DELKIN DEVICES®

M.2 2280
SATA III Industrial
Solid State Drive

Engineering Specification

Document Number: 401-0580-00

Revision: A

Product Overview

- **Capacity**
  - 128GB up to 2TB
- **SATA Interface**
  - SATA Revision 3.1
  - SATA Gen3/Gen2/Gen1 interface
- **Flash Interface**
  - Flash type: 3D TLC
- **Performance**
  - Read: up to 550 MB/s
  - Write: up to 510 MB/s
- **Power Consumption**[Note1]
  - Active mode: < 1,750 mW
  - Idle mode: < 210 mW
- **TBW (Terabytes Written)** [Note2]
  - 2TB ≥ 2900 TBW
- **MTBF**
  - More than 3,000,000 hours
- **Features**
  - Advanced Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provisioning
- **Low Power Management**
  - DIPM/HIPM Mode
  - DEVSLP Mode (Optional)
- **Temperature Range**
  - Operation: -40°C ~ 85°C
  - Storage: -40°C ~ 85°C
- **RoHS compliant**

Notes:

1. Please see “4.2 Power Consumption” for details.
2. Please see “TBW (Terabytes Written)” in Chapter 2” for details.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1. General Description

Delkin Devices' M.2 2280 Industrial 3D TLC Solid State Drive (SSD) delivers all the advantages of flash disk technology with the performance of the Serial ATA I/II/III interface and is fully compliant with the standard Next Generation Form Factor (NGFF) or M.2. Delkin's SSD draws significantly less power compared to traditional hard drives and is ideal for embedded applications. The drive is available in capacities from 128GB to 2TB and can reach speeds up to 550 MB/s read and 510MB/s write.

1.2. Product Block Diagram

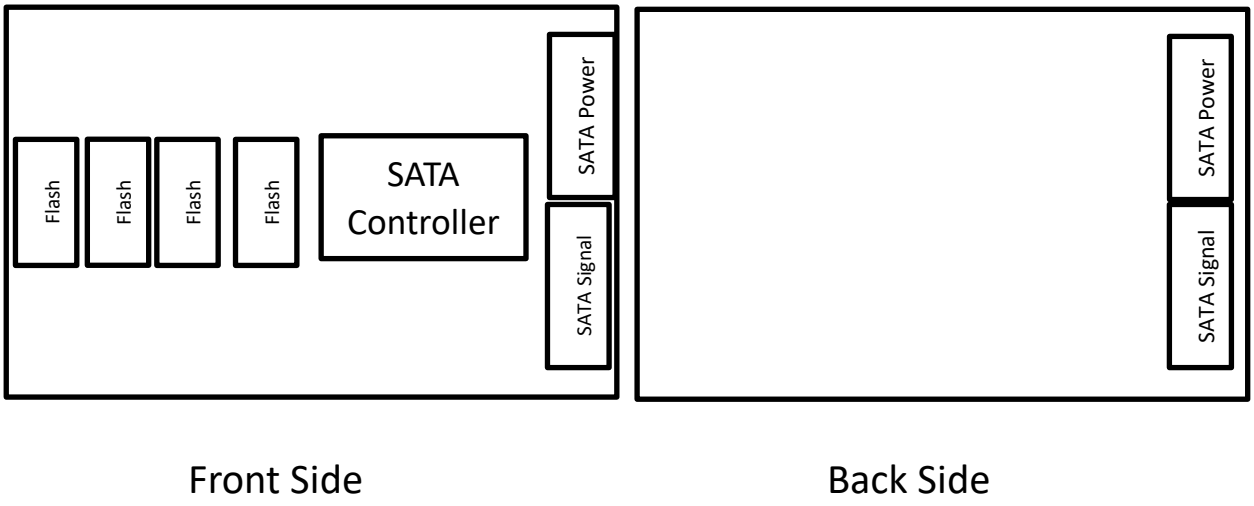


Figure 1-1 Product Block Diagram

1.3. Flash Management

1.3.1. Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, Delkin's M.2 2280 SSD utilizes a sophisticated LDPC (Low Density Parity Check) ECC algorithm, which can detect and correct errors occur during read process, ensure data been read correctly, as well as protect data from corruption.

1.3.2. 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 are 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.

Delkin utilizes advanced Wear Leveling algorithms, which can efficiently distribute 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.

