mSATA mini

3TE7 Series

Customer:	
Customer Part Number:	
Innodisk Part Number:	
Innodisk Model Name:	
Date:	

Innodisk Approver	Customer Approver

Features:

- SATA III
- Kioxia 3D TLC NAND
- mSATA mini
- Standard & Wide-temperature
- iPower Guard
- iData Guard
- Dynamic Thermal Management
- Direct Write

Performance:

- Sequential Read up to 550 MB/s
- Sequential Write up to 520 MB/s

Power Requirements:

Input Voltage:	3.3V±5%
Max Operating Wattage:	1.7W
Idle Wattage:	0.8W

Reliability:

Capacity	TBW(Client)	DWPD(Client)
32GB	37	1.08
64GB	75	1.09
128GB	150	1.09
256GB	300	1.09
512GB	600	1.09
1TB	1200	1.09

Data Retention	1 Year
Warranty	3 Years

For warranty details, please refer to:

https://www.innodisk.com/en/support_and_service/warranty

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REVISION HISTORY

Revision	Description	Date
1.0	First Release	Mar., 2019
1.1	Update Performance Update RoHS Declaration of Conformity	Apr., 2019
1.2	Update Power Consumption Update SMART Feature Set	Oct., 2019
1.3	Add Version 2 & B models	Jan., 2020
1.4	Revised Part Number Rules	Sep., 2021
1.5	Revised Pin Assignment (Remove DEVSLP)	May, 2025
1.6	Add 112-Layer 3D TLC	Jul., 2025

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1. Product Overview

1.1 Introduction of Innodisk mSATA mini 3TE7

Innodisk mSATA mini 3TE7 which is designed with mSATA mini form factor by JEDEC MO-300/MO-300B, supporting SATA III standard (6.0Gb/s), achieves excellent performance up to 4CH standard by cost effective controller with 4CH. Regarding of mechanical interference, Innodisk mSATA mini 3TE7 absolutely replaces the traditional hard disk and makes personal computer, in any field, smaller and easier.

With Innodisk L^3 FW architecture, combining our signature 4K mapping algorithm L^2 FW architecture with powerful LDPC technology, 3TE7 series has outstanding high IOPS, better data integrity and extended lifespan through reducing the bad block number happening.

For real industrial application, 3TE7 series is built in thermal sensor to monitor the environment temperature. iData Guard, the power loss management mechanism developed by Innodisk, ensures data integrity while power sudden loss happened.

1.2 Product View and Models

Innodisk mSATA mini 3TE7 is available in follow capacities within 3D NAND flash ICs.

mSATA mini 3TE7 32GB   mSATA mini 3TE7 64GB   mSATA mini 3TE7 128GB
mSATA mini 3TE7 256GB   mSATA mini 3TE7 512GB   mSATA mini 3TE7 1TB

TSOP   BGA
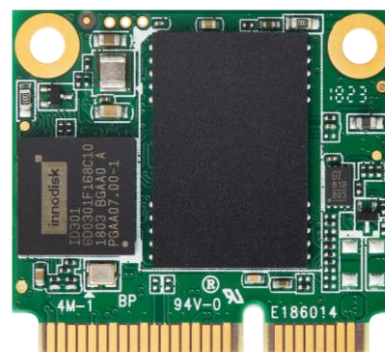
Figure 1: Innodisk mSATA mini 3TE7

1.3 SATA Interface

Innodisk mSATA mini 3TE7 supports SATA III(6.0Gb/s) interface, and compliant with SATA I (1.5Gb/s) and SATA II(3.0Gb/s).

2. Product Specifications

2.1 Capacity and Device Parameters

mSATA mini 3TE7 device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	Cylinders	Heads	Sectors	LBA	User Capacity (GB)
32GB	16383	16	63	53742528	25.6
64GB	16383	16	63	117231408	55.9
				107463888(112-L)	51.2
128GB	16383	16	63	234441648	111.8
256GB	16383	16	63	468862128	223.6
512GB	16383	16	63	937703088	447.1
1TB	16383	16	63	1875385008	894.2

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance – 64 Layers 3D TLC

Capacity	Unit	32GB	64GB	128GB	256GB	512GB
Sequential * Read (max.)	MB/s	180	355	510	510	560
Sequential * Write (max.)		35	75	150	300	330
4KB Random** Read (QD32)	IOPS	11,000	23,000	43,000	72,000	85,000
4KB Random** Write (QD32)		9,000	18,000	36,000	67,000	70,000

