

M.2 2280 SATA SSD 840F Datasheet

(SQFFSM8xx-xxxxDSCC)

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Revision History

Rev.	Date	History
1.0	2024/8/23	1. Preliminary

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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:!
 - 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, DÉJETEZ LES PILES UTILISÉES SELON LES INSTRUCTIONS DU FABRICANT.**

Specifications subject to change without notice, contact your sales representatives for the most update information.

1. Overview

Advantech SQFlash 840F series M.2 2280 SATA SSD delivers all the advantages of flash disk technology with Serial ATA I/II/III interface and is fully compliant with the standard Next Generation Form Factor (NGFF) called M.2 Card Format. SQFlash 840F M.2 2280 offers a wide range of capacities up to 2,048GB and its performance can reach up to 550MB/s (for read) and 530MB/s (for Write) based on KIOXIA BiCS5 TLC NAND flash with the choice of 512MB DDR4. Moreover, the power consumption of SQFlash 840F M.2 2280 is much lower than traditional hard drives, making it the best embedded solution for new platforms.

2. Features

■ Standard SATA interface

- Support SATA 1.5/3.0/6.0 Gbps interface
- SATA Revision 3.2 compliant

■ Operating Voltage : 3.3V

■ Support LDPC with RAID ECC

■ TRIM 、 AHCI 、 AES256 and TCG OPAL supported

■ Temperature Ranges

- Commercial Temperature¹
 - 0°C to 70°C for operating
 - -40°C to 85°C for storage

Note: 1. Based on SMART Attribute C2h, which measured by thermal sensor

■ Mechanical Specification

- Shock : 1,500G / 0.5ms
- Vibration : 20G / 80~2,000Hz

■ Humidity

- Humidity : Up to 95% under 55°C

■ Physical Anti temper

- Coating on PCBA

■ Acquired RoHS 、 WHQL 、 CE 、 FCC Certificate

■ Acoustic : 0 dB

■ Dimension : 80.8 mm x 22.0 mm x 3.8 mm

3. Specification Table

■ Performance

		Sequential Performance (MB/sec)		Random Performance (IOPS @4K)	
		Read	Write	Read	Write
3D TLC	256 GB	550.0	530.0	94K	90K
	512 GB	550.0	530.0	98K	89K
	1 TB	550.0	530.0	98K	89K
	2 TB	550.0	530.0	98K	89K

* Subject to change based on firmware migration

■ 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.

$$TBW = [(NAND\ Endurance) \times (SSD\ Capacity)] / WAF$$

- **NAND Endurance:** Program / Erase cycle of a NAND flash.
 - 3D TLC (BiCS5): 3,000 cycles
- **SSD Capacity:** 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 New JEDEC 219 Client Workload and verified with following workload conditions,**
 - PreCond%full = 100%
 - Trim commands enabled
 - Random data pattern.

3D TLC	TBW	DWPD*
256 GB	270	0.96
512 GB	640	1.14
1 TB	1380	1.23
2 TB	3000	1.33

Notes :

1. Endurance of 1 drive writes per day (DWPD) for 3 years
2. TBW may differ according to flash configuration and platform.
3. 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.

4. General Description

■ Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, SQFlash 840F series SSD applies the LDPC with RAID 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.

■ Power Loss Protection

– Flush Manager

Power Loss Protection is a mechanism to prevent data loss during unexpected power failure. DRAM is a volatile memory and frequently used as temporary cache or buffer between the controller and the NAND flash to improve the SSD performance. However, one major concern of the DRAM is that it is not able to keep data during power failure. Accordingly, SQFlash SSD applies the Flush Manager technology, only when the data is fully committed to the NAND flash will the controller send acknowledgement (ACK) to the host. Such implementation can prevent false-positive performance and the risk of power cycling issues.

In addition, it is critical for a controller to shorten the time the in-flight data stays in the controller internal cache. Thus, SQFlash applies an algorithm to reduce the amount of data resides in the cache to provide a better performance. With Flush Manager, incoming data would only have a “pit stop” in the cache and then move to NAND flash directly. Also, the onboard DDR will be treated as an “organizer” to consolidate incoming data into groups before written into the flash to improve write amplification.

■ TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid-state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks all the time.

■ 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 overheating. 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.

5. Security Features

■ **Advanced Encryption Standard (AES)**

An AES 256-bit encryption key is generated in the drive's security controller before the data got stored on the NAND flash. When the controller or firmware fails, the data that is securely stored in the encryption key becomes inaccessible through the NAND flash.