1.3.3. 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 usage of the flash are named “Later Bad Blocks”. Delkin 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 data reliability.

1.3.4. 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 an erase action, which prevents unused data from occupying blocks.

1.3.5. SMART

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a 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.

1.3.6. Over-Provisioning

Over Provisioning refers to the inclusion of extra NAND capacity in a SSD, which is not visible or usable 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.

1.3.7. Firmware Upgrades

Firmware can be considered as a set of instructions on how the device communicates with the host. Firmware can be upgraded when new features are added, compatibility issues are fixed, or read/write performance gets improved, as controlled by the user. It is possible to update firmware in the field, however, there are important factors to consider before attempting a firmware upgrade. Contact Delkin technical support for more information.

1.3.8. Thermal Monitor

The purpose of thermal throttling is to prevent any components in the SSD from over-heating during read and write operations. Firmware will apply different levels of throttling to achieve the purpose of protection efficiently and proactively via SMART reading.

1.4. Low Power Management

1.4.1. DIPM/HIPM Mode

SATA interfaces contain two low power management states for power saving: Partial and Slumber modes. In Partial mode, the device must resume full operation within 10 microseconds, whereas in Slumber mode, the device has 10 milliseconds to become fully operational. SATA interfaces allow low power modes to be initiated by Host (HIPM, Host Initiated Power Management) or Device (DIPM, Device Initiated Power Management). As for HIPM, Partial or Slumber mode can be invoked directly by the software. For DIPM, the device will send requests to enter Partial or Slumber mode.

1.5. DEVSLP Mode (Optional)

With the increasing need of aggressive power/battery life, SATA interfaces include a new feature, Device Sleep (DEVSLP) mode, which helps further reduce the power consumption of the device. DEVSLP enables the device to completely power down the device PHY and other sub-systems, making the device reach a new level of lower power operation. The DEVSLP does not specify the exact power level a device can achieve in the DEVSLP mode, but the power usage can be dropped down to 5mW or less.

1.6. Advanced Device Security Features

1.6.1. Secure Erase

Secure Erase is a standard ATA command and will write “0xFF” to all cells, to fully wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will erase its storage blocks and return to its factory default settings.

1.6.2. Write Protect

When a SSD contains too many bad blocks and data is continuously written in, then the SSD may no longer be usable. Thus, Write Protect is a mechanism to prevent data from being written in and protect the accuracy of data that are already stored in the SSD.

1.7. SSD Lifetime Management

1.7.1. Terabytes Written (TBW)

TBW (Terabytes Written) is a measurement of SSDs’ expected lifespan, which represents the amount of data written to the device. To calculate the TBW of a SSD, the following equation is applied:

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

NAND Endurance: NAND endurance refers to the P/E (Program/Erase) cycle rating of NAND flash, per the manufacturer’s specification.

SSD Capacity: The SSD capacity is the specific capacity in total of a SSD.

WLE: Wear Leveling Efficiency (WLE) represents the ratio of the average amount of erases on all the blocks to the erases on any block at maximum.

WAF: Write Amplification Factor (WAF) is a numerical value representing the ratio between the amount of data that a SSD controller writes to the flash and the amount of data that the host’s flash controller writes. A better WAF, which is near 1, guarantees better endurance and lower frequency of data written to flash memory.

1.8. An Adaptive Approach to Performance Tuning

1.8.1. Throughput

Based on the available space of the disk, Delkin SSD controller will regulate the read/write speed and manage the throughput performance. When significant free space remains, the firmware will continuously perform read/write activity. At this stage, there is still no need to implement garbage

collection to allocate and release memory, which will accelerate read/write processing to improve the performance. However, when free space is used up, the controller will slow down the read/write processing, and implement garbage collection to release memory blocks. Hence, read/write performance will become slower.

1.8.2. Predict & Fetch

Normally, when the host tries to read data from the SSD, the SSD will only perform one read action after receiving one command. However, Delkin's controller applies ***Predict & Fetch*** to improve the read speed. When the host issues sequential read commands to the SSD, the SSD will automatically expect that the following will also be read commands. Thus, before receiving the next command, flash has already prepared the data. Accordingly, this accelerates the data processing time, and the host does not need to wait as long to receive data.