Note: * Sequential performance is based on CrystalDiskMark 5.1.2 with file size 1000MB

　　　** Random performance is based on IO meter with Queue Depth 32

Table 3: Performance – 112 Layers 3D TLC

Capacity	Unit	64GB	128GB	256GB	512GB	1TB
Sequential** Read (Q32T1)	MB/s	270	430	550	550	550
Sequential** Write (Q32T1)		170	300	500	520	450
Sustained Sequential Read (Avg.)***		200	330	410	420	390
Sustained Sequential Write (Avg.)***		40	75	150	300	270
4KB Random** Read (QD32)	IOPS	24,000	40,000	77,000	82,000	82,000
4KB Random** Write (QD32)		15,000	21,000	42,000	72,000	71,000

Note: * Performance results are tested in Room Temperature with Out-of-Box devices and may vary depending on overall system setup. In addition, 3TE7 series adopt hybrid mode which enables SLC Cache followed by TLC direct write to strike balance between burst performance and steady overall stability.

Note: ** Performance results are based on CrystalDiskMark 6.0.2 with typical tolerance for range from 1% to 10%.

Note: *** Performance results are based on AIDA 64 with block size 1MB of Linear Write Test Item

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 4: Innodisk mSATA mini 3TE7 Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V_{IN}	+3.3 DC +- 5%	V

2.3.2 Power Consumption

Table 5: Power Consumption

Mode	Power Consumption (W)
Read	1.5
Write	1.7
Idle	0.8
Power-on peak	3.1

* Target: mSATA mini 3TE7

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 6: Temperature range for mSATA mini 3TE7

Temperature	Range
Operating	Standard Grade: 0°C to +70°C
	Industrial Grade: -40°C to +85°C
Storage	-40°C to +85°C

2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

2.4.3 Shock and Vibration

Table 7: Shock/Vibration Testing for mSATA mini 3TE7

Reliability	Test Conditions	Reference Standards
Vibration	7 Hz to 2K Hz, 20G, 3 axes	IEC 60068-2-6
Mechanical Shock	Duration: 0.5ms, 1500 G, 3 axes	IEC 60068-2-27

2.4.4 Mean Time between Failures (MTBF)

Table 8 summarizes the MTBF prediction results for various mSATA mini 3TE7 configurations. The analysis was performed using a RAM Commander™ failure rate prediction.

· **Failure Rate**: The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.

· **Mean Time between Failures (MTBF)**: A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Table 8: mSATA mini 3TE7 MTBF

Product	Condition	MTBF (Hours)
Innodisk mSATA mini 3TE7	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

mSATA mini 3TE7 conforms to CE and FCC requirements.

2.6 RoHS Compliance

mSATA mini 3TE7 is fully compliant with RoHS directive.

2.7 Reliability

Parameter	Value
Flash endurance	3,000 P/E cycles
Error Correct Code	Support
Data Retention	Under 40℃: 1 Year at NAND Life End

TBW* (Total Bytes Written) Units: TB

Capacity	Sequential workload	Client workload
32GB	85	38
64GB	170	75
128GB	341	150
256GB	682	300
512GB	1364	600
1TB	2727	1200

* Note:

1. Sequential: Mainly sequential write, tested by Vdbench.

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.

2.8 Transfer Mode

mSATA mini 3TE7 support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

Innodisk mSATA mini 3TE7 uses a standard SATA pin-out. See Table 9 for mSATA mini 3TE7 pin assignment.

