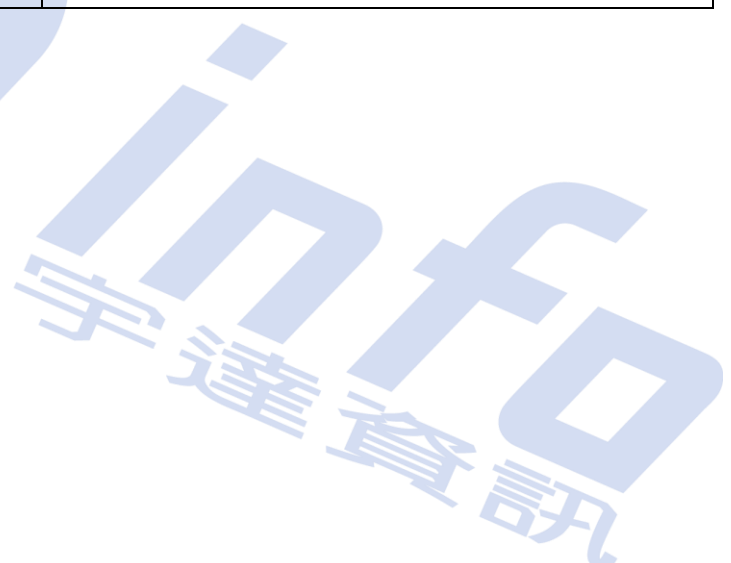
Pin #	Name	Type	Description
P1	WAKE#	Input	Signal for Link reactivation
P2	-	-	Outside scope of this specification
P3	CLKREQ#	Bi-Dir	Clock request
P4	Idet#	Input	Interface Type Detect
P5	Ground	Ground	Ground
P6	Ground	Ground	Ground
P7	-	-	Outside scope of this specification
P8	-	-	Outside scope of this specification
P9	-	-	Outside scope of this specification
P10	PRSNT#	Input	Presence detect
P11	Activity	Input	
P12	Ground	Ground	Ground
P13	+12V Precharge	Power	+12V Precharge power for SFF-8639 module
P14	+12V	Power	+12V power for SFF-8639 module
P15	+12V	Power	+12V power for SFF-8639 module
S1	Ground	Ground	Ground
S2	-	-	Outside scope of this specification
S3	-	-	Outside scope of this specification

Pin #	Name	Type	Description
S4	Ground	Ground	Ground
S5	-	-	Outside scope of this specification
S6	-	-	Outside scope of this specification
S7	Ground	Ground	Ground
S8	Ground	Ground	Ground
S9	-	-	Outside scope of this specification
S10	-	-	Outside scope of this specification
S11	Ground	Ground	Ground
S12	-	-	Outside scope of this specification
S13	-	-	Outside scope of this specification
S14	Ground	Ground	Ground
S15	Reserved	-	Reserved
S16	Ground	Ground	Ground
S17	PETp1	Diff-Pair	Transmitter differential pair, Lane 1
S18	PETn1	Diff-Pair	Transmitter differential pair, Lane 1
S19	Ground	Ground	Ground
S20	PERn1	Diff-Pair	Receiver differential pair, Lane 1
S21	PERp1	Diff-Pair	Receiver differential pair, Lane 1
S22	Ground	Ground	Ground
S23	PETp2	Diff-Pair	Transmitter differential pair, Lane 2
S24	PETn2	Diff-Pair	Transmitter differential pair, Lane 2
S25	Ground	Ground	Ground
S26	PERn2	Diff-Pair	Receiver differential pair, Lane 2
S27	PERp2	Diff-Pair	Receiver differential pair, Lane 2
S28	Ground	Ground	Ground
E1	REFCLKB+	Diff-Pair	Reference clock (differential pair) for second X2 port
E2	REFCLKB-	Diff-Pair	Reference clock (differential pair) for second X2 port
E3	+3.3 Vaux	Power	3.3 V auxiliary power
E4	PERSTB#	Output	Fundamental reset for second X2 port
E5	PERST#	Output	Fundamental reset (if dual-port enabled, first X2 port)
E6	Reserved	-	Reserved
E7	REFCLK+	Diff-Pair	Reference clock (if dual-port enabled, first X2 port)
E8	REFCLK-	Diff-Pair	Reference clock (if dual-port enabled, first X2 port)
E9	Ground	Ground	Ground
E10	PETp0	Diff-Pair	Transmitter differential pair, Lane 0

