U.3 PCIe SSD EU-1 DWPD 1 Datasheet

(SQF-CU3xxDxxxxDU1C)

CONTENTS

Revision History

Rev.	Date	History
0.1	2022/11/1	1. Preliminary release
0.2	2023/2/1	1. Update test result

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
    - The power cord or plug is damaged.
    - Liquid has penetrated the equipment.
    - The equipment has been exposed to moisture.
    - The equipment does not work well, or you cannot get it to work according to the user's manual.
    - The equipment has been dropped and damaged.
    - The equipment has obvious signs of breakage.
15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

Consignes de sécurité

1. Lisez attentivement ces instructions de sécurité.
2. Conservez ce manuel pour référence ultérieure.
3. Débranchez cet appareil de toute prise secteur avant le nettoyage. Utilisez un chiffon humide. Ne pas utiliser de détergents liquides ou en aérosol pour le nettoyage
4. Pour les équipements enfichables, la prise de courant doit être située près de l'équipement et doit être facilement accessible.
5. Gardez cet équipement à l’abri de l’humidité.
6. Placez cet équipement sur une surface fiable lors de l'installation. Le laisser tomber ou le laisser tomber peut causer des dommages.
7. Les ouvertures sur l'enceinte sont destinées à la convection de l'air. Protégez l'équipement de la surchauffe. NE COUVREZ PAS LES OUVERTURES.
8. Assurez-vous que la tension de la source d'alimentation est correcte avant de connecter l'équipement à la prise de courant.
9. Positionnez le cordon d’alimentation de sorte que personne ne puisse marcher dessus. Ne placez rien sur le cordon d'alimentation.
10. Toutes les mises en garde et avertissements sur l'équipement doivent être notés..
11. Si l’appareil n’est pas utilisé pendant une longue période, débranchez-le de la source d’alimentation pour éviter tout dommage dû à une surtension transitoire.
12. Ne jamais verser de liquide dans une ouverture. Cela pourrait provoquer un incendie ou un choc électrique.
13. N'ouvrez jamais l'équipement. Pour des raisons de sécurité, l’équipement ne doit être ouvert que par du personnel qualifié.
14. Si l’une des situations suivantes se produit, faites vérifier l’équipement par le personnel de service:l:
    - Le cordon d'alimentation ou la fiche est endommagé Liquid has penetrated the equipment.
    - L'équipement a été exposé à l'humidité.
    - L'équipement ne fonctionne pas bien ou vous ne pouvez pas le faire fonctionner conformément au manuel d'utilisation..
    - L'équipement est tombé et endommagé..
    - L'équipement présente des signes évidents de rupture.
15. NE PAS LAISSER CET APPAREIL DANS UN ENVIRONNEMENT O LA TEMPÉRATURE DE STOCKAGE PEUT ÊTRE INFÉRIEURE À -20 ° C (-4 ° F) OU SUPÉRIEURE À 60 ° C (140 ° F). CELA POURRAIT ENDOMMAGER L'ÉQUIPEMENT. L’ÉQUIPEMENT DOIT ÊTRE DANS UN ENVIRONNEMENT CONTRÔLÉ.
16. ATTENTION: DANGER D'EXPLOSION EN CAS DE REMPLACEMENT INCORRECT DE LA PILE. REMPLACEZ UNIQUEMENT AVEC LE MÊME TYPE OU LE TYPE ÉQUIVALENT RECOMMANDÉ PAR LE FABRICANT, DÉJETTEZ LES PILES UTILISÉES SELON LES INSTRUCTIONS DU FABRICANT.

1. Overview

Advantech SQFlash EU-1 series U.3 PCIe SSD (Solid State Drive) delivers all the advantages of flash disk technology with PCIe Gen. 4x4 interface, including being fully compliant with standard U.3 form factor, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. EU-1 series offers a wide range of capacities up to 15,360GB and its performance can reach up to 6,650 MB/s (for sequential read) and 6,460 MB/s (for sequential write) based on Hynix V6 eTLC NAND flash with the DDR4. Moreover, the power consumption of EU-1 U.3 (15mm) SSD is much lower than traditional hard drives, making it the best embedded solution for new platforms.