Table 9: Innodisk mSATA mini 3TE7 Pin Assignment

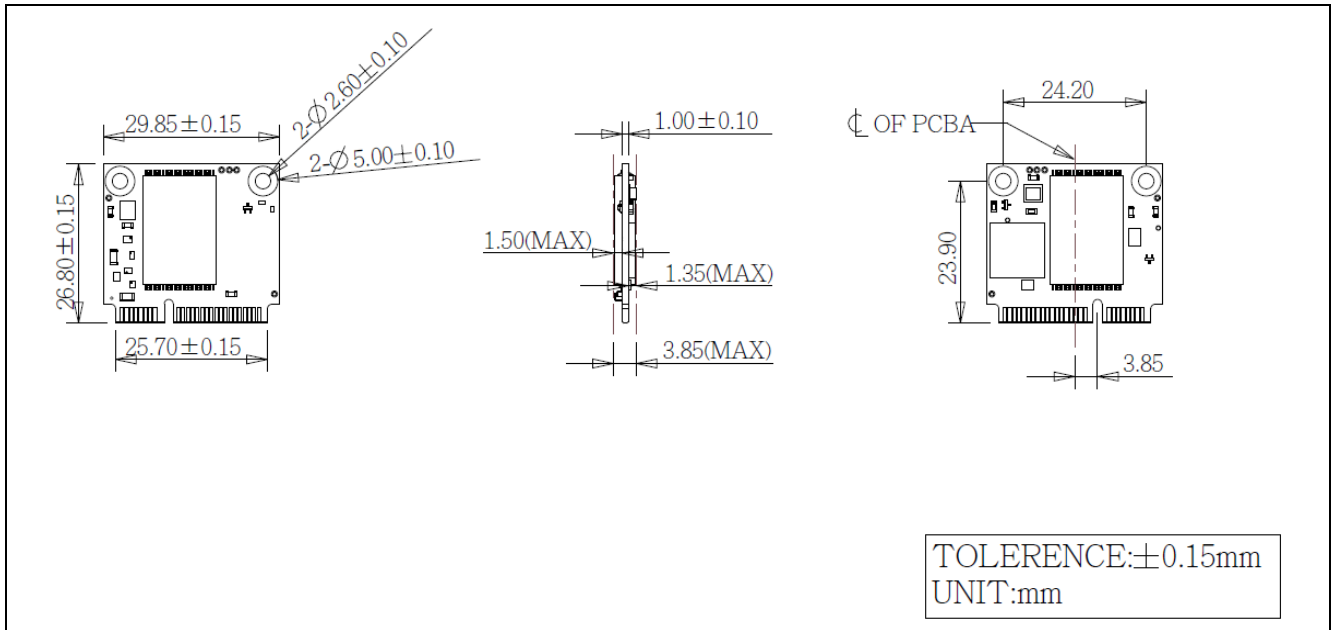| Signal Name	Pin #	Pin #	Signal Name
GND	51	52	+3.3V
DAS	49	50	GND
NC	47	48	NC
NC	45	46	NC
NC	43	44	Reserved
+3.3V	41	42	NC
+3.3V	39	40	GND
GND	37	38	NC
GND	35	36	NC
RX+	33	34	GND
RX-	31	32	NC
GND	29	30	NC
GND	27	28	NC
TX-	25	26	GND
TX+	23	24	+3.3V
GND	21	22	NC
NC	19	20	NC
NC	17	18	GND
GND	15	16	NC
NC	13	14	NC
NC	11	12	NC
GND	9	10	NC
NC	7	8	NC
NC	5	6	NC
NC	3	4	GND
NC	1	2	+3.3V

2.10 Mechanical Dimensions

Figure 2: Innodisk mSATA mini 3TE7 diagram (TSOP)
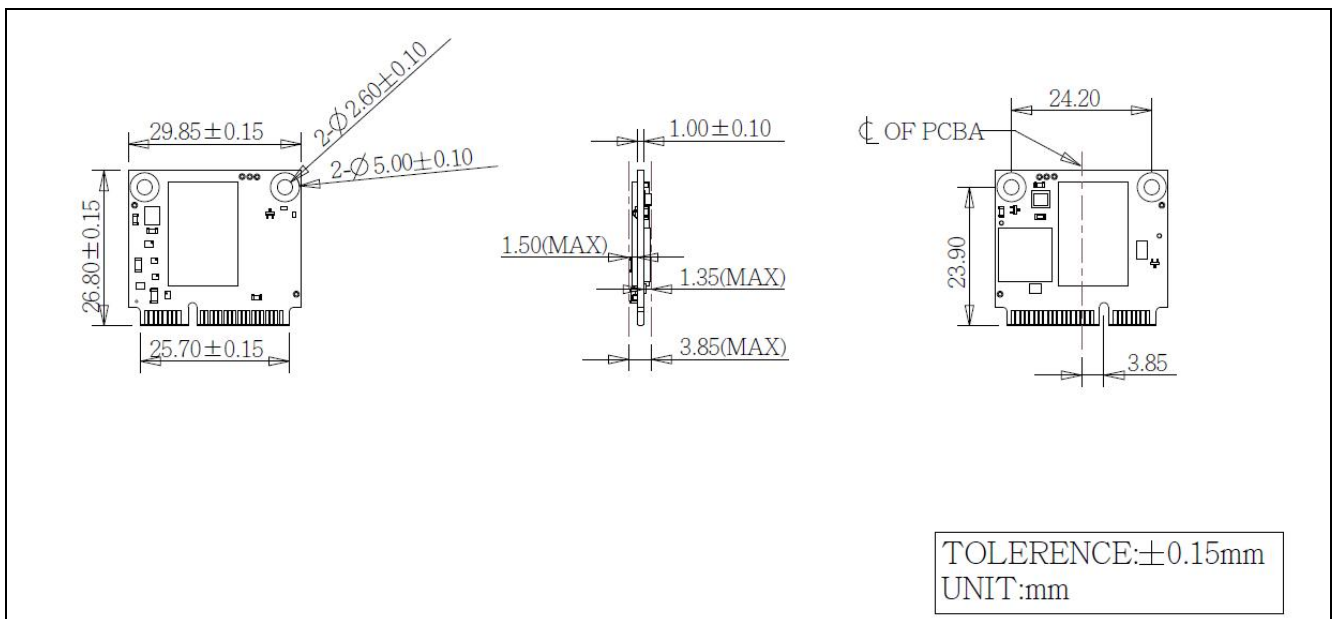
Figure 3: Innodisk mSATA mini 3TE7 diagram (BGA)

