

# InnoAGE

## 2.5" SATA SSD 3TI7

**Customer:** \_\_\_\_\_  
**Customer**  
**Part**  
**Number:** \_\_\_\_\_  
**Innodisk**  
**Part**  
**Number:** \_\_\_\_\_  
**Innodisk**  
**Model Name:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

Innodisk Approver	Customer Approver

Total Solution For  
Industrial Flash Storage

## Table of contents

<b>LIST OF FIGURES .....</b>	<b>6</b>
<b>1. PRODUCT OVERVIEW .....</b>	<b>7</b>
<b>1.1 INTRODUCTION OF INNOAGE™ INNOAGE 2.5" SATA SSD 3TI7 .....</b>	<b>7</b>
<b>1.2 PRODUCT VIEW AND MODELS .....</b>	<b>7</b>
<b>1.3 SATA INTERFACE.....</b>	<b>8</b>
<b>2. PRODUCT SPECIFICATIONS.....</b>	<b>8</b>
<b>2.1 CAPACITY AND DEVICE PARAMETERS.....</b>	<b>8</b>
<b>2.2 PERFORMANCE .....</b>	<b>9</b>
<b>2.3 ELECTRICAL SPECIFICATIONS .....</b>	<b>9</b>
<b>2.3.1 Power Requirement.....</b>	<b>9</b>
<b>2.3.2 Power Consumption .....</b>	<b>9</b>
<b>2.4 ENVIRONMENTAL SPECIFICATIONS .....</b>	<b>9</b>
<b>2.4.1 Temperature Ranges .....</b>	<b>9</b>
<b>2.4.2 Humidity.....</b>	<b>10</b>
<b>2.4.3 Shock and Vibration .....</b>	<b>10</b>
<b>2.4.4 Mean Time between Failures (MTBF) .....</b>	<b>10</b>
<b>2.5 CE AND FCC COMPATIBILITY .....</b>	<b>10</b>
<b>2.6 RoHS COMPLIANCE .....</b>	<b>10</b>
<b>2.7 RELIABILITY .....</b>	<b>11</b>
<b>2.8 TRANSFER MODE .....</b>	<b>12</b>
<b>2.9 PIN ASSIGNMENT .....</b>	<b>12</b>
<b>2.9.1 SATA Connector pin assignment.....</b>	<b>12</b>
<b>2.9.2 InnoAGE™ 2.5" SATA SSD pin header definition .....</b>	<b>13</b>
<b>2.10 MECHANICAL DIMENSIONS.....</b>	<b>15</b>
<b>2.10.1 InnoAGE™ 2.5" SATA SSD .....</b>	<b>15</b>
<b>2.10.2 Ethernet Daughter Board .....</b>	<b>15</b>
<b>2.11 ASSEMBLY WEIGHT .....</b>	<b>16</b>
<b>2.12 SEEK TIME .....</b>	<b>16</b>
<b>2.13 NAND FLASH MEMORY.....</b>	<b>16</b>
<b>3. THEORY OF OPERATION .....</b>	<b>17</b>
<b>3.1 OVERVIEW.....</b>	<b>17</b>
<b>3.2 SATA III CONTROLLER .....</b>	<b>17</b>
<b>3.3 MCU .....</b>	<b>17</b>
<b>3.4 ERROR DETECTION AND CORRECTION.....</b>	<b>19</b>
<b>3.5 WEAR-LEVELING .....</b>	<b>19</b>
<b>3.6 BAD BLOCKS MANAGEMENT .....</b>	<b>20</b>
<b>3.7 iDATA GUARD.....</b>	<b>20</b>