■ **TCG-OPAL 2.0 Compliance**

TCG-OPAL compliance SED (Self-encryption Drive) supports a built-in shadow MBR to process user authentication to SSD before booting to normal MRR area and OS. SQFlash 840F series supports such feature with 100% TCG-OPAL compliance. Further, with SQFlash Flash Lock function, the user authentication process in shadow MBR can be done automatically by bonding with motherboard unique ID such as UUID in BIOS / MAC address / TPM unique code. So with Flash Lock enabled, only designated motherboard can have access to the SSD.

6. Pin Assignment and Description

Pin #	SATA Pin	Description
1	CONFIG_3 = GND	Ground
2	3.3V	Supply pin
3	GND	Ground
4	3.3V	Supply pin
5	N/C	No Connect
6	N/C	No Connect
7	N/C	No Connect
8	N/C	No Connect
9	N/C or GND ^{Note}	No Connect or Ground
10	DAS/DSS# (O) (OD)	Status indicators via LED devices that will be provided by the system Active Low. A pulled-up LED with series current limiting resistor should allow for 9mA when On.
11	N/C	No Connect
12	Module Key	
13	Module Key	
14	Module Key	
15	Module Key	
16	Module Key	
17	Module Key	
18	Module Key	
19	Module Key	
20	N/C	No Connect
21	CONFIG_0 = GND	Ground
22	N/C	No Connect
23	N/C	No Connect
24	N/C	No Connect
25	N/C	No Connect
26	N/C	No Connect
27	GND	Ground
28	N/C	No Connect
29	N/C	No Connect
30	N/C	No Connect
31	N/C	No Connect
32	N/C	No Connect
33	GND	Ground
34	N/C	No Connect
35	N/C	No Connect
36	N/C	No Connect
37	N/C	No Connect

38	DEVSLP (I)	Device Sleep, Input. When driven high the host is informing the SSD to enter a low power state
39	GND	Ground
40	N/C	No Connect
41	SATA-B+	SATA differential signals in the SATA specification
42	N/C	No Connect
43	SATA-B-	SATA differential signals in the SATA specification
44	N/C	No Connect
45	GND	Ground
46	N/C	No Connect
47	SATA-A-	SATA differential signals in the SATA specification
48	N/C	No Connect
49	SATA-A+	SATA differential signals in the SATA specification
50	N/C	No Connect
51	GND	Ground
52	N/C	No Connect
53	N/C	No Connect
54	N/C	No Connect
55	N/C	No Connect
56	Reserved for MFG Data	No Connect
57	GND	Ground
58	Reserved for MFG Clock	No Connect
59	Module Key	
60	Module Key	
61	Module Key	
62	Module Key	
63	Module Key	
64	Module Key	
65	Module Key	
66	Module Key	
67	N/C	No Connect
68	SUSCLK (I) (0/3.3V)	No Connect
69	CONFIG_1 = GND	Ground
70	3.3V	Supply pin
71	GND	Ground
72	3.3V	Supply pin
73	GND	Ground
74	3.3V	Supply pin
75	CONFIG_2 = GND	Ground

NOTE: N/C for Socket 2, and GND for Socket 3.

7. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command of ATA8-ACS4 SPEC

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
0	F	0040h	General configuration
1	X	*1	Number of cylinders in the default CHS translation
2	F	C837h	Specific configuration
3	X	0010h	Number of heads in the default CHS translation
4..5	X	0000h	Retired
6	X	003Fh	Number of sectors per track in the default CHS translation
7..8	X	0000h	Reserved for CFA
9	X	0000h	Retired
10..19	V	ASCII	Serial number
20..21	X	0000h	Retired
22	X	0000h	Obsolete
23..26	V	ASCII	Firmware revision
27..46	V	ASCII	Model number
47	X	8010h	READ/WRITE MULTIPLE commands function
48	F	4001h	Bit 0: Trusted Computing feature set options
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51..52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	*1	Number of current logical cylinders
55	X	0010h	Number of current logical heads
56	X	003Fh	Number of current sectors per track
57..58	X	*2	Current capacity in sectors
59	V	0110h	Multiple sector setting
60..61	V	*3	Total number of user addressable logical sectors for 28-bit commands
62	X	0000h	Obsolete
63	V	0407h	Multiword DMA transfer modes
64	F	0003h	Advanced PIO modes modes
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	Manufacturer's recommended Multiword DMA transfer cycle time
67	F	0078h	Minimum PIO transfer cycle time without flow control
68	F	0078h	Minimum PIO transfer cycle time with IORDY flow control
69	F	5F30h	Bit 4: Device Encrypts All User data
70..74	X	0000h	Bit 9: Set max password(support)
75	F	001Fh	Reserved
76	V	E50Eh	Serial SATA capabilities