2.11 Assembly Weight

An Innodisk mSATA mini 3TE7 within flash ICs, 1TB's weight is 6 grams approximately.

2.12 Seek Time

Innodisk mSATA mini 3TE7 is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 NAND Flash Memory

Innodisk mSATA mini 3TE7 uses 3D TLC NAND flash memory, with 3,000 program & erase cycles, which is non-volatility, high reliability and high speed memory storage.

3. Theory of Operation

3.1 Overview

Figure 4 shows the operation of Innodisk mSATA mini 3TE7 from the system level, including the major hardware blocks.

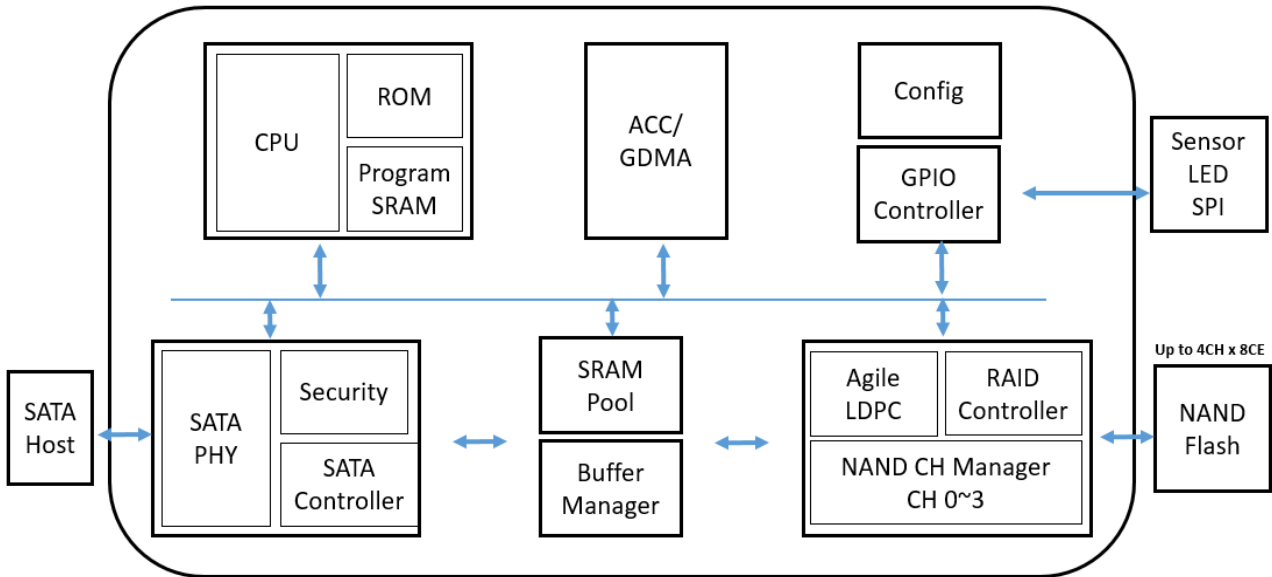**Figure 4: Innodisk mSATA mini 3TE7 Block Diagram**

Innodisk mSATA mini 3TE7 integrates a SATA III controller and NAND flash memories. Communication with the host occurs through the host interface, using the standard ATA protocol. Communication with the flash device(s) occurs through the flash interface.