<b>3.8 GARBAGE COLLECTION/TRIM .....</b>	<b>20</b>
<b>3.9 TRIM .....</b>	<b>20</b>
<b>3.10 IPOWER GUARD .....</b>	<b>20</b>
<b>3.11 DIE RAID .....</b>	<b>21</b>
<b>3.12 HARDWARE-BASED 256-BIT AES .....</b>	<b>21</b>
<b>3.12.1 INNOAGE SSD WITH AES FLOW CHART .....</b>	<b>21</b>
<b>3.12.2 ENCRYPTED KEY MANAGEMENT .....</b>	<b>21</b>
<b>3.12.3 AUTHORIZED KEY MANAGEMENT .....</b>	<b>22</b>
<b>3.12 FW RECOVERY FUNCTION*1 .....</b>	<b>22</b>
<b>3.13 QUICK ERASE .....</b>	<b>23</b>
<b>3.14 WRITE PROTECT .....</b>	<b>23</b>
<b>3.15 SANITIZING INNOAGE SSD .....</b>	<b>24</b>
<b>4.1 INNOAGE 2.5" SATA SSD 3TI7 PIN DIRECTIONS .....</b>	<b>26</b>
<b>4.2 ELECTRICAL CONNECTIONS FOR INNOAGE 2.5" SATA SSD 3TI7 .....</b>	<b>26</b>
<b>4.3 FORM FACTOR .....</b>	<b>26</b>
<b>4.4 DEVICE DRIVE .....</b>	<b>27</b>
<b>5. SMART FEATURE SET .....</b>	<b>28</b>
<b>5.1 SMART ATTRIBUTES .....</b>	<b>28</b>
<b>6. PART NUMBER RULE .....</b>	<b>30</b>
<b>7. APPENDIX .....</b>	<b>31</b>

## REVISION HISTORY

Revision	Description	Date
Rev 1.0	First Released	Apr., 2020
Rev 1.1	Update Pin definition	Jun., 2020
Rev 1.1.1	Correct part number	July, 2020
Rev 1.2	Correct the typo of pin header 2 Support Private Cloud	July, 2020

## List of Tables

<b>TABLE 1: DEVICE PARAMETERS</b>	8
<b>TABLE 2: PERFORMANCE</b>	9
<b>TABLE 3: INNODISK INNOAGE 2.5" SATA SSD 3TI7 POWER REQUIREMENT</b>	9
<b>TABLE 4: POWER CONSUMPTION</b>	9
<b>TABLE 5: TEMPERATURE RANGE FOR INNOAGE 2.5" SATA SSD 3TI7</b>	9
<b>TABLE 6: SHOCK/VIBRATION TESTING FOR INNOAGE 2.5" SATA SSD 3TI7</b>	10
<b>TABLE 7: INNOAGE 2.5" SATA SSD 3TI7 MTBF</b>	10
<b>TABLE 8: INNODISK INNOAGE™ 2.5" SATA SSD 3TI7 PIN ASSIGNMENT</b>	12
<b>TABLE 9: INNODISK INNOAGE™ 2.5" SATA SSD 3TI7 PIN HEADER 1 ASSIGNMENT</b>	13
<b>TABLE 10: INNODISK INNOAGE™ 2.5" SATA SSD 3TI7 PIN HEADER 2 ASSIGNMENT</b>	14
<b>TABLE 11: SMART COMMAND</b>	28
<b>TABLE 12: SMART ATTRIBUTE</b>	28

## List of Figures

<b>FIGURE 1: INNODISK INNOAGE 2.5" SATA SSD 3TI7</b>	7
<b>FIGURE 2: INNODISK INNOAGE™ 2.5" SATA SSD 3TI7 BLOCK DIAGRAM</b>	17
<b>FIGURE 3: EDGE TO CLOUD SYSTEM ARCHITECTURE</b>	18
<b>FIGURE 4: INNOAGE SSD WITH AN EMBEDDED AZURE SPHERE</b>	18
<b>FIGURE 5: EDGE TO PRIVATE CLOUD SYSTEM ARCHITECTURE</b>	19
<b>FIGURE 6: INNOAGE SSD PARTITIONED FOR FUTURE RECOVERY PURPOSES</b>	23
<b>FIGURE 7: PC RESET PIN CONNECTION TO INNOAGE SSD BLOCK DIAGRAM</b>	23
<b>FIGURE 8: ATA CRYPTOGRAPHIC ERASE COMMAND</b>	24
<b>FIGURE 9: SCREENSHOT OF INNOAGE SSD MANAGEMENT PLATFORM</b>	25
<b>FIGURE 10: SIGNAL SEGMENT AND POWER SEGMENT</b>	26
<b>FIGURE 11: INNOAGE 2.5" SATA SSD 3TI7 MECHANICAL SCREW HOLE</b>	26

# 1. Product Overview

## 1.1 Introduction of InnoAGE™ InnoAGE 2.5" SATA SSD 3TI7

The InnoAGE™ SSD comes with a Microsoft Azure Sphere inside, and is further integrated with Innodisk's customized firmware, software, and hardware technology. This new solution enables multifunctional management: smart data analysis and updates, data security, and remote control through the cloud, while benefitting from the power of the Azure Sphere to guarantee secured communications between the SSD and the cloud.