2. PRODUCT SPECIFICATIONS

- **Capacity**
  - From 128GB up to 2TB

- **Electrical/Physical Interface**
  - SATA Interface
    - Compatible with SATA Gen3 / Gen2 / Gen1 interface
    - AC coupling for transmitter and receiver
    - Self-calibrated and embedded termination resistor at transmitter
    - Support power management
    - Support expanded register for SATA protocol 48-bit addressing mode
- **ECC Scheme**
  - LDPC (Low Density Parity Check) ECC Algorithm
- **Supports SMART and TRIM commands**

- **Operation Voltage Supply**
  - 3.3V ± 5%

- **Performance**

Capacity	Sequential Performance	
	CrystalDiskMark	
	Read (MB/s)	Write (MB/s)
128GB	550	450
256GB	550	485
512GB	550	500
1TB	550	510
2TB	550	510

Notes:

1. Performance measured with CrystalDiskMark v5.0 x 64 with SATA 6Gbps host.
2. Performance may vary with host platform.
3. Table above is for reference only.

- ## Endurance - TBW (TeraBytes Written) & DWPD (Drive Writes Per Day)

Capacity	TBW	DWPD
128GB	90	0.64
256GB	220	0.78
512GB	540	0.96
1TB	1200	1.07
2TB	2900	1.29

NOTES:

1. The test followed JEDEC219A client endurance workload.
2. DWPD is calculated based on 3-year lifetime.
3. DWPD (Drive Write Per Day) = TBW/ (365 x years x User Capacity(TB))
4. The endurance of SSD is estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by the flash vendor.

- ## Part Numbers

M.2 2280 Industrial TLC SSD
Industrial Temperature (-40 to 85°C)

Capacity	Part Number
128GB	MB1HFTUM5-80000-2
256GB	MB2HFTVM5-80000-2
512GB	MB5HFTVM5-80000-2
1TB	MB1TFTVM5-80000-2
2TB	MB2TFTWM5-80000-2

3. ENVIRONMENTAL SPECIFICATIONS

3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- Temperature:
  - Storage: -40°C to 85°C
  - Operational: -40°C to 85°C

- Humidity:
  - RH 90% under 55°C (operational)

3.1.2. Shock & Vibration

- Shock Specification
  - 1500G, 0.5ms duration

- Vibration Specification
  - 20Hz ~80Hz/1.52mm displacement
  - 80Hz~2000Hz / 20G Acceleration

3.1.3. Electrostatic Discharge (ESD)

- +/- 4KV

3.1.4. EMI Compliance

- FCC : ANSI C63.4
- CE: EN 55032, CISPR32
- BSMI : CNS 13438
- VCCI : VCCI-CISPR32

3.2. MTBF

MTBF, an acronym for Mean Time Between Failures, is a measure of a device's reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device. The predicted result of Delkin's M.2 SSD is more than 3,000,000 hours.

3.3. Certification & Compliance

- RoHS

WARNING: This product may contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.p65warnings.ca.gov.

4. ELECTRICAL SPECIFICATIONS

4.1. Supply Voltage

Table 4-1 Supply Voltage

Parameter	Rating
Operating Voltage	3.3V ± 5% (3.14~3.46V)
Rise Time (Max/min)	100ms / 0.1ms
Fall Time (Max/min)	5s / 1ms
Min. Off Time	1s

NOTES:

1. The min. off time is the time between power removed from SSD (Vcc < 100mV) and power re-applied.
2. Ensure the voltage of each power domain in SSD has enough time to discharge (< 0.1V).
3. Rise time from 10% to 90% of 3.3V.
4. Fall time from 90% to 10% of 3.3V.

4.2. Power Consumption

Table 4-2 Power Consumption

Capacity	Read	Write	Partial	Slumber	Idle
128GB	1150	1250	65	25	210
256GB	1150	1350	65	25	210
512GB	1250	1600	65	27	210
1TB	1350	1750	65	27	210
2TB	1450	1750	65	27	210

Unit: mW

NOTES:

1. The average value of power consumption is achieved based on 100% conversion efficiency.
2. Measurement environment: Room temperature: 20~25℃, humidity: 40~60%RH.
3. Sequential R/W is measured while testing 4000MB sequential R/W 5 times by CrystalDiskMark.
4. Power Consumption may differ according to flash configuration, SDR configuration, and host platform.

5. INTERFACE

5.1. Pin Assignment and Descriptions

Table 5-1 defines the signal assignment of the internal NGFF connector for SSD usage, described in the PCI Express M.2 Specification, version 1.0 of the PCI-SIG.