3.2 SATA III Controller

Innodisk mSATA mini 3TE7 is designed with a SATA III 6.0Gbps (Gen. 3) controller. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

3.3 Error Detection and Correction

Innodisk mSATA mini 3TE7 is designed with hardware LDPC ECC engine with hard-decision and Soft-decision decoding. Low-density parity-check (LDPC) codes have excellent error correcting Performance close to the Shannon limit when decoded with the belief-propagation (BP) algorithm using soft-decision information.

3.4 Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the **_erase cycle limit_** or **_write endurance limit_** and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

Innodisk mSATA mini 3TE7 uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

3.5 Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may develop during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management, Bad Blocks replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit.

3.6 iData Guard

iData Guard is a comprehensive data protection mechanism that functions before and after a sudden power outage to SSD. Low-power detection terminates data writing before an abnormal power-off, while table-remapping after power-on deletes corrupt data and maintains data integrity. iData Guard provides effective power cycling management, preventing data stored in flash from degrading with use.

3.7 Garbage Collection

Garbage collection 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.

3.8 Trim

The Trim command is designed to enable the operating system to notify the SSD which pages no longer contain valid data due to erases either by the user or operating system itself. During a delete operation, the OS will mark the sectors as free for new data and send a Trim command to the SSD to mark them as not containing valid data. After that the SSD knows not to preserve the contents of the block when writing a page, resulting in less write amplification with fewer writes to the flash, higher write speed, and increased drive life.

3.9 iPower Guard

iPower Guard technology is a set of preventive measures that protect the SSD in an unstable power supply environment. This comprehensive package comprises safeguards for startup and shutdown to maintain device performance and ensure data integrity.

3.10 Die RAID

Die RAID is a controller function which leveraged user capacity to back up the data in NAND flash. Die RAID supported can ensure the user data in the NAND Flash more consistent in certain scenario. Innodisk mSATA 3TE7 series is default enable the Die RAID function for the industrial application.

3.11 SLC cache

mSATA mini 3TE7 112 layers series adopt hybrid mode which enables SLC Cache up to 3% of total user capacity by TLC direct write to strike balance between burst performance and steady overall stability.

3.12 Thermal Throttling

Thermal throttling is a protective mechanism designed to safeguard components from potential damage caused by excessive temperatures. When an SSD approaches a critical temperature threshold, Innodisk firmware activates the thermal throttling mechanism to regulate the SSD's temperature. Thermal throttling is crucial for SSDs since it prevents drive damage, which could otherwise result in data loss. However, it's worth noting that when thermal throttling is activated, read and write tasks may experience a reduction in speed.