2. Features

- **PCIe Interface**
  - Compliant with NVMe1.4
  - PCIe Express Base Ver 4.0
  - PCIe Gen 4 x 4 lane & backward compatible to PCIe Gen3, Gen 2 and Gen 1
- **Operating Voltage：12.0V**
- **Support fourth LDPC generation of ECC algorithm**
- **AES256、TCG-OPAL、TRIM supported**
- **Temperature Ranges**[1]
  - Commercial Temperature
    - 0℃ to 70℃ for operating
    - -40℃ to 85℃ for storage

  *Note : 1. Based on SMART Attribute (Byte index [2 :1] of PCIe-SIG standard, which measured by thermal sensor

- **Mechanical Specification**
  - Shock：500G / 2ms
  - Vibration：2.17G / 200~2,000Hz
- **Humidty**
  - Humidity：up to 95% on 40℃
- **Acquired RoHS、WHQL、CE、FCC Certificate**
- **Acoustic：0 dB**
- **Dimension (w/ heatsink)：100.0 mm x 69.85 mm x 14.65 mm**

3. Specification Table

Performance (High Performance)

		Sequential 128KB (QD=32, Workers=1) (MB/sec)		4K Sustained Random (QD=64, Workers=8) (IOPS)	
		Read	**Write**	**Read**	**Write**
3D TLC (V6)	1920 GB	6,650	3,325	1,520K	90K
	3840 GB	6,650	6,460	1,520K	161K
	7680 GB	6,650	6,460	1,520K	171K
	15360 GB	6,650	6,460	1,520K	171K

Note.

1. Performance may differ according to flash configuration and platform.
2. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

Latency (High Performance)

		4K Sustained Random (QD=1, Workers=1)		4K Sustained Random (QD=32, Workers=1)		4K Sustained Random (QD=64, Workers=8)	
		Read (us)	**Write (us)**	**Read (us)**	**Write (us)**	**Read (us)**	**Write (us)**
3D TLC (V6)	1920 GB	91	16	101	351	321	5601
	3840 GB	91	16	101	201	321	3151
	7680 GB	91	16	101	201	321	3151
	15360 GB	91	16	101	181	321	2801

Quality of Service (High Performance, QoS=99.999%, 4KB sustained)

		QD=1, Workers=1		QD=32, Workers=1		QD=64, Workers=8	
		Read (4KB)	**Write (4KB)**	**Read (4KB)**	**Write (4KB)**	**Read (4KB)**	**Write (4KB)**
3D TLC (V6)	1920 GB	101	13	161	351	1001	5701
	3840 GB	101	13	141	201	601	3201
	7680 GB	101	13	131	201	601	3201
	15360 GB	101	13	121	181	601	3001

Note.

1. Performance was estimated based on Hynix V6 eTLC NAND flash.
2. Performance may differ according to flash configuration and platform.
3. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations

Endurance

JEDEC defined an endurance rating TBW (TeraByte Written), following by the equation below, for indicating the number of terabytes a SSD can be written which is a measurement of SSDs' expected lifespan, represents the amount of data written to the device.

TBW = [(NAND Endurance) x (SSD Capacity)] / WAF

- **NAND Endurance**: Program / Erase cycle of a NAND flash.
  - 3D TLC (V6): 10,000 cycles
- **SSD Capacit**y: SSD physical capacity in total of a SSD.
- **WAF**: Write Amplification Factor (WAF), as the equation shown below, is a numerical value representing the ratio between the amount of data that a SSD controller needs to write and the amount of data that the host's flash controller writes. A better WAF, which is near to 1, guarantees better endurance and lower frequency of data written to flash memory.

WAF = (Lifetime write to flash) / (Lifetime write to host)

- **Endurance measurement is based on JESD218 Test method and JESD219A Workload, tested by ULINK**

3D TLC (V6)	Enterprise workload
1920 GB	3,505
3840 GB	7,008
7680 GB	14,016
15360 GB	28,032

Note.