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
77	V	0006h	Serial ATA Additional Capabilities
78	V	004Ch	Serial ATA features supported
79	F	0040h	Serial ATA features enabled
80	F	07F8h	Major version number
81	F	0000h	Minor version number
82	F	746Bh	Commands and feature sets supported
83	F	7D09h	Commands and feature sets supported
84	F	4063h	WWN
85	F	7469h	Commands and feature sets supported or enabled
86	F	BC09h	Commands and feature sets supported or enabled
87	F	4063h	WWN
88	F	007Fh	Ultra DMA Modes
89	F	0001h	Time required for Normal Erase mode SECURITY ERASE UNIT command
90	F	0001h	Time required for Enhanced Erase mode SECURITY ERASE UNIT command
91	F	00FEh	Current APM (advanced power management) level value
92	F	FFFEh	Master password identifier
93	F	0000h	Hardware reset result.
94	X	0000h	Obsolete
95	F	0000h	Stream Minimum Request Size
96	F	0000h	Streaming Transfer Time – DMA
97	F	0000h	Streaming Access Latency – DMA and PIO
98..99	F	0000h	Streaming Performance Granularity
100..103	V	*4	Number of User Addressable Logical Sectors
104	F	0000h	Streaming Transfer Time – PIO
105	F	0008h	Maximum number of 512-byte blocks per DATA SET MANAGEMENT command
106	F	4000h	Physical sector size/Logical sector size
107	F	0000h	Inter-seek delay for ISO/IEC 7779 standard acoustic testing
108..111	V	0000h	World Wide Name
112..115	X	0000h	Reserved
116	X	0000h	Obsolete
117..118	F	0000h	Logical sector size
119	V	4019h	Commands and feature sets supported
120	V	4019h	Commands and feature sets supported or enabled
121..126	X	0000h	Reserved for expanded supported and enabled settings
127	X	0000h	Obsolete
128	F	0021h	Security status
129..159	V	0000h	Vendor specific
160..167	X	0000h	Reserved for CFA

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
168	V	Varies	Device Nominal Form Factor
169	F	0001h	DATA SET MANAGEMENT command is support
170..173	F	0000h	Additional Product Identifier
174..175	X	0000h	Reserved
176..205	F	0000h	Current media serial number
206	V	0000h	SCT Command Transport
207..208	X	0000h	Reserved
209	F	4000h	Alignment of logical sectors within a physical sector
210..211	F	0000h	Write-Read-Verify Sector Mode 3 Count
212..213	F	0000h	Write-Read-Verify Sector Mode 2 Count
214..216	X	0000h	Obsolete
217	F	0001h	Nominal media rotation rate
218	X	0000h	Reserved
219	X	0000h	Obsolete
220	V	0000h	Current mode of the Write-Read-Verify feature set
221	X	0000h	Reserved
222	V	107Fh	Transport major version number
223	F	0000h	Transport minor version number
224..229	X	0000h	Reserved
230..233	F	0000h	Extend Number of User Addressable Sectors
234	F	0001h	Minimum number of 512-byte data blocks per Download Microcode operation
235	F	0400h	Maximum number of 512-byte data blocks per Download Microcode operation
236..252	X	0000h	Reserved
253	X	0001h/0003h	[specific] Bit 0: FIPS Firmware Bit 1: FIPS mode
254	X	0000h	Reserved
255	V	XXA5h	Integrity word (checksum and signature)

Capacity (GB)	*1 (Word 1/Word 54)	*2 (Word 57 – 58)	*3 (Word 60 – 61)	*4 (Word 100 – 103)
256	3FFFh	FBFC10h	FFFFFFFh	1DCF32B0h
512	3FFFh	FBFC10h	FFFFFFFh	3B9E12B0h
1024	3FFFh	FBFC10h	FFFFFFFh	773BD2B0h
2048	3FFFh	FBFC10h	FFFFFFFh	EE7752B0h

8. ATA Command Set

[Command Set List]