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Pin #	Name	Type	Description
E11	PETn0	Diff-Pair	Transmitter differential pair, Lane 0
E12	Ground	Ground	Ground
E13	PERn0	Diff-Pair	Receiver differential pair, Lane 0
E14	PERp0	Diff-Pair	Receiver differential pair, Lane 0
E15	Ground	Ground	Ground
E16	Reserved	-	Reserved
E17	PETp3	Diff-Pair	Transmitter differential pair, Lane 3
E18	PETn3	Diff-Pair	Transmitter differential pair, Lane 3
E19	Ground	Ground	Ground
E20	PERn3	Diff-Pair	Receiver differential pair, Lane 3
E21	PERp3	Diff-Pair	Receiver differential pair, Lane 3
E22	Ground	Ground	Ground
E23	SMCLK	Bi-Dir	SMBus (System Management Bus) clock
E24	SMDAT	Bi-Dir	SMBus (System Management Bus) data
E25	DualPortEn#	Output	Dual-port Enable



6. SUPPORTED COMMANDS



6.1. NVMe Command List

Table 6-1 Admin Commands

Op-Code	O/M	Command Description
00h	M	Delete I/O Submission Queue
01h	M	Create I/O Submission Queue
02h	M	Get Log Page
04h	M	Delete I/O Completion Queue
05h	M	Create I/O Completion Queue
06h	M	Identify
08h	M	Abort
09h	M	Set Features
0Ah	M	Get Features
0Ch	M	Asynchronous Event Request
10h	O	Firmware Activate
11h	O	Firmware Image Download
14h	O	Device Self-test
80h	O	Format NVM
81h	O	Security Send
82h	O	Security Receive
84h	O	Sanitize

Table 6-2 I/O Commands

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

Table 6-3 Set Feature Commands

Op-Code	O/M	Command Description
00h		Reserved
01h	M	Arbitration
02h	M	Power Management
03h	O	LBA Range Type
04h	M	Temperature Threshold
05h	M	Error Recovery
06h	O	Volatile Write Cache
07h	M	Number of Queues
08h	M	Interrupt Coalescing
09h	M	Interrupt Vector Configuration
0Ah	M	Write Atomicity Normal
0Bh	M	Asynchronous Event Configuration
0Ch	O	Autonomous Power State Transition
0Dh	O	Host Memory Buffer
0Eh	O	Timestamp
10h	O	Host Controlled Thermal Management
11h	O	Non-Operational Power State Config
0Eh – 7Dh		Reserved
80h	O	Software Progress Marker

Table 6-4 Get Log Page Commands

Op-Code	O/M	Command Description
00h		Reserved
01h	M	Error Information
02h	M	SMART / Health Information
03h	M	Firmware Slot Information
04h	O	Changed Namespace List
06h	O	Device Self-test
09h – 7Fh		Reserved
81h	O	Sanitize Status
82h - FFh		Reserved

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	0x0001	Controller ID (CNTLID)
83:80	M	0x00010300	Version (VER)
87:84	M	0x001E8480(2sec)	RTD3 Resume Latency (RTD3R)
91:88	M	0x00989680(10sec)	RTD3 Entry Latency (RTD3E)
95:92	M	0x00000300	Optional Asynchronous Events Supported (OAES)
99:96	M	0x0002	Controller Attributes (CTRATT)
239:100	-	0x00	Reserved
255:240	-	0x00	Refer to the NVMe Management Interface Specification for definition
257:256	M	0x0017	Optional Admin Command Support (OACS)
258	M	0x03	Abort Command Limit (ACL)
259	M	0x03	Asynchronous Event Request Limit (AERL)
260	M	0x1F	Firmware Updates (FRMW)
261	M	0x0C	Log Page Attributes (LPA)
262	M	0x3E	Error Log Page Entries (ELPE)
263	M	4	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	0x0157 (70C)	Warning Composite Temperature Threshold (WCTEMP)
269:268	M	0x0161 (80C)	Critical Composite Temperature Threshold (CCTEMP)
271:270	O	0x0000 (No report)	Maximum Time for Firmware Activation (MTFA)
275:272	O	0x00000000	Host Memory Buffer Preferred Size (HMPRE)
279:276	O	0x00000000	Host Memory Buffer Minimum Size (HMMIN)

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Bytes	O/M	Default Value	Description
295:280	O	**	Total NVM Capacity (TNVMCAP)
311:296	O	**	Unallocated NVM Capacity (UNVMCAP)
315:312	O	0x00000000	Replay Protected Memory Block Support (RPMBS)
511:316	-	Non-zero	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	0x001F	Optional NVM Command Support (ONCS)
523:522	M	0x0000	Fused Operation Support (FUSES)
524	M	0x00	Format NVM Attributes (FNA)
525	M	0x01	Volatile Write Cache (VWC)
527:526	M	TBD	Atomic Write Unit Normal (AWUN)
529:528	M	TBD	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)
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)

Bytes	O/M	Default Value	Description
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 State 26 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)

* The OUI shall be a valid IEEE/RAC assigned identifier that may be registered at <http://standards.ieee.org/develop/regauth/oui/public.html>.

