



# Industrial M.2 2280 Specification

**(INSPIRE SERIES, 3D TLC)**

**Version 1.7**

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## 1. GENERAL DESCRIPTION

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### 1.1. Introduction

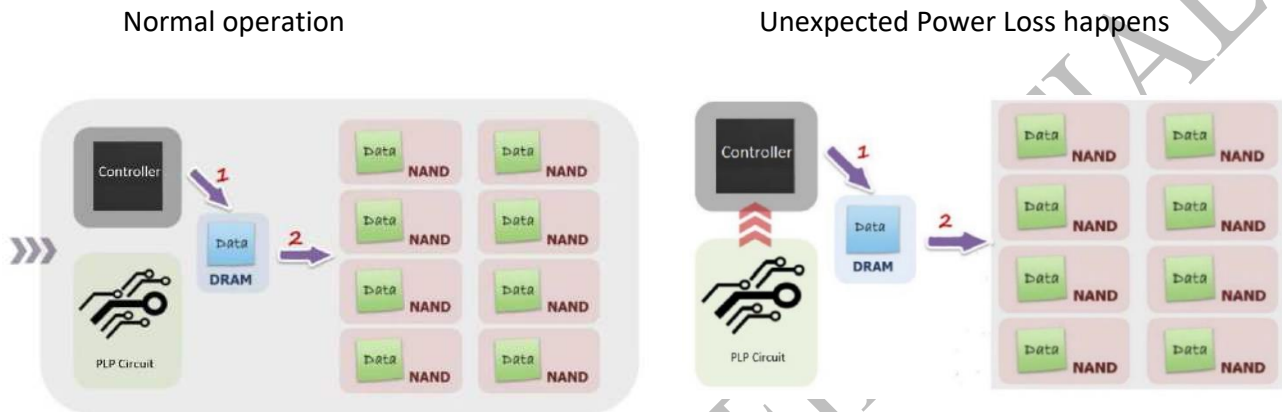
FLEXXON's INSPIRE M.2 2280 has SATA III interface, and is fully compliant with the standard Next Generation Form Factor (NGFF) called M.2 Card Format Form Factor. It supports high performance, high endurance, good compatibility and provides comprehensive data protection. It is suitable for multi-tasking application.

### 1.2. Product Overview

- ❖ **Flash**
  - 3D TLC
- ❖ **Capacity**
  - 32GB up to 2TB
- ❖ **SATA Interface**
  - Compliant with SATA Revision 3.1
  - Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
- ❖ **ECC Scheme**
  - INSPIRE M.2 2280 applies the LDPC (Low Density Parity Check) of ECC algorithm
- ❖ **UART Function**
- ❖ **GPIO**
- ❖ **Support SMART and TRIM commands**
- ❖ **Support DDR3/DDR3L External DRAM**
- ❖ **Low Power Management**
- ❖ **Power Failure Protection (Optional)**
- ❖ **Data shaping technique for enhanced data endurance**
- ❖ **Data Refresh technology for data integrity**
- ❖ **Global Wear Leveling Algorithm**
- ❖ **AES256 and TCG Opal (Optional)**
- ❖ **Temperature Range**
  - Operation (Silver) : 0°C ~ 70°C
  - Operation (Diamond) : -40°C ~ 85°C
  - Storage: -55°C ~ 95°C
- ❖ **RoHS Compliant**

### 1.3. Power Loss Protection (Optional)

FLEXON designs SSD device with a hardware power loss protection mechanism. It has a voltage drop detector, so when the SSD device detects the host power dropping, the SSD's power loss protection circuit will be triggered and begin providing power to the SSD. The SSD then will start to flush cached data from DRAM memory to NAND flash memory in order to preserve data integrity and prevent data loss.



The SSD is powered by the host power, and the power loss protection circuit is charged by the host power.

When the SSD detects the host power dropping, the power loss protection circuit starts to provide power to the SSD while it flushes cached data from DRAM to NAND.