The following ATA command list table is followed by ATA8-ACS4 SPEC

Op-Code	Support	Command Description	Op-Code		Support	Command Description
00h	Y	NOP	B6h	12h	-	NV Cache: QUERY NV CACHE PINNED SET DMA EXT
03h	-	CFA REQUEST EXTENDED ERROR	B6h	13h	-	NV Cache: QUERY NV CACHE MISSES DMA EXT
06h	Y	DATA SET MANAGEMENT	B6h	14h	-	NV Cache: FLUSH NV CACHE
08h	-	DEVICE RESET	C4h		Y	READ MULTIPLE
0Bh	-	REQUEST SENSE DATA EXT	C5h		Y	WRITE MULTIPLE
10h	Y	RECALIBRATE	C6h		Y	SET MULTIPLE MODE
11h-1Fh	-	RECALIBRATE	C7h		-	READ DMA QUEUED
20h	Y	READ SECTOR(S)	C8h		Y	READ DMA
21h	Y	READ SECTOR(S) WITHOUT RETRY	C9h		Y	READ DMA WITHOUT RETRY
22h	-	READ LONG	CAh		Y	WRITE DMA
23h	-	READ LONG WITHOUT RETRY	CBh		Y	WRITE DMA WITHOUT RETRY
24h	Y	READ SECTOR(S) EXT	CCh		-	WRITE DMA QUEUED
25h	Y	READ DMA EXT	CDh		-	CFA WRITE MULTIPLE WITHOUT ERASE
26h	-	READ DMA QUEUED EXT	CEh		Y	WRITE MULTIPLE FUA EXT
27h	Y	READ NATIVE MAX ADDRESS EXT	D1h		-	CHECK MEDIA CARD TYPE
29h	Y	READ MULTIPLE EXT	DAh		-	GET MEDIA STATUS
2Ah	-	READ STREAM DMA EXT	DEh		-	MEDIA LOCK
2Bh	-	READ STREAM EXT	DFh		-	MEDIA UNLOCK
2Fh	Y	READ LOG EXT	E0h		Y	STANDBY IMMEDIATE
30h	Y	WRITE SECTOR(S)	E1h		Y	IDLE IMMEDIATE
31h	Y	WRITE SECTOR(S) WITHOUT RETRY	E2h		Y	STANDBY
32h	-	WRITE LONG	E3h		Y	IDLE
33h	-	WRITE LONG WITHOUT RETRY	E4h		Y	READ BUFFER
34h	Y	WRITE SECTOR(S) EXT	E5h		Y	CHECK POWER MODE
35h	Y	WRITE DMA EXT	E6h		Y	SLEEP
36h	-	WRITE DMA QUEUED EXT	E7h		Y	FLUSH CACHE
37h	Y	SET MAX ADDRESS EXT	E8h		Y	WRITE BUFFER
38h	-	CFA WRITE SECTORS WITHOUT ERASE	E9h		Y	READ BUFFER DMA
39h	Y	WRITE MULTIPLE EXT	EAh		Y	FLUSH CACHE EXT
3Ah	-	WRITE STREAM DMA EXT	EBh		Y	WRITE BUFFER DMA
3Bh	-	WRITE STREAM EXT	ECh		Y	IDENTIFY DEVICE
3Ch	-	WRITE VERIFY	EDh		-	MEDIA EJECT
3Dh	Y	WRITE DMA FUA EXT	EEh		-	IDENTIFY DEVICE DMA
3Eh	-	WRITE DMA QUEUED FUA EXT	EFh	01h	-	SET FEATURES: Enable 8-bit PIO transfer mode (CFA