Table 5-1 Pin Assignment and Descriptions for M.2

Pin #	SATA Pin	Description
1	CONFIG_3	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	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) (0/3.3V)	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	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	Ground

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

6. SUPPORTED COMMANDS

6.1. ATA Command List

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

Table 6-1 ATA Command List

Op Code	Description	Op Code			Description
00h	NOP	E1h			Idle Immediate
06h	Data Set Management	E2h			Standby
10h-1Fh	Recalibrate	E3h			Idle
20h	Read Sectors	E4h			Read Buffer
21h	Read Sectors without Retry	E5h			Check Power Mode
24h	Read Sectors EXT	E6h			Sleep
25h	Read DMA EXT	E7h			Flush Cache
27h	Read Native Max Address EXT	E8h			Write Buffer
29h	Read Multiple EXT	E9h			READ BUFFER DMA
2Fh	Read Log EXT	EAh			Flush Cache EXT
30h	Write Sectors	EBh			Write Buffer DMA
31h	Write Sectors without Retry	ECh			Identify Device
34h	Write Sectors EXT	EFh			Set Features
35h	Write DMA EXT	90h			Execute Device Diagnostic
37h	Set Native Max Address EXT	91h			Initialize Device Parameters
39h	Write Multiple EXT	92h			Download Microcode
3Dh	Write DMA FUA EXT	93h			Download Microcode DMA
3Fh	Write Long EXT	B0h			SMART
40h	Read Verify Sectors	EFh	02h		Enable volatile write cache
41h	Read Verify Sectors without Retry	EFh	03h		Set transfer mode
42h	Read Verify Sectors EXT	EFh	05h		Enable the APM feature set
47h	Read Log DMA EXT	EFh	10h		Enable use of SATA features et
57h	Write Log DMA EXT	EFh	10h	02h	Enable DMA Setup FIS Auto-Activate optimization
60h	Read FPDMA Queued	EFh	10h	03h	Enable Device-initiated interface power state (DIPM) transitions
61h	Write FPDMA Queued	EFh	10h	06h	Enable Software Settings Preservation (SSP)

70h-76h		Seek	EFh	10h	07h	Enable Device Automatic Partial to Slumber transitions
79h-7Fh		Seek	EFh	10h	09h	Enable Device Sleep
C9h		Read DMA without Retry	EFh	55h		Disable read look-ahead
CAh		Write DMA	EFh	66h		Disable reverting to power-on defaults
CBh		Write DMA without Retry	EFh	82h		Disable volatile write cache
CEh		Write Multiple FUA EXT	EFh	85h		Disable the APM feature set
E0h		Standby Immediate	EFh	90h		Disable use of SATA feature set
C4h		Read Multiple	EFh	90h	02h	Disable DMA Setup FIS Auto-Activate optimization
C5h		Write Multiple	EFh	90h	03h	Disable Device-initiated interface power state (DIPM) transitions
C6h		Set Multiple Mode	EFh	90h	06h	Disable Software Settings Preservation (SSP)
C8h		Read DMA	EFh	90h	07h	Disable Device Automatic Partial to Slumber transitions
B0h	D0h	SMART READ DATA	EFh	90h	09h	Disable Device Sleep
B0h	D2h 00h	SMART READ ATTRIBUTE THRESHOLDS	EFh	90h	02h	Disable DMA Setup FIS Auto-Activate optimization
B0h	D2h F1h	SMART ENABLE ATTRIBUTE AUTOSAVE	EFh	90h	03h	Disable Device-initiated interface power state (DIPM) transitions
B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE	EFh	90h	06h	Disable Software Settings Preservation (SSP)
B0h	D5h	SMART READ LOG	EFh	90h	07h	Disable Device Automatic Partial to Slumber transitions
B0h	D6h	SMART WRITE LOG	EFh	90h	09h	Disable Device Sleep
B0h	D8h	SMART ENABLE OPERATIONS	EFh	AAh		Enable read look-ahead
B0h	D9h	SMART DISABLE OPERATIONS	EFh	CCh		Enable reverting to power-on defaults
B0h	DAh	SMART RETURN STATUS	F1h			Security Set Password
B1h	C0h	DEVICE CONFIGURATION RESTORE	F2h			Security Unlock
B1h	C2h	DEVICE CONFIGURATION IDENTIFY	F3h			Security Erase Prepare
B1h	C3h	DEVICE CONFIGURATION SET	F4h			Security Erase Unit
B1h	C4h	DEVICE CONFIGURATION IDENTIFY DMA	F5h			Security Freeze Lock
B1h	C5h	DEVICE CONFIGURATION SET DMA	F6h			Security Disable Password
F9h	01h	SET MAX SET PASSWORD	F8h			Read Native Max Address
F9h	02h	SET MAXLOCK	F9h			Set Max Address
F9h	03h	SET MAX UNLOCK				
F9h	04h	SET MAX FREEZE LOCIK				