1. Sequential: Mainly sequential write are estimated by PassMark Burnin Test v8.1 pro.

2. Client: Follow JESD218 Test method and JESD219A Workload, tested by ULINK. (The capacity lower than 64GB client workload is not specified in JEDEC219A, the values are estimated.)

3. Based on out-of-box performance.

4. Current TBW Values are for reference only. Actual figures will be released after MP.

4. General Description

Error Detection and Correction

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, SQF-CU3 PCIe SSD applies the 445bit/4KB LDPC (Low Density Parity Check) of ECC algorithm, which can detect and correct errors occur during read process, ensure data been read correctly, as well as protect data from corruption

Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

SQFlash provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND flash is greatly improved.

Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks”. SQFlash implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

Garbage Collection / TRIM

Garbage collection and TRIM technology is used to maintain data consistency and perform continual data cleansing on SSDs. It runs as a background process, freeing up valuable controller resources while sorting good data into available blocks, and deleting bad blocks. It also significantly reduces write operations to the drive, thereby increasing the SSD’s speed and lifespan.

SMART

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a hard disk drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

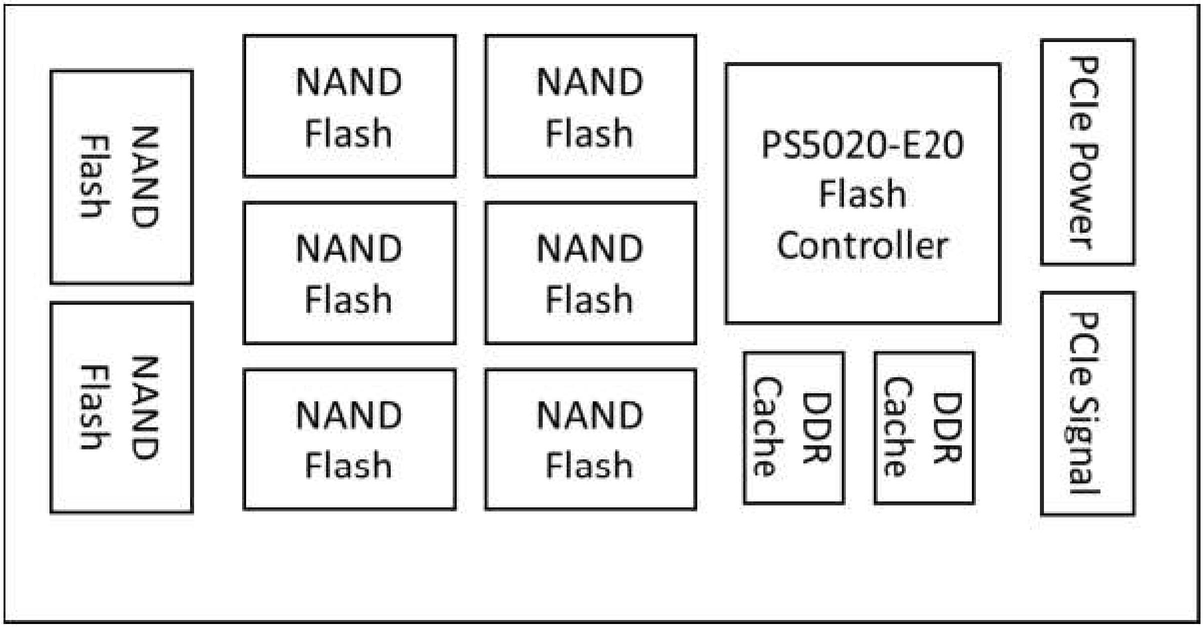
Over-Provision

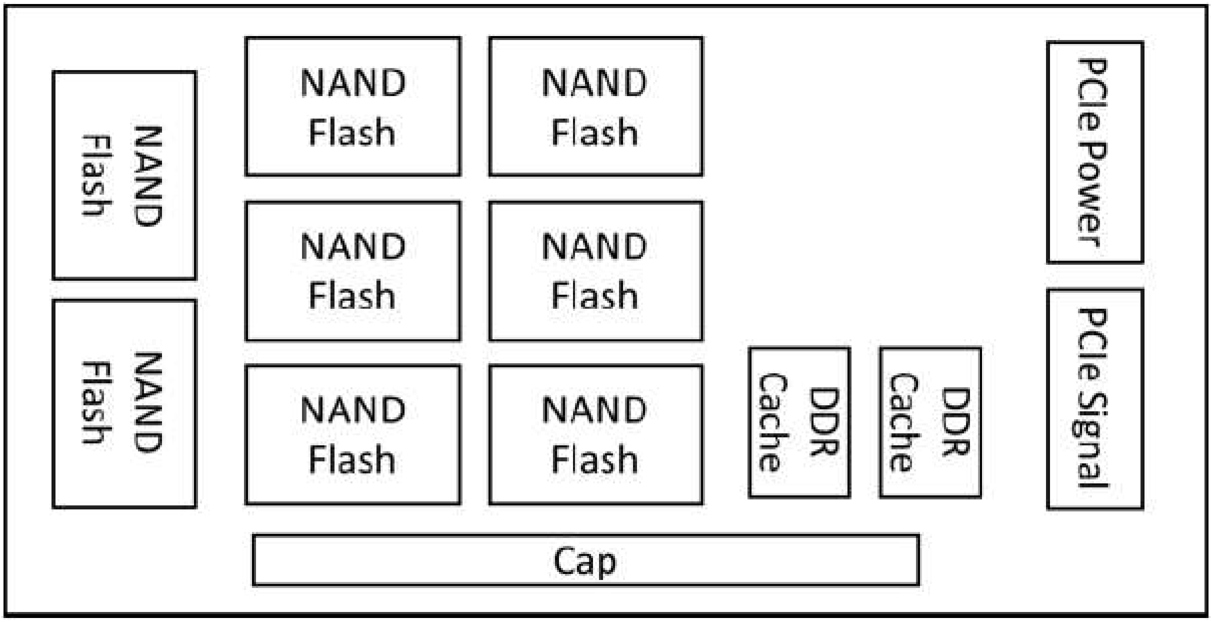
Over Provisioning refers to the inclusion of extra NAND capacity in a SSD, which is not visible and cannot be used by users. With Over Provisioning, the performance and IOPS (Input/Output Operations per Second) are improved by providing the controller additional space to manage P/E cycles, which enhances the reliability and endurance as well. Moreover, the write amplification of the SSD becomes lower when the controller writes data to the flash.

Thermal Throttling

Thermal Throttling function is for protecting the drive and reducing the possibility of read / write error due to overheat. The temperature is monitored by the thermal sensor. As the operating temperature continues to increase to threshold temperature, the Thermal Throttling mechanism is activated. At this time, the performance of the drive will be significantly decreased to avoid continuous heating. When the operating temperature falls below threshold temperature, the drive can resume to normal operation.

Block Diagram

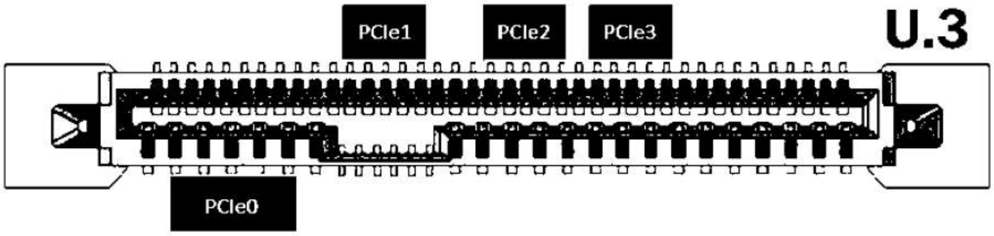


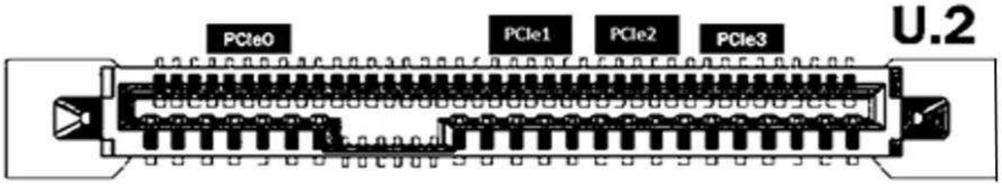


LBA value

Density (GB)	LBA
1920 GB	3,750,748,848
3840 GB	7,501,476,528
7680 GB	15,002,931,888
15360 GB	30,005,842,608