4. Installation Requirements

4.1 mSATA mini 3TE7 Pin Directions
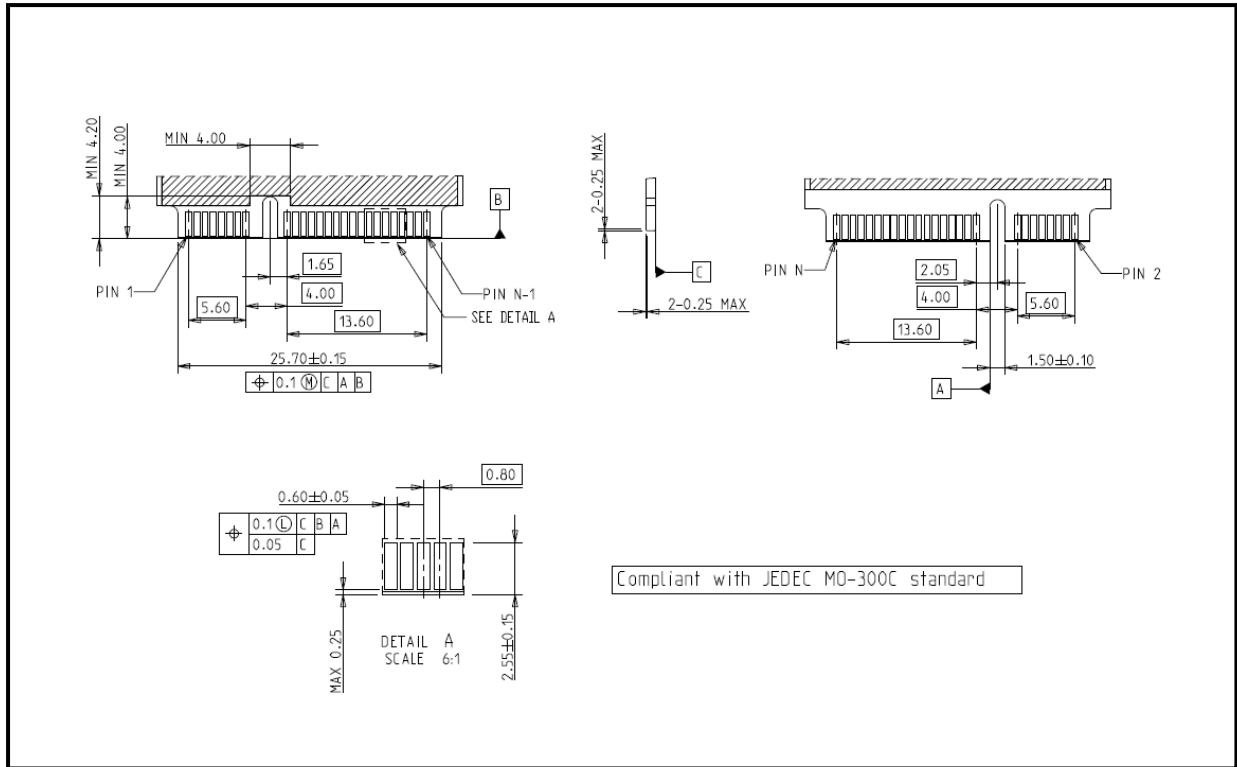
Figure 5: Signal Segment and Power Segment

4.2 Electrical Connections for mSATA mini 3TE7

A Serial ATA device may be either directly connected to a host or connected to a host through an adaptor card. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Device Drive

No additional device drives are required. The Innodisk mSATA mini 3TE7 can be configured as a boot device.

5. SMART Feature Set

Innodisk 3TE7 series support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

Table 10: SMART command

Value	Command	Value	Command
D0h	Read Data	D5h	Read Log
D1h	Read Attribute Threshold	D6h	Return Status
D2h	Enable/Disable Auto save	D8h	Enable SMART Operations
D3h	Save Attribute Values	D9h	Disable SMART Operations
D4h	Execute OFF-LINE Immediate	DAh	Return Status

5.1 SMART Attributes

Innodisk 3TE7 series SMART data attributes are listed in following table.

Table 11: SMART attribute

Attribute ID (hex)	Value	Raw Attribute Value						Rsv	Attribute Name
01	X								Read Error Rate
05	X	LSB	MSB	00	00	00	00	00	Later Bad
09	LSB	LSB	MSB	00	00	00	00	00	Power-On hours Count
0C	LSB	LSB	MSB	00	00	00	00	00	Drive Power Cycle Count
A3	X	LSB			MSB	00	00	00	Total Bad Block Count
A5	LSB	LSB			MSB	00	00	00	Max Erase count
A7	LSB	LSB			MSB	00	00	00	Avg Erase count
A9	LSB	LSB	00	00	00	00	00	00	Device Life
AA	X	LSB	MSB	00	00	00	00	00	Spare Block Count
AB	LSB	LSB	MSB	00	00	00	00	00	Program fail count
AC	LSB	LSB	MSB	00	00	00	00	00	Erase fail count
C0	LSB	LSB	MSB	00	00	00	00	00	Unexpected Power Loss Count

C2	LSB			MIN		MAX	00	00	Temperature
E5		ID 0	ID 1	ID 2	ID 3	ID 4	ID 5		Flash ID
EB			**MSB**	**LSB**	**MSB**	**LSB**	**MSB**	**LSB**	Later bad block info (**Read**/**Write**/**Erase**)
F1	00	LSB			MSB	00	00	00	Total LBA written(LBA=32MB)
F2	00	LSB			MSB	00	00	00	Total LBA read(LBA=32MB)

6. Part Number Rule

CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	D	E	M	S	M	–	C	1	2	D	K	1	K	C	A	Q	F	–	X	X	X
Definition																					