6.2. Identify Device Data

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

Table 6-2 List of Device Identification

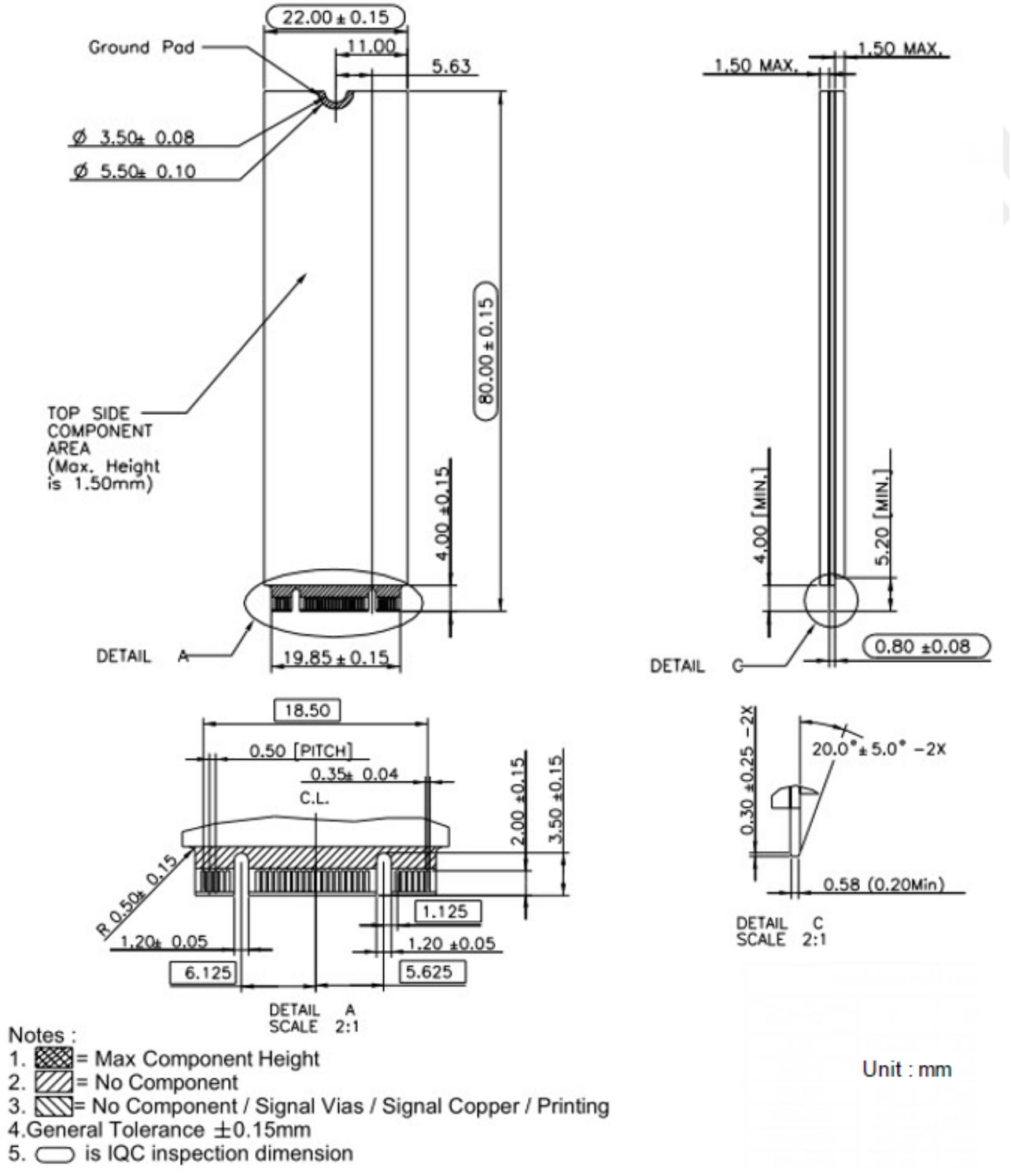
Word	F: Fixed V: Variable X: Retired / Obsolete / Reserved	Default Value	Description
0	F	0040h	General configuration bit-significant information
1	X	***1**	Obsolete
2	F	C837h	Specific configuration
3	X	***2**	Obsolete
4-5	X	0000h	Retired
6	X	***3**	Obsolete
7-8	X	0000h	Reserved for assignment by the Compact Flash Association
9	X	0000h	Retired
10-19	V	Varies	Serial number (ATA string)
20-21	X	0000h	Retired
22	X	***4**	Obsolete
23-26	V	Varies	Firmware revision (ATA string)
27-46	V	Varies	Model number (ATA string)
47	X	***5**	Obsolete
48	F	4000h	Trusted Computing feature set options
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51-52	X	***6**	Obsolete
53	F	0007h	Word 88 and 70:64 are valid
54-58	X	***7**	Obsolete
59	F	DD10h	Number of sectors transferred per interrupt on MULTIPLE commands
60-61	V	Varies	Maximum number of sector (28bit LBA mode)
62	X	***8**	Obsolete
63	F	0407h	Multiword DMA modes supported/selected
64	F	0003h	PIO mode 3 and mode 4 supported
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	9F00h	Additional Supported (support download microcode DMA)
70	X	0000h	Reserved
71-74	X	0000h	Reserved for the IDENTIFY PACKET DEVICE command
75	F	001Fh	Queue depth
76	F	C50Eh	Serial SATA capabilities
77	F	0006h	Serial ATA Additional Capabilities
78	F	004Ch	Serial ATA features supported
79	F	0040h	Serial ATA features enabled
80	F	0FF8h	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	4163h	Commands and feature sets supported
85	F	7469h	Commands and feature sets supported or enabled
86	F	BC01h	Commands and feature sets supported or enabled
87	F	4163h	Commands and feature sets supported or enabled
88	F	007Fh	Ultra DMA Modes
89	F	000Ah	Time required for Security Erase Unit command
90	F	001Eh	Time required for Security Erase Unit command
91	F	0000h	Current APM level value
92	F	FFFEh	Master Password Identifier
93	F	0000h	Hardware reset result. For SATA devices, word 93 shall be set to the value 0000h.
94	X	***9**	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	Varies	Number of User Addressable Logical Sectors
104	F	0000h	Streaming Transfer Time – PIO
105	F	0004h	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-7779 acoustic testing
108-111	V	Varies	World Wide Name
112-115	X	0000h	Reserved
116	X	***10**	Obsolete
117-118	F	0000h	Logical sector size

