



# Industrial mSATA Specification

(INSPIRE Series, 3D TLC)

Version 1.3

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# 1. GENERAL DESCRIPTION

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## 1.1. Introduction

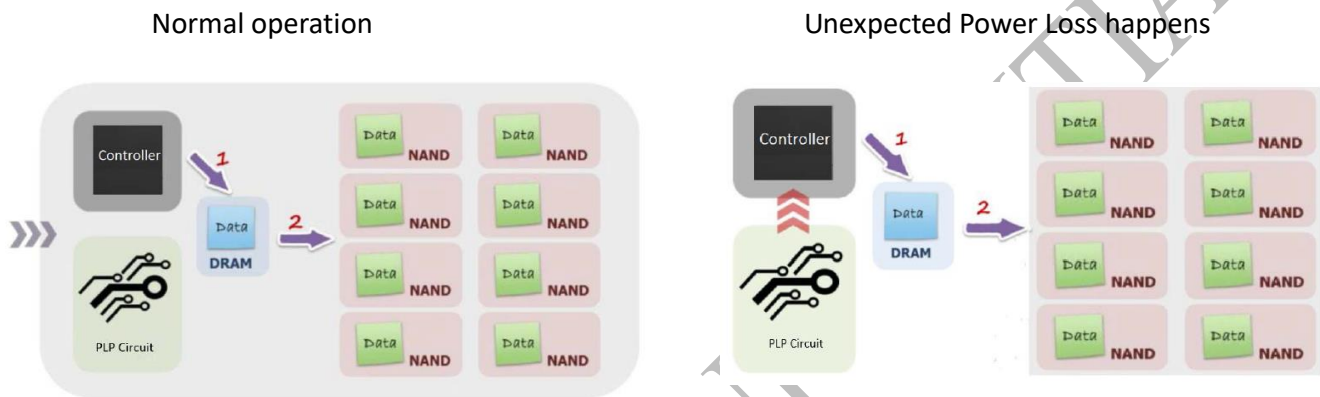
FLEXXON's INSPIRE mSATA has SATA III interface, and is fully compliant with mSATA Form Factor, known as JEDEC MO-300. It supports high performance, high endurance, good compatibility and provides comprehensive data protection. It is suitable for multi-tasking application.

## 1.2. Product Overview

- ❖ **Flash**
  - 3D TLC
- ❖ **Capacity**
  - 64GB up to 2TB
- ❖ **SATA Interface**
  - Compliant with SATA Revision 3.2
  - Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
- ❖ **ECC Scheme**
  - INSPIRE mSATA 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**
- ❖ **Data shaping technique for enhanced data endurance**
- ❖ **Data Refresh technology for data integrity**
- ❖ **Global Wear Levelling 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)

FLEXXON 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**-power loss protection mechanism

## 2. PRODUCT SPECIFICATIONS



### 2.1. Performance

Table 2-1 Performance of INSPIRE mSATA

Capacity	Sequential	
	Read (MB/s)	Write (MB/s)
60/64GB	392	245
120/128GB	555	406
240/256GB	550	520
480/512GB	564	524
960GB/1TB	560	528
1920GB/2TB	560	530

**NOTES:**

1. The performance was measured using CrystalDiskMark v5.0x64 with SATA 6Gbps host.
2. Performance may differ according to flash configuration and platform.

### 2.2. Power

Table 2-2 Supply Voltage of INSPIRE mSATA

Parameter	Rating
Operating Voltage	3.3V +/-5%

Table 2-3 Power Consumption of INSPIRE mSATA

Parameter	Power Consumption
Idle (Max.)	0.43W
Active (Max.)	2.40W

**NOTE:**

1. Power Consumption may differ from flash configuration and platform.

## 2.3. TBW (Terabytes Written)

Capacity	TBW
64GB	95
128GB	191
256GB	384
512GB	769
1TB	1536
2TB	3065

### 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 mSATA 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
Bending	≥ 20N, Hold 1 min/5 times
ESD	24°C, 49% RH, +/-4KV

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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 mSATA**