Code 1ˢᵗ (Disk)	Code 13ᵗʰ (Flash Mode)
D: Disk	E: 64 layers 3D TLC
	K: 112 layers 3D TLC
Code 2ⁿᵈ Feature Set	**Code 14ᵗʰ (Operation Temperature)**
E: Embedded	C: Standard Grade (0℃~ +70℃)
	W: Industrial Grade (-40℃~ +85℃)
Code 3ʳᵈ ~ 5ᵗʰ (Form Factor)	**Code 15ᵗʰ (Internal control)**
MSM: mSATA mini	1~9/A~Z: PCB version
Code 7ᵗʰ ~9ᵗʰ (Capacity)	**Code 16ᵗʰ (Channel of data transfer)**
32G: 32GB	S: Single Channel
64G: 64GB	D: Dual Channels
A28: 128GB	Q: Quad Channels
B56: 256GB	
C12: 512GB	**Code 17ᵗʰ (Flash Type)**
01T: 1TB	
Code 10th ~12th (Controller)	F: Kioxia 3D TLC
DK1: SATA 3TE7	**Code 19ᵗʰ~21ᵗʰ (Customized Code)**

![innodisk logo]

宜鼎國際股份有限公司
Innodisk Corporation

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: http://www.innodisk.com/

RoHS 自我宣告書(RoHS Declaration of Conformity)

Manufacturer Product: All Innodisk EP products

一、 宜鼎國際股份有限公司（以下稱本公司）特此保證售予貴公司之所有產品，皆符合歐盟 2011/65/EU 及(EU) 2015/863 關於 RoHS 之規範要求。

Innodisk Corporation declares that all products sold to the company, are complied with European Union RoHS Directive (2011/65/EU) and (EU) 2015/863 requirement.

二、 本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。

Innodisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

Name of hazardous substance	Limited of RoHS ppm（mg/kg）
鉛（Pb）	< 1000 ppm
汞（Hg）	< 1000 ppm
鎘（Cd）	< 100 ppm
六價鉻（Cr 6+）	< 1000 ppm
多溴聯苯（PBBs）	< 1000 ppm
多溴二苯醚（PBDEs）	< 1000 ppm
鄰苯二甲酸二(2-乙基己基)酯（DEHP）	< 1000 ppm
鄰苯二甲酸丁酯苯甲酯（BBP）	< 1000 ppm
鄰苯二甲酸二丁酯（DBP）	< 1000 ppm
鄰苯二甲酸二異丁酯（DIBP）	< 1000 ppm

立 保 證 書 人 (Guarantor)

Company name 公司名稱： Innodisk Corporation 宜鼎國際股份有限公司

Company Representative 公司代表人： Randy Chien 簡川勝

Company Representative Title 公司代表人職稱： Chairman 董事長

Date 日期： 2018 / 07 / 01

REACH Declaration of Conformity

Manufacturer Product: All Innodisk EM Flash and Dram products

1. 宜鼎國際股份有限公司（以下稱本公司）特此保證此售予貴公司之產品，皆符合歐盟化學品法案(Registration , Evaluation and Authorization of Chemicals；(EC) No 1907/2006 REACH)以及附錄 XIV 中的限用物質之規定 (http://www.echa.europa.eu/de/candidate-list-table last updated: 12/01/2017，SVHC's 173)。

   所提供之產品包含：(1) 產品或產品所使用到的所有原物料；(2)包裝材料；(3)設計、生產及重工過程中所使用到的所有原物料。

   We Innodisk Corporation hereby declare that our products are in compliance with the requirements according to the (EC) No 1907/2006 REACH Regulation and restricted substances in Annex XIV   (http://www.echa.europa.eu/de/candidate-list-table last updated: 12/01/2017，SVHC's 173).

   Products include： 1) Product and raw material used by the product；2) Packaging material ；3) Raw material used in the process of design, production and rework.