Word	F: Fixed V: Variable X: Retired / Obsolete / Reserved	Default Value	Description
119	F	4018h	Commands and feature sets supported
120	F	4018h	Commands and feature sets supported or enabled
121-126	X	0000h	Reserved for expanded supported and enabled settings
127	X	***11**	Obsolete
128	F	0021h	Security status
129-159	V	Varies	Vendor specific
160-167	X	0000h	Reserved for CFA
168	V	Varies	Device Nominal Form Factor
169	F	0001h	DATA SET MANAGEMENT command support
170-173	F	0000h	Additional Product Identifier
174-175	X	0000h	Reserved
176-205	F	0000h	Current media serial number
206	F	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 (not support)
212-213	F	0000h	Write-Read-Verify Sector Mode 2 Count (not support)
214-216	X	***12**	Obsolete
217	F	0001h	Nominal media rotation rate
218	X	0000h	Reserved
219	X	***13**	Obsolete
220	V	0000h	Write-Read-Verify feature set current mode
221	X	0000h	Reserved
222	F	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	FFFEh	Minimum number of 512-byte data blocks per Download Microcode operation
236-254	X	0000h	Reserved
255	F	Varies	Integrity word (Checksum and Signature) Bit[15:8] Checksum

7. PHYSICAL DIMENSIONS

Dimension: 80mm (L) x 22mm (W) x 3.8mm (H)



Notes :
1. = Max Component Height
2. = No Component
3. = No Component / Signal Vias / Signal Copper / Printing
4. General Tolerance ±0.15mm
5. is IQC inspection dimension

Unit : mm