Figure 1-1 power loss protection mechanism

## 2. PRODUCT SPECIFICATIONS



### 2.1. Performance

Table 2-1 Performance of INSPIRE M.2 2280

Capacity	Sequential		CrystalDiskMark	
	Read (MB/s)	Write (MB/s)	Read (IOPS)	Write (IOPS)
32GB	300	180	18732	18688
40GB	345	200	25073	27468
60/64GB	351	204	31372	30973
120/128GB	390	402	51147	47144
240/256GB	410	401	91553	78320
480/512GB	563	511	132788	109668
960GB/1TB	563	517	132568	115747
1920GB/2TB	563	512	132635	112758

**NOTES:**

1. The performance was measured using CrystalDiskMark with SATA 6Gbps host.
2. Performance may differ according to flash configuration and platform.

### 2.2. Power

Table 2-2 Supply Voltage of INSPIRE M.2 2280

Parameter	Rating
Operating Voltage	3.3V +/- 5%

Table 2-3 Power Consumption of INSPIRE M.2 2280

Parameter	Power Consumption
Idle (max.)	0.415W
Active (max.)	2.362W

**NOTE:**

1. Power Consumption may differ according to flash configuration and platform.

## 2.3. TBW (Terabytes Written)

Capacity	TBW
32GB	60
40GB	93
60/64GB	95
120/128GB	191
240/256GB	384
480/512GB	769
960/1TB	1536
1920/2TB	3077

### NOTES:

1. TBW may differ according to flash configuration and platform.
2. Samples were tested under JESD218A endurance test method and JESD219A endurance workloads specification.

## 2.4. 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 predicted result of FLEXXON's INSPIRE M.2 2280 is more than 2 million hours.

## 2.5. Data Retention

- 10 years if > 90% life remaining (@25C)
- 1 year if < 10% life remaining (@25C)

### 3. ENVIRONMENTAL SPECIFICATIONS



Test Items	Test Conditions
Storage Temperature	-55°C ~ 95°C
Operating Temperature	Silver Grade: 0°C ~ 70°C Diamond Grade: -40°C ~ 85°C
Storage Humidity	Silver Grade: 40°C, 95% RH Diamond Grade: 55°C, 95% RH
Operating Humidity	Silver Grade: 40°C, 93% RH Diamond Grade: 55°C, 95% RH
Shock	1500G, Half Sin Pulse Duration 0.5ms
Vibration	80Hz ~ 2000Hz/20G, 20Hz ~ 80Hz/1.52mm, 3 axis/60min
Drop	80cm free fall, 6 face of each unit, 2 times each
Bending	≥ 20N, Hold 1 min/5 times
ESD	24°C, 49% RH, +/-4KV 25 times, Air +/-8KV 10 times

**Table 4-1 Supported ATA Command Set**

# Command	Code	Protocol
<b>General Feature Set</b>		
Execute Drive Diagnostic	90h	Device diagnostic
Flush Cache	E7h	Non-data
Identify Device	ECh	PIO data-in
Initialize Drive Parameters	91h	Non-data
Read DMA	C8h	DMA
Read Log Ext	2Fh	PIO data-in
Read Multiple	C4h	PIO data-in
Read Sector(s)	20h	PIO data-in
Read Verify Sector(s)	40h or 41h	Non-data
Set Feature	EFh	Non-data
Set Multiple Mode	C6h	Non-data
Write DMA	CAh	DMA
Write Multiple	C5h	PIO data-out
Write Sector(s)	30h	PIO data-out
NOP	00h	Non-data
Read Buffer	E4h	PIO data-in
Write Buffer	E8h	PIO data-out
<b>Power Management Feature Set</b>		
Check Power Mode	E5h or 98h	Non-data
Idle	E3h or 97h	Non-data
Idle Immediate	E1h or 95h	Non-data
Sleep	E6h or 99h	Non-data
Standby	E2h or 96h	Non-data
Standby Immediate	E0h or 94h	Non-data
<b>Security Mode Feature Set</b>		
Security Set Password	F1h	PIO data-out