Pin #	mSATA Pin	Description
1	NC	No Connect
2	+3.3V	3.3V Source
3	NC	No Connect
4	GND	Ground
5	NC	No Connect
6	NC	No Connect
7	NC	No Connect
8	NC	No Connect
9	GND	Ground
10	NC	No Connect
11	NC	No Connect
12	NC	No Connect
13	NC	No Connect
14	NC	No Connect
15	GND	Ground
16	NC	No Connect
17	NC	No Connect
18	GND	Ground
19	NC	No Connect
20	NC	No Connect
21	GND	Ground
22	NC	No Connect
23	TXP (out)	Host Receiver Differential Signal Pair
24	+3.3V	3.3V Source
25	TXN (out)	Host Receiver Differential Signal Pair
26	GND	Ground
27	GND	Ground
28	NC	No Connect
29	GND	Ground
30	NC	No Connect
31	RXN (in)	Host Transmitter Differential Signal Pair
32	NC	No Connect
33	RXP (in)	Host Transmitter Differential Signal Pair

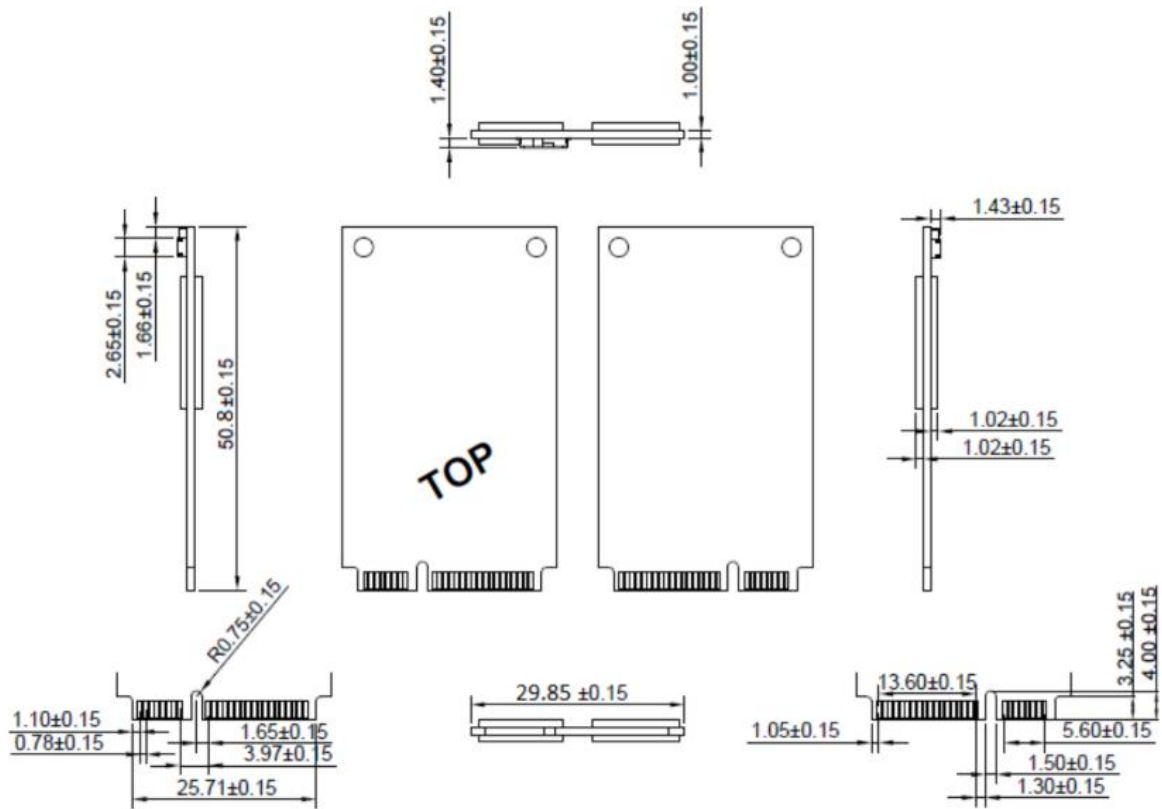
34	GND	Ground
35	GND	Ground
36	NC	No Connect
37	GND	Ground
38	NC	No Connect
39	+3.3V	3.3V Source
40	GND	Ground
41	+3.3V	3.3V Source
42	NC	No Connect
43	GND	Ground
44	NC	No Connect
45	NC	No Connect
46	NC	No Connect
47	NC	No Connect
48	NC	No Connect
49	DAS	Device Activity Signal
50	GND	Ground
51	PD	Presence Detection
52	+3.3V	3.3V Source