** Depends on the using of capacity

■ 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)

* See IDEMA SPEC

** See IEEE EUI-64 SPEC

■ List of Identify Namespace Data Structure for Each Capacity

Capacity (GB)	Byte[7:0]: Namespace Size (NSZE)
480	37E436B0h
960	6FC81AB0h
1920	DF8FE2B0h
3840	1BF1F72B0h
7680	37E3E92B0h

6.3. SMART Attributes

■ SMART Attributes (Log Identifier 02h)

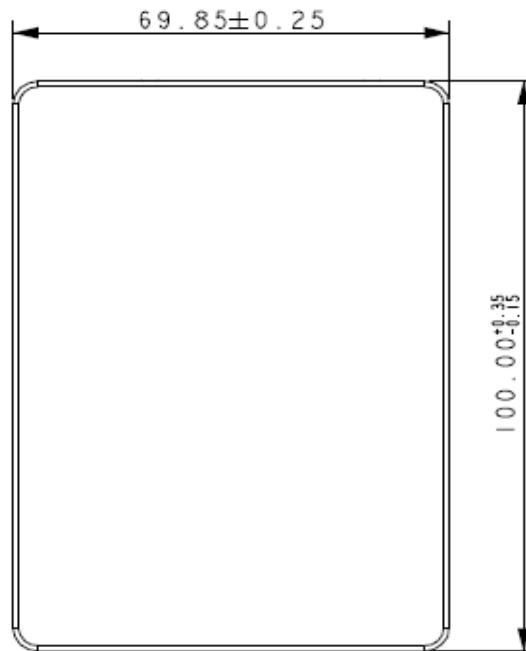
Bytes Index	Bytes	Description
[0]	1	Critical Warning
[2:1]	2	Composite Temperature
[3]	1	Available Spare
[4]	1	Available Spare Threshold
[5]	1	Percentage Used
[31:6]	26	Reserved
[47:32]	16	Data Units Read
[63:48]	16	Data Units Written
[79:64]	16	Host Read Commands
[95:80]	16	Host Write Commands
[111:96]	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

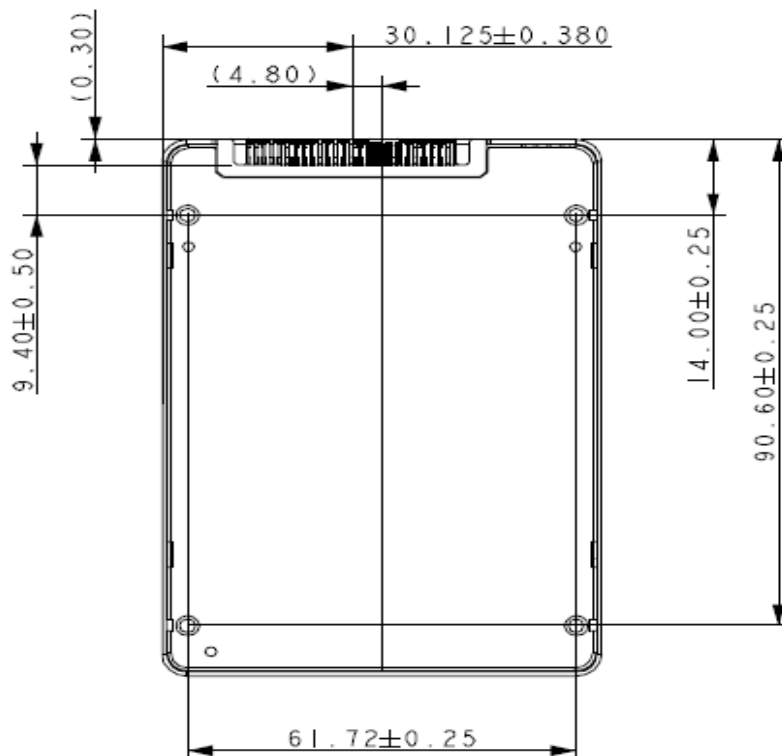


Dimension: 100.00mm (L) x 69.85mm (W) x 9.50mm (H)