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						feature set only)	
Op-Code	Support	Command Description	Op-Code	Support	Command Description	Op-Code	
3Fh	Y	WRITE LOG EXT	EFh	02h	Y	SET FEATURES: Enable write cache	
40h	Y	READ VERIFY SECTOR(S)	EFh	03h	Y	SET FEATURES: Set transfer mode based on value in Count field	
41h	Y	READ VERIFY SECTOR(S) WITHOUT RETRY	EFh	05h	Y	SET FEATURES: Enable advanced power management	
42h	Y	READ VERIFY SECTOR(S) EXT	EFh	06h	-	SET FEATURES: Enable Power-Up In Standby feature set	
44h	-	Reserved	EFh	07h	-	SET FEATURES: Power-Up In Standby feature set device spin-up	
45h	O	WRITE UNCORRECTABLE EXT	EFh	0Ah	-	SET FEATURES: Enable CFA power mode 1	
47h	Y	READ LOG DMA EXT	EFh	0Bh	-	SET FEATURES: Enable Write-Read-Verify feature set	
50h	-	FORMAT TRACK	EFh	10h	01h	-	SET FEATURES: Enable use of Serial ATA feature
51h	-	CONFIGURE STREAM	EFh	10h	02h	Y	SET FEATURES: Enable DMA Setup FIS Auto-Activate optimization
57h	Y	WRITE LOG DMA EXT	EFh	10h	03h	Y	SET FEATURES: Enable Device-initiated interface power state (DIPM) transitions
60h	Y	READ FPDMA QUEUED	EFh	10h	04h	-	SET FEATURES: Enable use of Serial ATA feature
61h	Y	WRITE FPDMA QUEUED	EFh	10h	05h	-	SET FEATURES: Enable use of Serial ATA feature
70h	Y	SEEK	EFh	10h	06h	O	SET FEATURES: Enable Software Settings Preservation (SSP)
71-76h	-	SEEK	EFh	10h	07h	Y	SET FEATURES: Enable Device Automatic Partial to Slumber transitions
77h	Y	SET DATE AND TIME EXT	EFh	10h	09h	O	SET FEATURES: Enable Device Sleep
79-7Fh	-	SEEK	EFh	43h	-	-	SET FEATURES: Set Maximum Host Interface Sector Times
87h	-	CFA TRANSLATE SECTOR	EFh	44h	-	-	SET FEATURES: Vendor Specific ECC byte
90h	Y	EXECUTE DEVICE DIAGNOSTIC	EFh	55h	Y	-	SET FEATURES: Disable read look-ahead feature
91h	Y	INITIALIZE DEVICE PARAMETERS	EFh	5Dh	-	-	SET FEATURES: Enable release interrupt
92h	Y	DOWNLOAD MICROCODE	EFh	5Eh	-	-	SET FEATURES: Enable service interrupt
93h	Y	DOWNLOAD MICROCODE DMA	EFh	5Fh	-	-	SET FEATURES: Enable NDRQ Feature
94h	-	STANDBY IMMEDIATE	EFh	66h	Y	-	SET FEATURES: Disable reverting to power-on defaults

Specifications subject to change without notice, contact your sales representatives for the most update information.

95h		-	IDLE IMMEDIATE	EFh	81h		-	SET FEATURES: Disable 8-bit PIO transfer mode (CFA feature set only)
96h		-	STANDBY	EFh	82h		Y	SET FEATURES: Disable write cache
97h		-	IDLE	EFh	85h		Y	SET FEATURES: Disable advanced power management
98h		-	CHECK POWER MODE	EFh	86h		-	SET FEATURES: Disable Power-Up In Standby feature set
99h		-	SLEEP	EFh	8Ah		-	SET FEATURES: Disable CFA power mode
A0h		-	PACKET	EFh	8Bh		-	SET FEATURES: Disable Write-Read-Verify feature set
A1h		-	IDENTIFY PACKET DEVICE	EFh	90h	01h	-	SET FEATURES: Disable use of Serial ATA feature
A2h		-	SERVICE	EFh	90h	02h	Y	SET FEATURES: Disable DMA Setup FIS Auto-Activate optimization
B0h	D0h	Y	SMART: READ DATA	EFh	90h	03h	Y	SET FEATURES: Disable Device-initiated interface power state (DIPM) transitions
B0h	D1h	Y	SMART: READ ATTRIBUTE THRESHOLDS	EFh	90h	04h	-	SET FEATURES: Disable use of Serial ATA feature
B0h	D2h	Y	SMART: ENABLE/DISABLE AUTOSAVE	EFh	90h	05h	-	SET FEATURES: Disable use of Serial ATA feature
B0h	D3h	Y	SMART: SAVE ATTRIBUTE VALUES	EFh	90h	06h	Y	SET FEATURES: Disable Software Settings Preservation (SSP)
B0h	D4h	Y	SMART: EXECUTE OFF-LINE IMMEDIATE	EFh	90h	07h	Y	SET FEATURES: Disable Device Automatic Partial to Slumber transitions
B0h	D5h	Y	SMART: READ LOG	EFh	90h	09h	O	SET FEATURES: Disable Device Sleep
B0h	D6h	Y	SMART: WRITE LOG	EFh	AAh		Y	SET FEATURES: Enable read look-ahead feature
B0h	D8h	Y	SMART: ENABLE OPERATIONS	EFh	BBh		-	SET FEATURES: Default ECC byte
B0h	D9h	Y	SMART: DISABLE OPERATIONS	EFh	C2h		-	SET FEATURES: Disable Automatic Acoustic Management feature set
B0h	DAh	Y	SMART: RETURN STATUS	EFh	C3h		-	SET FEATURES: Enable/Disable the Sense Data Reporting feature set
B0h	DBh	Y	SMART: ENABLE/DISABLE AUTOMATIC OFF-LINE	EFh	CCh		Y	SET FEATURES: Enable reverting to power-on defaults
B0h	E0h	-	SMART: Vendor specific	EFh	DDh		-	SET FEATURES: Disable release interrupt
B1h	C0h	Y	DEVICE CONFIGURATION: RESTORE	EFh	DEh		-	SET FEATURES: Disable SERVICE interrupt
B1h	C1h	Y	DEVICE CONFIGURATION: FREEZE LOCK	EFh	DFh		-	SET FEATURES: Disable NDRQ Feature
B1h	C2h	Y	DEVICE CONFIGURATION: IDENTIFY	F1h			non-FIPS	SECURITY SET PASSWORD