Security Unlock	F2h	PIO data-out
Security Erase Prepare	F3h	Non-data
Security Erase Unit	F4h	PIO data-out
Security Freeze Lock	F5h	Non-data
Security Disable Password	F6h	PIO data-out
<b>SMART Feature Set</b>		
SMART Disable Operations	B0h	Non-data
SMART Enable/Disable Autosave	B0h	Non-data
SMART Enable Operations	B0h	Non-data
SMART Execute Off-Line Immediate	B0h	Non-data
SMART Read Data	B0h	PIO data-in
SMART Read Threshold	B0h	PIO data-in
SMART Return Status	B0h	Non-data
SMART Save Attribute Values	B0h	Non-data
<b>Host Protected Area Feature Set</b>		
Read Native Max Address	F8h	Non-data
Set Max Address	F9h	Non-data
Set Max Set Password	F9h	PIO data-out
Set Max Lock	F9h	Non-data
Set Max Freeze Lock	F9h	Non-data
Set Max Unlock	F9h	PIO data-out
<b>48-bit Address Feature Set</b>		
Flush Cache Ext	Eah	Non-data
Read Sector(s) Ext	24h	PIO data-in
Read DMA Ext	25h	DMA
Read Multiple Ext	29h	PIO data-in
Read Native Max Address Ext	27h	Non-data
Read Verify Sector(s) Ext	42h	Non-data
Set Max Address Ext	37h	Non-data
Write DMA Ext	35h	DMA
Write Multiple Ext	39h	PIO data-out
Write Sector(s) Ext	34h	PIO data-out
<b>NCQ Feature Set</b>		
Read FPDMA Queued	60h	DMA Queued
Write FPDMA Queued	61h	DMA Queued
<b>Others</b>		
Data Set Management	06h	DMA
Seek	70h	Non-data

## 5. PIN ASSIGNMENT



Table 5-1 Pin Assignment and Description of INSPIRE M.2 2280

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	No Connect
10	DAS/DSS# (I/O)	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) (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 A+	SATA differential signals in the SATA specification
42	N/C	No Connect
43	SATA A-	SATA differential signals in the SATA specification
44	N/C	No Connect
45	GND	Ground
46	N/C	No Connect
47	SATA B-	SATA differential signals in the SATA specification
48	N/C	No Connect
49	SATA B+	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	N/C	Not Connect
57	GND	Ground
58	N/C	No Connect
59	Module Key	
60	Module Key	
61	Module Key	
62	Module Key	
63	Module Key	
64	Module Key	
65	Module Key	