5. PCIe U.3 and U.2 Pin Assignment and Description





Pin Number	Name	Type	Description
Power Segment			
P1	WAKE#	Input	Reserved
P2	Reserved	Reserved	Reserved
P3	PWRDIS	Output	Power disable
P4	IfDet#	Input	Interface Type
P5	Ground	Ground	Ground
P6	Ground	Ground	Ground
P7	+5V	Power	Reserved
P8	+5V	Power	Reserved
P9	+5V	Power	Reserved
P10	PRSNT#	Input	Presence detect
P11	Activity#	Input	Activity indicator
P12	Ground	Ground	Ground
P13	12V Precharge	Power	+12V Precharge
P14	+12V	Power	+12V power
P15	+12V	Power	+12V power
SG1	Ground	Ground	Ground
SG2	Ground	Ground	Ground
S1	Ground	Ground	Ground
S2	U.3 TX p0	Diff-Pair	Transmitter differential pair, U.3 Lane 0
S3	U.3 TX n0	Diff-Pair	Transmitter differential pair, U.3 Lane 0
S4	Ground	Ground	Ground
S5	U.3 RX n0	Diff-Pair	Receiver differential pair, U.3 Lane 0
S6	U.3 RX p0	Diff-Pair	Receiver differential pair, U.3 Lane 0
S7	Ground	Ground	Ground
S8	Ground	Ground	Ground
S9	U.3 TX p1	Diff-Pair	Transmitter differential pair, U.3 Lane 1
S10	U.3 TX n1	Diff-Pair	Transmitter differential pair, U.3 Lane 1
S11	Ground	Ground	Ground
S12	U.3 RX n1	Diff-Pair	Receiver differential pair, U.3 Lane 1
S13	U.3 RX p1	Diff-Pair	Receiver differential pair, U.3 Lane 1
S14	Ground	Ground	Ground
S15	HPT0	Output	Host port type
S16	Ground	Ground	Ground
S17	U.3 TX p2/ U.2 TX p1	Diff-Pair	Transmitter differential pair, U.3 Lane 2, or U.2 Lane 1
S18	U.3 TX n2/ U.2 TX n1	Diff-Pair	Transmitter differential pair, U.3 Lane 2, or U.2 Lane 1

S19	Ground	Ground	Ground
S20	U.3 RX n2/ U.2 RX n1	Diff-Pair	Receiver differential pair, U.3 Lane 2, or U.2 Lane 1
S21	U.3 RX p2/ U.2 RX p1	Diff-Pair	Receiver differential pair, U.3 Lane 2, or U.2 Lane 1
S22	Ground	Ground	Ground
S23	U.3 TX p3/ U.2 TX p2	Diff-Pair	Transmitter differential pair, U.3 Lane 3, or U.2 Lane 2
S24	U.3 TX n3/ U.2 TX n2	Diff-Pair	Transmitter differential pair, U.3 Lane 3, or U.2 Lane 2
S25	Ground	Ground	Ground
S26	U.3 RX n3/ U.2 RX n2	Diff-Pair	Receiver differential pair, U.3 Lane 3, or U.2 Lane 2
S27	U.3 RX p3/ U.2 RX p2	Diff-Pair	Receiver differential pair, U.3 Lane 3, or U.2 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	CLKREQ#/PERSTB#	Bi-dir	Clock request/Fundamental reset for second x2 port
E5	PERST#	Output	Fundamental reset (if Dual port mode enabled, first x2 port)
E6	IFDet2#	Input	Interface Type Detect
E7	REFCLK+	Diff-Pair	Reference clock
E8	REFCLK-	Diff-Pair	Reference clock
E9	Ground	Ground	Ground
E10	U.2 TX p0	Diff-Pair	Transmitter differential pair, U.2 Lane 0
E11	U.2 TX n0	Diff-Pair	Transmitter differential pair, U.2 Lane 0
E12	Ground	Diff-Pair	Ground
E13	U.2 RX n0	Diff-Pair	Receiver differential pair, U.2 Lane 0
E14	U.2 RX p0	Diff-Pair	Receiver differential pair, U.2 Lane 0
E15	Ground	Ground	Ground
E16	HPT1	Output	Host port type
E17	U.2 TX p3	Diff-Pair	Transmitter differential pair, U.2 Lane 3
E18	U.2 TX n3	Diff-Pair	Transmitter differential pair, U.2 Lane 3
E19	Ground	Ground	Ground
E20	U.2 RX n3	Diff-Pair	Receiver differential pair, U.2 Lane 3
E21	U.2 RX p3	Diff-Pair	Receiver differential pair, U.2 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. NVMe Command List