Top View



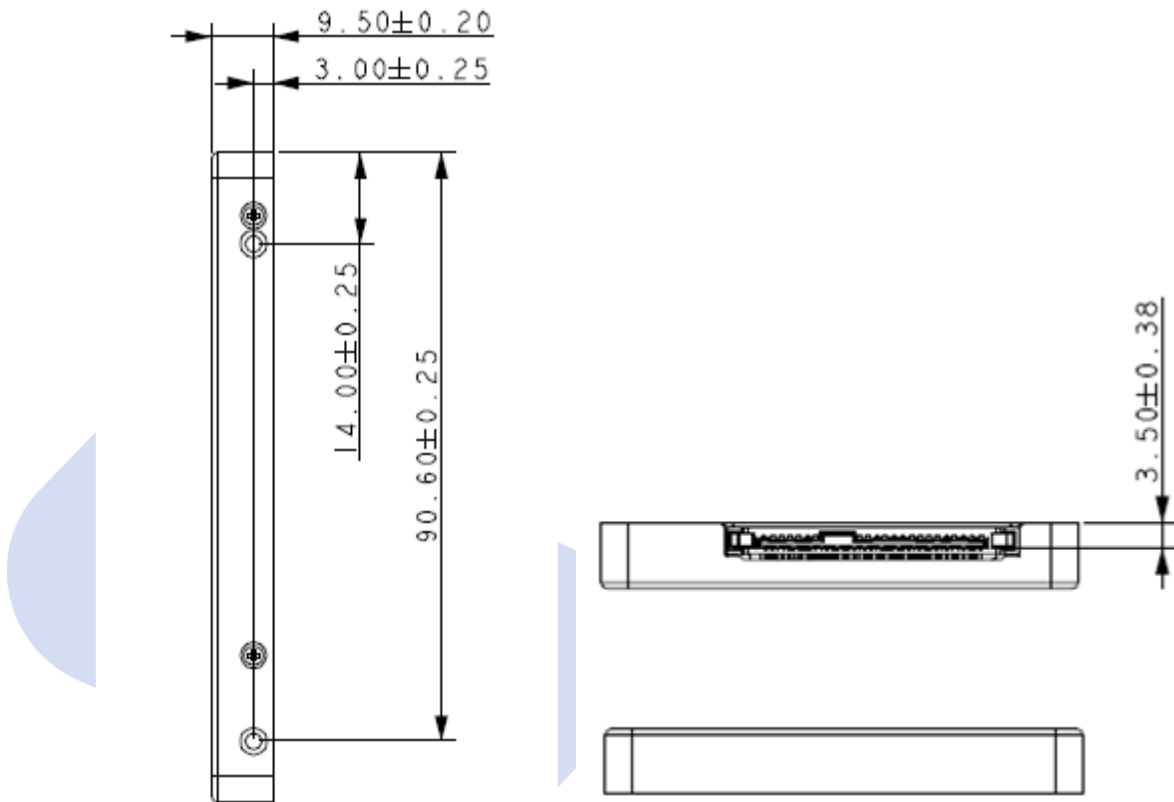
Bottom View



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Side View



8. TERMINOLOGY



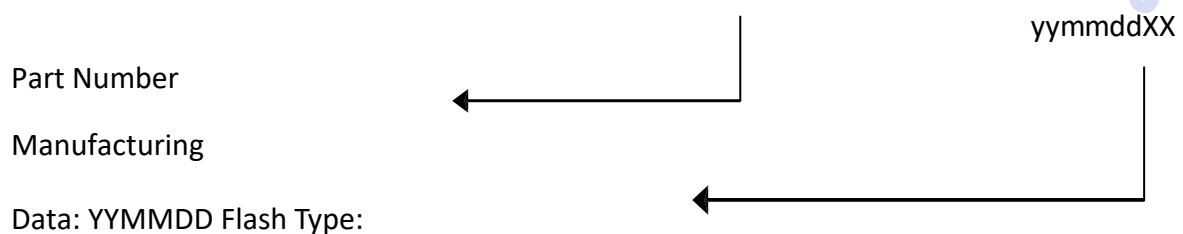
The following table is to list out the acronyms that have been applied throughout the document.

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



P F D 2 5 D C 9 6 0 G B A E P



10. PARTNUMBER DECODER



PFD-25DCX⁸X⁹X¹⁰X¹¹X¹²X¹³X¹⁴X¹⁵X¹⁶X¹⁷

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
PFD	25	DC	480GB 960GB 1920G 3840G 7680G	A: 3D TLC Standard (0°C ~ +70°C) B: 3D TLC Industrial (-40°C ~ +85°C)	E	P	blank