Specifications subject to change without notice, contact your sales representatives for the most update information.

B1h	C3h	Y	DEVICE CONFIGURATION: SET	F2h		non-FIPS	SECURITY UNLOCK
B1h	C4h	Y	DEVICE CONFIGURATION: IDENTIFY DMA	F3h		non-FIPS	SECURITY ERASE PREPARE
B1h	C5h	Y	DEVICE CONFIGURATION: SET DMA	F4h		non-FIPS	SECURITY ERASE UNIT
B4h	0000h	-	SANITIZE DEVICE: SANITIZE STATUS EXT	F5h		non-FIPS	SECURITY FREEZE LOCK
B4h	0011h	-	SANITIZE DEVICE: CRYPTO SCRAMBLE EXT	F6h		non-FIPS	SECURITY DISABLE PASSWORD
B4h	0012h	-	SANITIZE DEVICE: BLOCK ERASE EXT	F8h		Y	READ NATIVE MAX ADDRESS
B4h	0014h	-	SANITIZE DEVICE: OVERWRITE EXT	F9h	00h	Y	SET MAX: SET MAX ADDRESS
B4h	0020h	-	SANITIZE DEVICE: SANITIZE FREEZE LOCK EXT	F9h	01h	Y	SET MAX: SET MAX PASSWORD
B4h	0040h	-	SANITIZE DEVICE: SANITIZE ANTIFREEZE LOCK EXT	F9h	02h	Y	SET MAX: SET MAX LOCK
B6h	00h	-	NV Cache: SET NV CACHE POWER MODE EXT	F9h	03h	Y	SET MAX: SET MAX UNLOCK
B6h	01h	-	NV Cache: RETURN FROM NV CACHE POWER MODE EXT	F9h	04h	Y	SET MAX: SET MAX FREEZE LOCK
B6h	10h	-	NV Cache: ADD LBA(S) TO NV CACHE PINNED SET DMA EXT	F9h	05h	Y	SET MAX: SET MAX SET PASSWORD DMA
B6h	11h	-	NV Cache: REMOVE LBA(S) FROM NV CACHE PINNED SET DMA EXT	F9h	06h	Y	SET MAX: SET MAX UNLOCK DMA

Note: "Y" = "Support"

"O" = "Option, default No support"

"-" = "No support"

"non-FIPS" = "only supported when in non-FIPS mode"