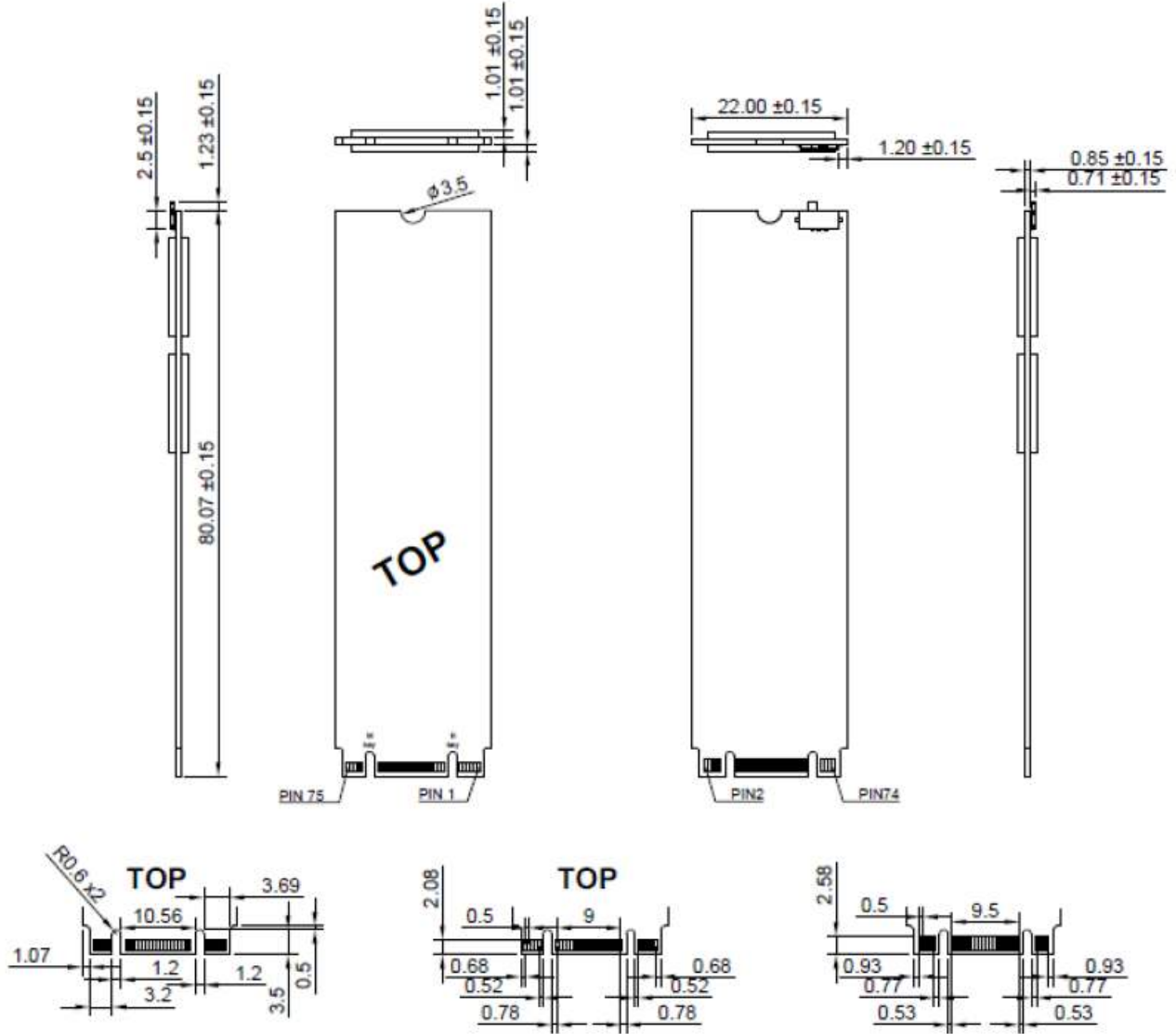
<b>66</b>	Module Key	
<b>67</b>	N/C	No Connect
<b>68</b>	N/C	No Connect
<b>69</b>	CONFIG_1 = GND	Defines module type
<b>70</b>	3.3V	Supply pin
<b>71</b>	GND	Ground
<b>72</b>	3.3V	Supply pin
<b>73</b>	GND	Ground
<b>74</b>	3.3V	Supply pin
<b>75</b>	CONFIG_2 = GND	Ground

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## 6. PHYSICAL DIMENSION



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



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## 7. ORDERING INFORMATION



Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
32GB	-	FSSO032GBS-M500
40GB	FSSO040GBE-M500	FSSO040GBS-M500
64GB	FSSO064GBE-M500	FSSO064GBS-M500
60GB	FSSO060GBE-M500	FSSO060GBS-M500
128GB	FSSO128GBE-M500	FSSO128GBS-M500
120GB	FSSO120GBE-M500	FSSO120GBS-M500
256GB	FSSO256GBE-M500	FSSO256GBS-M500
240GB	FSSO240GBE-M500	FSSO240GBS-M500
512GB	FSSO512GBE-M500	FSSO512GBS-M500
480GB	FSSO480GBE-M500	FSSO480GBS-M500
1TB	FSSO001TBE-M500	FSSO001TBS-M500
960GB	FSSO960GBE-M500	FSSO960GBS-M500
2TB	FSSO002TBE-M500	FSSO002TBS-M500
1920GB	FSSO1920BE-M500	FSSO1920BS-M500

### TCG OPAL and conformal coating

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
32GB	-	FSSO032GBS-M50V
40GB	FSSO040GBE-M50V	FSSO040GBS-M50V
64GB	FSSO064GBE-M50V	FSSO064GBS-M50V
60GB	FSSO060GBE-M50V	FSSO060GBS-M50V
128GB	FSSO128GBE-M50V	FSSO128GBS-M50V
120GB	FSSO120GBE-M50V	FSSO120GBS-M50V
256GB	FSSO256GBE-M50V	FSSO256GBS-M50V
240GB	FSSO240GBE-M50V	FSSO240GBS-M50V
512GB	FSSO512GBE-M50V	FSSO512GBS-M50V
480GB	FSSO480GBE-M50V	FSSO480GBS-M50V
1TB	FSSO001TBE-M50V	FSSO001TBS-M50V
960GB	FSSO960GBE-M50V	FSSO960GBS-M50V
2TB	FSSO002TBE-M50V	FSSO002TBS-M50V
1920GB	FSSO1920BE-M50V	FSSO1920BS-M50V