The InnoAGE™ SSD delivers an easy-to-use interface with its customized cloud management platform. In technical terms, the Innodisk-developed firmware receives commands from the Azure Sphere via a second connection to Azure. Therefore, it is able to execute SSD debugging messages as well as monitor read/write behavior patterns to increase the storage device's lifespan. Most importantly, system operators can quickly revert to the default settings from the cloud-based dashboard in the case of a device or system crash.

In other words, the InnoAGE™ SSD is designed for both in-band and out-of-band network management, providing full recovery even when the operating system has crashed or is severely impaired to the extent that in-band management would be of little help.

**CAUTION** *TRIM must be enabled.*

*TRIM enables SSD's controller to skip invalid data instead of moving. It can free up significant amount of resources, extends the lifespan of SSD by reducing erase, and write cycles on the SSD. Innodisk's handling of garbage collection along with TRIM command improves write performance on SSDs.*

## 1.2 Product View and Models

Innodisk InnoAGE 2.5" SATA SSD 3TI7 is available in follow capacities within 3D TLC flash ICs.

[InnoAGE 2.5" SATA SSD 3TI7 64GB-1TB](#)



**Figure 1: Innodisk InnoAGE 2.5" SATA SSD 3TI7**

## 1.3 SATA Interface

Innodisk InnoAGE 2.5" SATA SSD 3TI7 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

InnoAGE™ 2.5" SATA SSD 3TI7 device parameters are shown in Table 1.

**Table 1: Device parameters**

Capacity	P/N	OS back-up capacity (GB)	LBA	User Capacity(GB)
64GB	DTS25-64GDK1E*1*2*3DF10G	10	96259888	45.9
	DTS25-64GDK1E*1*2*3DF20G	20	75288368	35.9
128GB	DTS25-A28DK1E*1*2*3QF10G	10	213470128	101.7
	DTS25-A28DK1E*1*2*3QF20G	20	19249860	91.7
	DTS25-A28DK1E*1*2*3QF30G	30	171527088	81.7
	DTS25-A28DK1E*1*2*3QF40G	40	150555568	71.7
	DTS25-A28DK1E*1*2*3QF50G	50	129584048	61.7
256GB	DTS25-B56DK1E*1*2*3QF10G	10	447890608	213.5
	DTS25-B56DK1E*1*2*3QF20G	20	426919088	203.5
	DTS25-B56DK1E*1*2*3QF30G	30	405947568	193.5
	DTS25-B56DK1E*1*2*3QF40G	40	384976048	183.5
	DTS25-B56DK1E*1*2*3QF50G	50	364004528	173.5
512GB	DTS25-C12DK1E*1*2*3QF10G	10	916731568	437.1
	DTS25-C12DK1E*1*2*3QF20G	20	895760048	427.1
	DTS25-C12DK1E*1*2*3QF30G	30	874788528	417.1
	DTS25-C12DK1E*1*2*3QF40G	40	853817008	407.1
	DTS25-C12DK1E*1*2*3QF50G	50	832845488	397.1
1TB	DTS25-01TDK1E*1*2*3QF10G	10	1854413488	884.2
	DTS25-01TDK1E*1*2*3QF20G	20	1833441968	874.2
	DTS25-01TDK1E*1*2*3QF30G	30	1812470448	864.2
	DTS25-01TDK1E*1*2*3QF40G	40	1791498928	854.2
	DTS25-01TDK1E*1*2*3QF50G	50	1770527408	844.2
Note	*1 E: Azure Cloud; J: Private Cloud *2 C: standard temperature (0°C to 70°C); W: wide temperature (-40°C to 85°C) *3 1: with Ethernet daughter board; 2: with Wi-Fi antenna			

## 2.2 Performance

Burst Transfer Rate: 6.0Gbps

**Table 2: Performance**

Capacity	64GB	128GB	256GB	512GB	1TB
Sequential* Read (max.)	350	550	550	560	550
Sequential* Write (max.)	70	150	290	330	340
4KB Random* Read (QD32)	22,000	44,000	77,000	83,000	80,000
4KB Random* Write (QD32)	18,000	36,000	67,000	74,000	71,000

Note: \*Performance results are measured in Room Temperature with Out-of-Box devices and may vary depending on overall system setup.