Admin Commands

Identifier	O/M	Supported	Command Description
00h	M	Y	Delete I/O Submission Queue
01h	M	Y	Create I/O Submission Queue
02h	M	Y	Get Log Page
04h	M	Y	Delete I/O Completion Queue
05h	M	Y	Create I/O Completion Queue
06h	M	Y	Identify
08h	M	Y	Abort
09h	M	Y	Set Feature
0Ah	M	Y	Get Feature
0Ch	M	Y	Asynchronous Event Request
0Dh	O	Y	Namespace Management
10h	O	Y	Firmware Commit
11h	O	Y	Firmware Image Download
14h	O	Y	Device Self-test
15h	O	Y	Namespace Attachment
18h	O	N	Keep Alive
19h	O	-	Directive Send
1Ah	O	-	Directive Receive
1Ch	O	-	Virtualization Management
1Dh	O	Y	NVMe-MI Send
1Eh	O	Y	NVMe-MI Receive
7Ch	O	-	Doorbell Buffer Config
80h	O	Y	Format NVM
81h	O	Y	Security Send
82h	O	Y	Security Receive
84h	O	Y	Sanitize
86h	O	-	Get LBA Status

I/O Commands

Identifier	O/M	Supported	Command Description
00h	M	Y	Flush
01h	M	Y	Write
02h	M	Y	Read
04h	O	Y	Write Uncorrectable
05h	O	Y	Compare
08h	O	Y	Write Zeroes
09h	O	Y	Dataset Management (Trim only)
0Ch	O	Y	Verify

0Dh	O	Y	Reservation Register
0Eh	O	Y	Reservation Report
11h	O	Y	Reservation Acquire
15h	O	Y	Reservation Release

Set Feature Commands

Identifier	O/M	Supported	Command Description
00h	-	-	Reserved
01h	M	Y	Arbitration
02h	M	Y	Power Management
03h	O	-	LBA Range Type
04h	M	Y	Temperature Threshold
05h	M	Y	Error Recovery
06h	O	Y	Volatile Write Cache
07h	M	Y	Number Of Queues
08h	M	Y	Interrupt Coalescing
09h	M	Y	Interrupt Vector Configuration
0Ah	M	Y	Write Atomicity Normal
0Bh	M	Y	Asynchronous Event Configuration
0Ch	O	-	Autonomous Power State Transition
0Dh	O	-	Host Memory Buffer
0Eh	O	Y	Timestamp
0Fh	O	Y	Keep Alive Timer
10h	O	-	Host Controlled Thermal Management
11h	O	-	Non-Operational Power State Config
12h	O	-	Read Recovery Level Config
13h	O	-	Predictable Latency Mode Config
14h	O	-	Predictable Latency Mode Window
15h	O	-	LBA Status Information Attributes
16h	O	-	Host Behavior Support
17h	O	Y	Sanitize Config
18h	O	-	Endurance Group Event Configuration
19h - 77h	-	-	Reserved (NVMe Reserved)
78h – 7Dh	-	-	Reserved(NVMe MI Reserved)
7Eh	M	Y	Controller Metadata (NVMe MI)
7Fh	M	Y	Namespace Metadata (NVMe MI)
80h	O	-	Software Progress Marker
81h	O	Y	Host Identifier
82h	O	Y	Reservation Notification Mask
83h	O	Y	Reservation Persistence
84h	O	-	Namespace Write Protection Config