2. 本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。
   InnoDisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

立 保 證 書 人 (Guarantor)

Company name 公司名稱： InnoDisk Corporation   宜鼎國際股份有限公司

Company Representative 公司代表人： Randy Chien 簡川勝

Company Representative Title 公司代表人職稱： Chairman 董事長

Date 日期： 2017 / 02 / 08

$C\,E$

VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

Technical Standard: EMC DIRECTIVE 2014/30/EU
(EN55022 / EN55024)

General Information
Applicant: Innodisk Corporation
5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)

Product Description
EUT Description: mSATA
Brand Name: Innodisk
Model Number: mSATA 3$*#-&
$:Flash type: (S:SLC, I:iSLC, M:MLC, T:3D TLC)
*:Product line: (E:Embedded, G:EverGreen, R:InnoRobust)
#:Product Generation: (empty, 0~9)
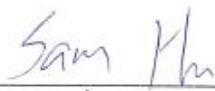&:Product line: (empty, P:Plus)

Measurement Standard
EN 55022: 2010 / AC: 2011
EN 61000-3-2: 2014
EN 61000-3-3: 2013
EN 55024: 2010 + A1: 2015
  (IEC 61000-4-2: 2008; IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010; IEC 61000-4-4: 2012;
  IEC 61000-4-5: 2014; IEC 61000-4-6: 2013; IEC 61000-4-8: 2009; IEC 61000-4-11: 2004)

Measurement Facilities
Xindian Lab.: **Compliance Certification Services Inc.**
No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T161004D13-E

Sam Hu / Assistant Manager
Date: October 11, 2016

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VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

Technical Standard: EMC DIRECTIVE 2014/30/EU (EN55032)

General Information

Applicant: Innodisk Corporation
                5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
                New Taipei City 22161, Taiwan (R.O.C)

Product Description

EUT Description: mSATA
Brand Name: Innodisk
Model Number: mSATA 3$*#-&
                    $:Flash type: (S:SLC, I:iSLC, M:MLC, T:3D TLC)
                    *:Product line: (E:Embedded, G:EverGreen, R:InnoRobust)
                    #:Product Generation: (empty, 0~9)
                    &:Product line: (empty, P:Plus)

Measurement Standard

EN 55032: 2012 / AC: 2013
CISPR 32: 2012

Measurement Facilities

Xindian Lab.:   **Compliance Certification Services Inc.**
                  No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
                  Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T161004D13-E

Sam Hu / Assistant Manager
Date: October 11, 2016

FC

VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

Technical Standard: FCC Part 15 Class B
IC ICES-003

General Information
Applicant: Innodisk Corporation
             5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
             New Taipei City 22161, Taiwan (R.O.C)

Product Description
EUT Description: mSATA
Brand Name: Innodisk
Model Number: mSATA 3$*#-&
                   $:Flash type: (S:SLC, I:iSLC, M:MLC, T:3D TLC)
                   *:Product line: (E:Embedded, G:EverGreen, R:InnoRobust)
                   #:Product Generation: (empty, 0~9)
                   &:Product line: (empty, P:Plus)

Measurement Facilities
Xindian Lab.:   **Compliance Certification Services Inc.**
                No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
                Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T161004D13-D

Sam Hu / Assistant Manager
Date: October 11, 2016

MSL Declaration of Conformity

1. Purpose: MSL (Moisture Sensitivity Levels) specification statement for all Innodisk products

2. Scope: For All Innodisk finish goods

3. Responsibilities: QA

4. Reference:

4.1 JEDEC, S-STD-020

4.2 JEDEC,J-STD-033

5. Description

5.1 Innodisk Products Level: All Innodisk products meet MSL Level 1

5.2 Floor Life Time: Refer following table

| Level | Floor Life | | Soak Requirements | | | |
| | | | Standard | | Accelerated | |
	Time	Cond degC/%RH	Time (hrs)	Cond degC/%RH	Time (hrs)	Cond degC/%RH
1	unlimited	<=30/85%	168+5/-0	85/85	n/a	n/a
2	1 year	<=30/60%	168+5/-0	85/60	n/a	n/a
2a	4 weeks	<=30/60%	696+5/-0	30/60	120+1/-0	60/60
3	168 hours	<=30/60%	192+5/-0	30/60	40+1/-0	60/60
4	72 hours	<=30/60%	96+2/-0	30/60	20+0.5/-0	60/60
5	48 hours	<=30/60%	72+2/-0	30/60	15+0.5/-0	60/60
5a	24 hours	<=30/60%	48+2/-0	30/60	10+0.5/-0	60/60
6	TOL	<=30/60%	TOL	30/60	n/a	60/60

Innodisk Corporation
Quality Assurance Div
Manager
Yi Chuan Chen
Date: 2018.09.21

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