\*\* Performance results are based on CrystalDiskMark 6.0.0 with file size 1000MB of Queue Depth 32

## 2.3 Electrical Specifications

### 2.3.1 Power Requirement

**Table 3: Innodisk InnoAGE 2.5" SATA SSD 3TI7 Power Requirement**

Item	Symbol	Rating	Unit
Input voltage	V <sub>IN</sub>	+5 DC +- 5%	V

### 2.3.2 Power Consumption

**Table 4: Power Consumption**

Mode	Power Consumption (mA)					
	32GB	64GB	128GB	256GB	512GB	1TB
Read	210	250	300	290	310	390
Write	185	245	250	360	340	430
Idle	165	160	170	170	170	200
Peak	565	540	590	570	660	620

## 2.4 Environmental Specifications

### 2.4.1 Temperature Ranges

**Table 5: Temperature range for InnoAGE 2.5" SATA SSD 3TI7**

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

Storage	-55°C to +95°C
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## 2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

## 2.4.3 Shock and Vibration

**Table 6: Shock/Vibration Testing for InnoAGE 2.5" SATA SSD 3TI7**

Reliability	Test Conditions	Reference Standards
Vibration	7 Hz to 2K Hz, 20G, 3 axes	IEC 68-2-6
Mechanical Shock	Duration: 0.5ms, 1500 G, 3 axes	IEC 68-2-27

## 2.4.4 Mean Time between Failures (MTBF)

Table 7 summarizes the MTBF prediction results for various InnoAGE 2.5" SATA SSD 3TI7 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 7: InnoAGE 2.5" SATA SSD 3TI7 MTBF**

Product	Condition	MTBF (Hours)
Innodisk InnoAGE 2.5" SATA SSD 3TI7	Telcordia SR-332 GB, 25°C	>3,000,000

## 2.5 CE and FCC Compatibility

InnoAGE 2.5" SATA SSD 3TI7 conforms to CE and FCC requirements.

## 2.6 RoHS Compliance

InnoAGE 2.5" SATA SSD 3TI7 is fully compliant with RoHS directive.

## 2.7 Reliability

Parameter		Value
Read Cycles		Unlimited Read Cycles
Flash endurance		3,000 P/E cycles
Wear-Leveling Algorithm		Support
Bad Blocks Management		Support
DIE RAID Recovery		Support
Error Correct Code		Support
<b>TBW* (Total Bytes Written)</b> Units: TB		
Capacity	Sequential workload	Client workload
32GB	84.3	37.5
64GB	168.6	75
128GB	337.2	150
256GB	674.4	250
512GB	1348.8	500
1TB	2697.6	1000
* 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

InnoAGE™ 2.5" SATA SSD 3TI7 support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

## 2.9 Pin Assignment

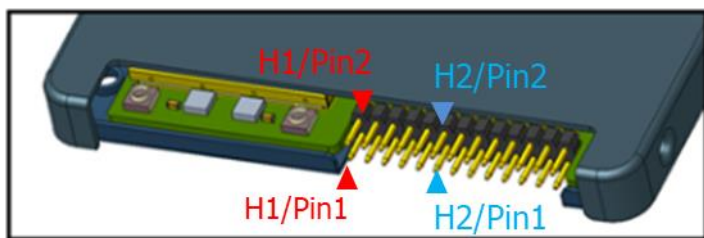
### 2.9.1 SATA Connector pin assignment

Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 uses a standard SATA pin-out. See Table 8 for InnoAGE™ 2.5" SATA SSD 3TI7 pin assignment.

**Table 8: Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 Pin Assignment**

Name	Type	Description
S1	GND	NA
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	NA
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	NA
<b>Key and Spacing separate signal and power segments</b>		
P1	NC	NA
P2	NC	NA
P3	NC	NA
P4	GND	NA
P5	GND	NA
P6	GND	NA
P7	V5	5V Power, Pre-Charge
P8	V5	5V Power
P9	V5	5V Power
P10	GND	NA
P11	DAS/DSS	Device Activity Signal / Disable Staggered
P12	GND	NA
P13	NC	NA
P14	NC	NA
P15	NC	NA

## 2.9.2 InnoAGE™ 2.5" SATA SSD pin header definition



Pin header 1 is assigned for trigger PC reset function, while the OS recovery is finished, it will be automatically send command to notify PC to re-boot power. In addition, InnoAGE™ SSD reserves external GPIO pins to connect with system for customized application. Pin header 2 is design for connecting with daughter board from SPI to Ethernet. See table 9 and 10.