9. System Power Consumption

9.1 Supply Voltage

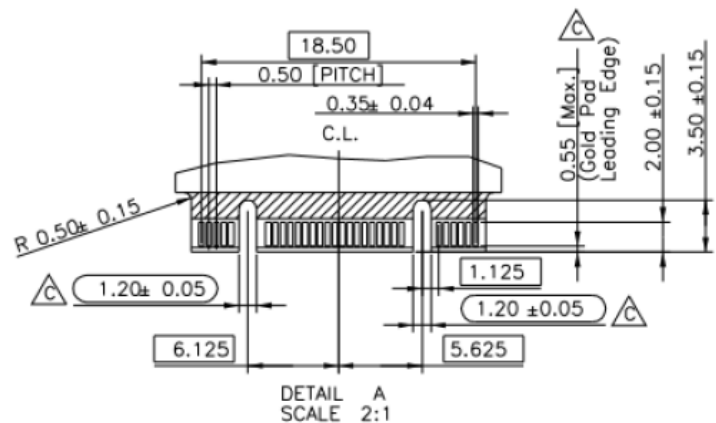
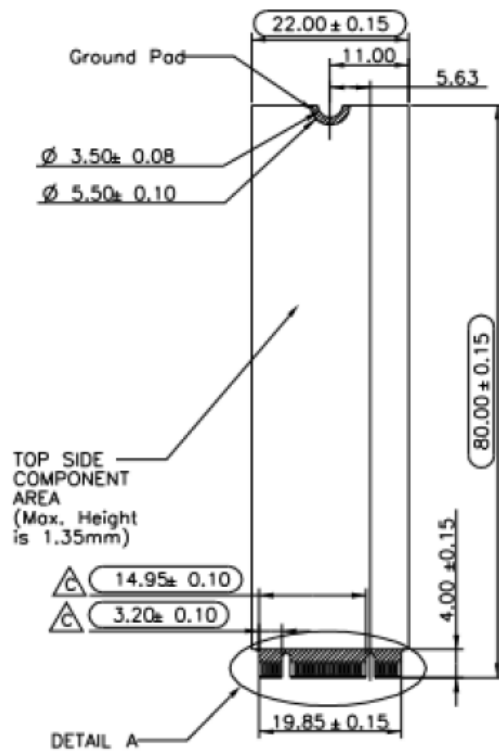
Parameter	Rating
Operating Voltage	3.3V +/- 5%
Rise Time (Max/Min)	100 ms / 0.1 ms
Fall Time (Max/Min)	5 s / 1 ms

9.2 Power Consumption

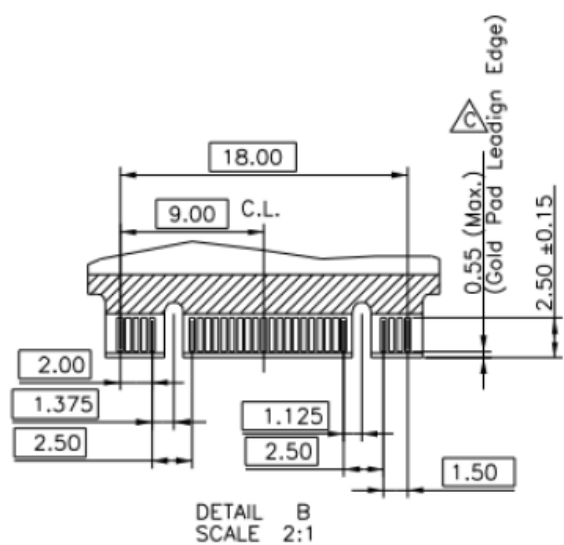
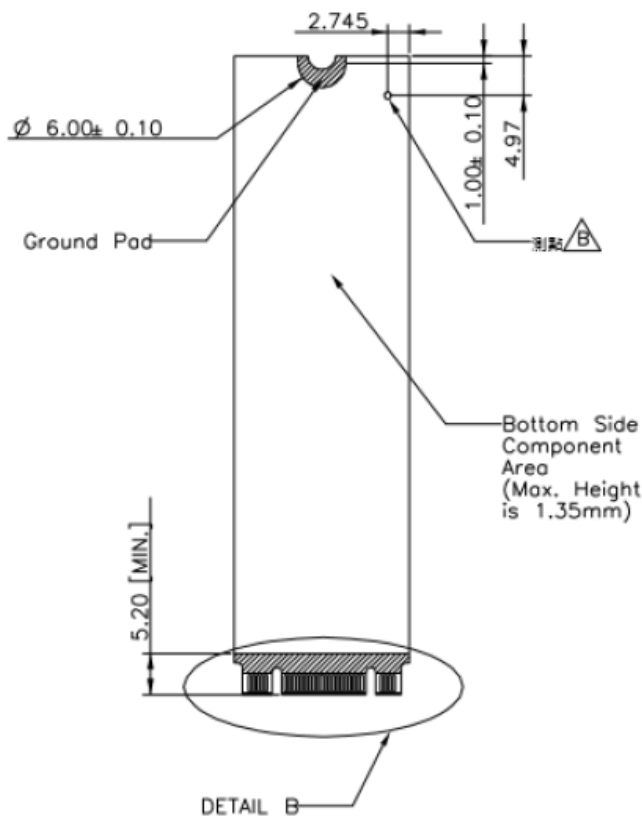
(Unit: mW)		Read	Write	Idle	Slumber
3D TLC	256 GB	1,900	1,700	100	20
	512 GB	1,900	1,700	105	20
	1 TB	2,000	1,800	105	20
	2 TB	2,000	1,800	110	20