85h - BFh	-	-	Command Set Specific (Reserved)
C0h - FFh	O	-	Vendor Specific

Get Log Page Commands

Identifier	O/M	Supported	Command Description
00h	-	-	Reserved
01h	M	Y	Error Information
02h	M	Y	SMART / Health Information
03h	M	Y	Firmware Slot Information
04h	O	Y	Changed Namespace List
05h	O	Y	Commands Supported and Effects
06h	O	Y	Device Self-test
07h	O	Y	Telemetry Host-Initiated
08h	O	Y	Telemetry Controller-Initiated
09h	O	-	Endurance Group Information
0Ah	O	-	Predictable Latency Per NVM Set
0Bh	O	-	Predictable Latency Event Aggregate
0Ch	O	-	Asymmetric Namespace Access
0Dh	O	Y	Persistent Event Log
0Eh	O	-	LBA Status Information
0Fh	O	-	Endurance Group Event Aggregate
10h - 7Fh	-	-	Reserved
80h	O	Y	Reservation Notification
81h	O	Y	Sanitize Status
82h - FFh	-	-	Reserved

NVMe Management Interface Commands

Identifier	O/M	Supported	Command Description
00h	M	Y	Read NVMe-MI Data Structure
01h	M	Y	NVM Subsystem Health Status Poll
02h	M	Y	Controller Health Status Poll
03h	M	Y	Configuration Set
04h	M	Y	Configuration Get
05h	M	Y	VPD Read
06h	M	Y	VPD Write
07h	M	Y	Reset
08h	-	-	SES Receive
09h	-	-	SES Send
0Ah	O	-	Management Endpoint Buffer Read
0Bh	O	-	Management Endpoint Buffer Write
0Ch - BFh	O	-	Reserved

C0h - FFh	O	-	Vendor Specific

1. “Y” means “Support”.
2. “O” means “Option, default No support”.
3. “-” means “No support”.

7. SMART Atrributes

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)
[219:216]	4	Thermal Management Temperature 1 Transition Count
[223:220]	4	Thermal Management Temperature 2 Transition Count
[227:224]	4	Total Time For Thermal Management Temperature 1 (seconds)
[231:228]	4	Total Time For Thermal Management Temperature 2 (seconds)
[511:232]	280	Reserved