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## 6. PHYSICAL DIMENSION



Dimension: 50.8mm(L) x 29.85mm(W) x 3.83mm(H)



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## 7. ORDERING INFORMATION



Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
64GB	FSSE064GBE-M500	FSSE064GBS-M500
60GB	FSSE060GBE-M500	FSSE060GBS-M500
128GB	FSSE128GBE-M500	FSSE128GBS-M500
120GB	FSSE120GBE-M500	FSSE120GBS-M500
256GB	FSSE256GBE-M500	FSSE256GBS-M500
240GB	FSSE240GBE-M500	FSSE240GBS-M500
512GB	FSSE512GBE-M500	FSSE512GBS-M500
480GB	FSSE480GBE-M500	FSSE480GBS-M500
1TB	FSSE001TBE-M500	FSSE001TBS-M500
960GB	FSSE960GBE-M500	FSSE960GBS-M500
2TB	FSSE002TBE-M500	FSSE002TBS-M500
1920GB	FSSE1920BE-M500	FSSE1920BS-M500

### Power Loss Protection

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
64GB	FSSE064GBE-M50P	FSSE064GBS-M50P
60GB	FSSE060GBE-M50P	FSSE060GBS-M50P
128GB	FSSE128GBE-M50P	FSSE128GBS-M50P
120GB	FSSE120GBE-M50P	FSSE120GBS-M50P
256GB	FSSE256GBE-M50P	FSSE256GBS-M50P
240GB	FSSE240GBE-M50P	FSSE240GBS-M50P
512GB	FSSE512GBE-M50P	FSSE512GBS-M50P
480GB	FSSE480GBE-M50P	FSSE480GBS-M50P
1TB	FSSE001TBE-M50P	FSSE001TBS-M50P
960GB	FSSE960GBE-M50P	FSSE960GBS-M50P
2TB	FSSE002TBE-M50P	FSSE002TBS-M50P
1920GB	FSSE1920BE-M50P	FSSE1920BS-M50P



**AES 256 and TCG OPAL**

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
64GB	FSSE064GBE-M50S	FSSE064GBS-M50S
60GB	FSSE060GBE-M50S	FSSE060GBS-M50S
128GB	FSSE128GBE-M50S	FSSE128GBS-M50S
120GB	FSSE120GBE-M50S	FSSE120GBS-M50S
256GB	FSSE256GBE-M50S	FSSE256GBS-M50S
240GB	FSSE240GBE-M50S	FSSE240GBS-M50S
512GB	FSSE512GBE-M50S	FSSE512GBS-M50S
480GB	FSSE480GBE-M50S	FSSE480GBS-M50S
1TB	FSSE001TBE-M50S	FSSE001TBS-M50S
960GB	FSSE960GBE-M50S	FSSE960GBS-M50S
2TB	FSSE002TBE-M50S	FSSE002TBS-M50S
1920GB	FSSE1920BE-M50S	FSSE1920BS-M50S

**Hardware Write Protect**

Capacity	MPN (Diamond Grade)	MPN (Silver Grade)
64GB	FSSE064GBE-M50K	FSSE064GBS-M50K
60GB	FSSE060GBE-M50K	FSSE060GBS-M50K
128GB	FSSE128GBE-M50K	FSSE128GBS-M50K
120GB	FSSE120GBE-M50K	FSSE120GBS-M50K
256GB	FSSE256GBE-M50K	FSSE256GBS-M50K
240GB	FSSE240GBE-M50K	FSSE240GBS-M50K
512GB	FSSE512GBE-M50K	FSSE512GBS-M50K
480GB	FSSE480GBE-M50K	FSSE480GBS-M50K
1TB	FSSE001TBE-M50K	FSSE001TBS-M50K
960GB	FSSE960GBE-M50K	FSSE960GBS-M50K
2TB	FSSE002TBE-M50K	FSSE002TBS-M50K
1920GB	FSSE1920BE-M50K	FSSE1920BS-M50K

## Revision History

Revision	Draft Date	History
1.0	2019/08	Preliminary release
1.1	2020/02	Update Ordering Information
1.2	2021/05	Update capacity
1.3	2021/11	Update Ordering Information

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