10. Physical Dimension

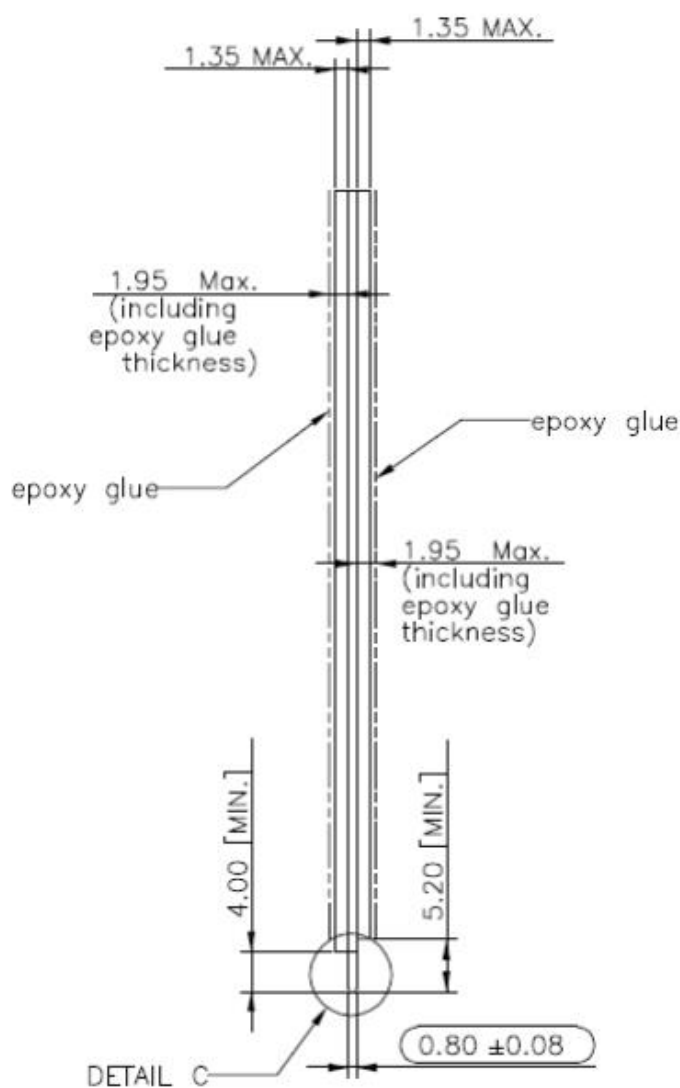
M.2 2280 SATA SSD (Unit: mm)



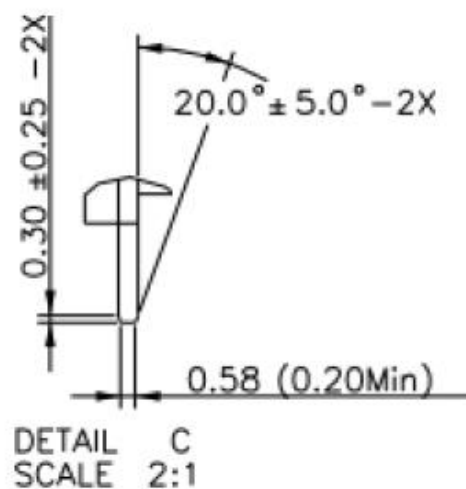
(Top View)



(Bottom View)



(Side View)



Appendix: Part Number Table

Product	Advantech PN
SQF M.2 2280 SATA SSD FIPS 840F 256G 3D TLC BiCS5 (0~70°C)	SQFFSM8V2-256GDSCC
SQF M.2 2280 SATA SSD FIPS 840F 512G 3D TLC BiCS5 (0~70°C)	SQFFSM8V2-512GDSCC
SQF M.2 2280 SATA SSD FIPS 840F 1024G 3D TLC BiCS5 (0~70°C)	SQFFSM8V4-1TDSCC
SQF M.2 2280 SATA SSD FIPS 840F 2048G 3D TLC BiCS5 (0~70°C)	SQFFSM8V4-2TDSCC