8. System Power Consumption

■ Supply Voltage

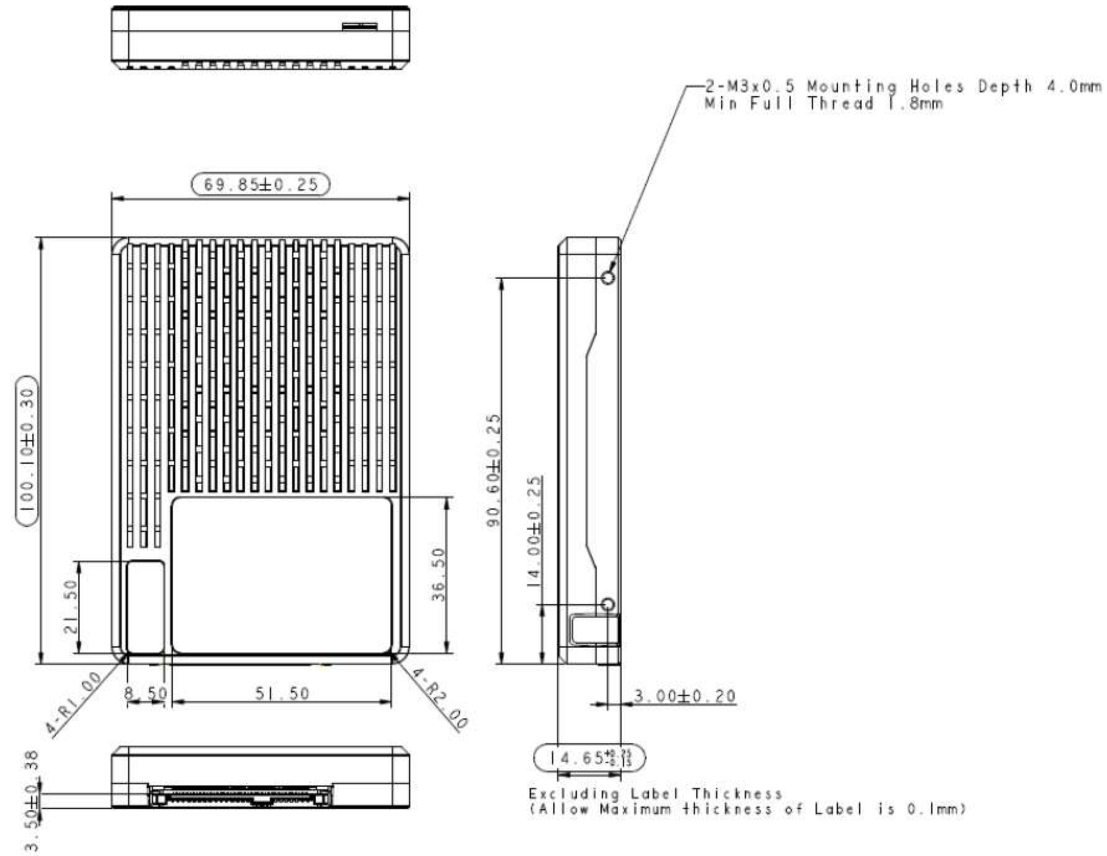
Parameter	Rating
Operating Voltage	12.0V ± 5%

■ Power Consumption

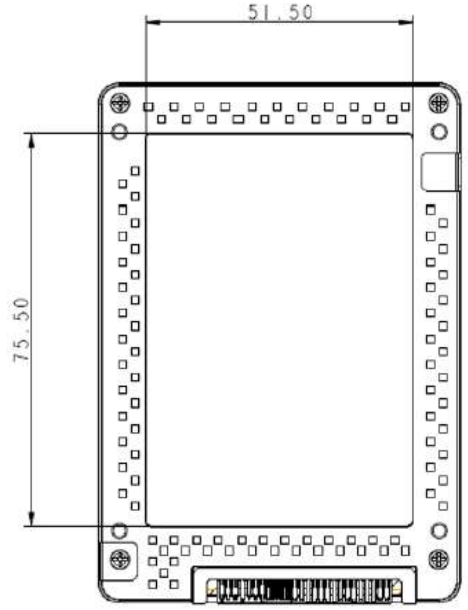
Unit (W)		Sequential		Random		Idle
		Read	Write	Read	Write	
3D TLC (V6)	1920 GB	9.6	12.2	11.8	11.4	5.2
	3840 GB	10.1	17.1	12.7	14.8	5.6
	7680 GB	11.1	18.2	15.0	16.6	5.5
	15360 GB	11.7	19.1	15.4	18.7	7.0

9. Physical Dimension

U.3 SSD (Unit: mm)



(Top View)



(Bottom View)

Appendix: Part Number Table

Product	Advantech PN
SQF EU-1 NVMe U.3 SSD (OPAL) DWPD 1, 1920G 3D TLC (V6) (0~70°C)	SQF-CU3G8D1K9GDU1C
SQF EU-1 NVMe U.3 SSD (OPAL) DWPD 1, 3840G 3D TLC (V6) (0~70°C)	SQF-CU3GFD3K8GDU1C
SQF EU-1 NVMe U.3 SSD (OPAL) DWPD 1, 7680G 3D TLC (V6) (0~70°C)	SQF-CU3GFD7K6GDU1C
SQF EU-1 NVMe U.3 SSD (OPAL) DWPD 1, 15360G 3D TLC (V6) (0~70°C)	SQF-CU3GGD15T3DU1C