**Power Loss Protection**

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
32GB	-	FSSO032GBS-M50P
40GB	FSSO040GBE-M50P	FSSO040GBS-M50P
64GB	FSSO064GBE-M50P	FSSO064GBS-M50P
60GB	FSSO060GBE-M50P	FSSO060GBS-M50P
128GB	FSSO128GBE-M50P	FSSO128GBS-M50P
120GB	FSSO120GBE-M50P	FSSO120GBS-M50P
256GB	FSSO256GBE-M50P	FSSO256GBS-M50P
240GB	FSSO240GBE-M50P	FSSO240GBS-M50P
512GB	FSSO512GBE-M50P	FSSO512GBS-M50P
480GB	FSSO480GBE-M50P	FSSO480GBS-M50P
1TB	FSSO001TBE-M50P	FSSO001TBS-M50P
960GB	FSSO960GBE-M50P	FSSO960GBS-M50P
2TB	FSSO002TBE-M50P	FSSO002TBS-M50P
1920GB	FSSO1920BE-M50P	FSSO1920BS-M50P

**AES 256 and TCG OPAL**

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
32GB	-	FSSO032GBS-M50S
40GB	FSSO040GBE-M50S	FSSO040GBS-M50S
64GB	FSSO064GBE-M50S	FSSO064GBS-M50S
60GB	FSSO060GBE-M50S	FSSO060GBS-M50S
128GB	FSSO128GBE-M50S	FSSO128GBS-M50S
120GB	FSSO120GBE-M50S	FSSO120GBS-M50S
256GB	FSSO256GBE-M50S	FSSO256GBS-M50S
240GB	FSSO240GBE-M50S	FSSO240GBS-M50S
512GB	FSSO512GBE-M50S	FSSO512GBS-M50S
480GB	FSSO480GBE-M50S	FSSO480GBS-M50S
1TB	FSSO001TBE-M50S	FSSO001TBS-M50S
960GB	FSSO960GBE-M50S	FSSO960GBS-M50S
2TB	FSSO002TBE-M50S	FSSO002TBS-M50S
1920GB	FSSO1920BE-M50S	FSSO1920BS-M50S



**Conformal coating and Power Loss Protection**

<b>Capacity</b>	<b>MPN (Diamond Grade)</b>	<b>MPN (Silver Grade)</b>
32GB	-	FSSO032GBS-M50D
40GB	FSSO040GBE-M50D	FSSO040GBS-M50D
64GB	FSSO064GBE-M50D	FSSO064GBS-M50D
60GB	FSSO060GBE-M50D	FSSO060GBS-M50D
128GB	FSSO128GBE-M50D	FSSO128GBS-M50D
120GB	FSSO120GBE-M50D	FSSO120GBS-M50D
256GB	FSSO256GBE-M50D	FSSO256GBS-M50D
240GB	FSSO240GBE-M50D	FSSO240GBS-M50D
512GB	FSSO512GBE-M50D	FSSO512GBS-M50D
480GB	FSSO480GBE-M50D	FSSO480GBS-M50D
1TB	FSSO001TBE-M50D	FSSO001TBS-M50D
960GB	FSSO960GBE-M50D	FSSO960GBS-M50D
2TB	FSSO002TBE-M50D	FSSO002TBS-M50D
1920GB	FSSO1920BE-M50D	FSSO1920BS-M50D

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## Revision History

Revision	Date	Description
1.0	2019/07	Preliminary release
1.1	2019/08	Update capacity
1.2	2019/09	Update ordering information
1.3	2019/12	Update capacity and performance
1.4	2020/03	Update ordering information
1.5	2021/04	Update ordering information
1.6	2022/02	Update capacity
1.7	2022/04	Update ordering information

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