**Table 9: Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 Pin Header 1 Assignment**

SSD control MB reset	MB control SSD Recovery	MB Power status LED pin	MB SSD status LED pin	SSD control MB power button (optional)
H1/Pin 1	H1/Pin 3	H1/Pin 5	H1/Pin 7	H1/Pin 9
H1/Pin 2	H1/Pin 4	H1/Pin 6	H1/Pin 8	H1/Pin 10
GND	GND	GND	GND	GND

Pin	Function	Direction	Notification
1	RC_RST*	O	Active low
	GPIO	I/O	Bi-direction, function programmable
3	Recovery*	I	Active low
	GPIO	I/O	Interrupt-capable and bi-direction, function programmable
5	GPIO	I/O	Bi-direction, function programmable
	TX	O	TX of UART, pair with pin 7
7	GPIO	I/O	Bi-direction, function programmable
	RX	I	RX of UART, pair with pin 5
9	GPIO	I/O	Interrupt-capable and bi-direction, function programmable
	PWM	O	PWM control, frequency/duty TBD
2/4/6/8/10	GND		System GND
* Default setting function $V_O$ range: $-0.28 < V_{OL} < 0.4$ ; $2.4 < V_{OH} < 3.63$ (V) $V_I$ range: $-0.28 < V_{IL} < 0.28$ ; $2.0 < V_{IH} < 3.63$ (V)			

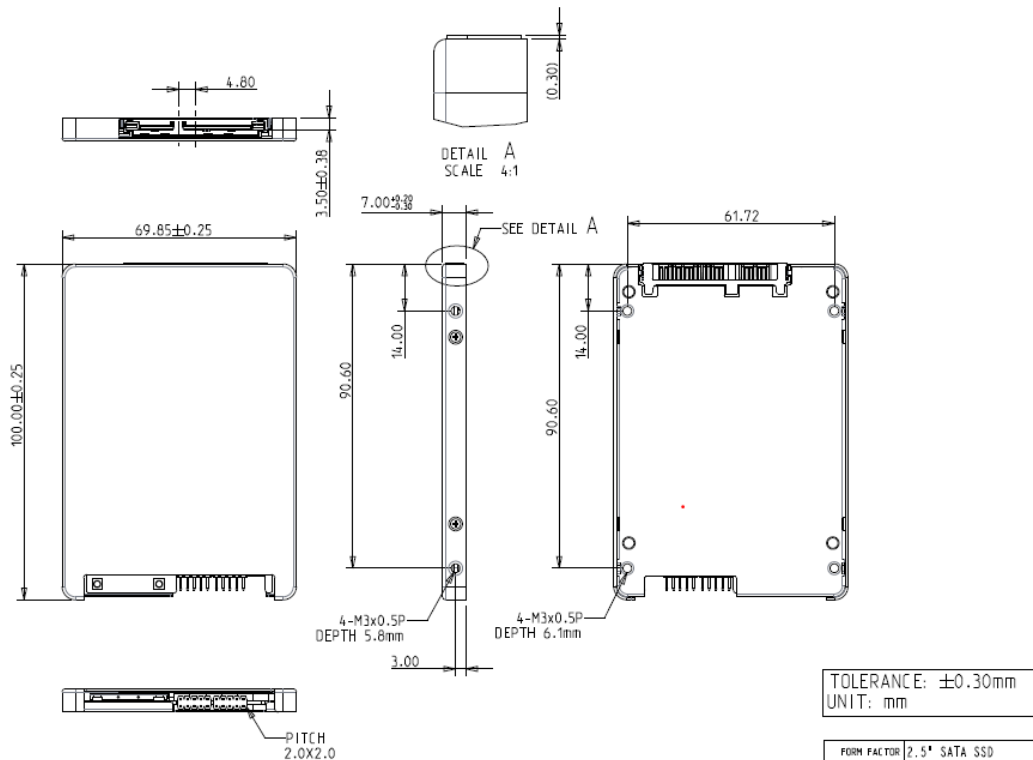
**Table 10: Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 Pin Header 2 Assignment**

INT	MISO	CLK	RST	GND
H2/Pin 1	H2/Pin 3	H2/Pin 5	H2/Pin 7	H2/Pin 9
H2/Pin 2	H2/Pin 4	H2/Pin 6	H2/Pin 8	H2/Pin 10
NC	NC	MOSI	CS	3.3V

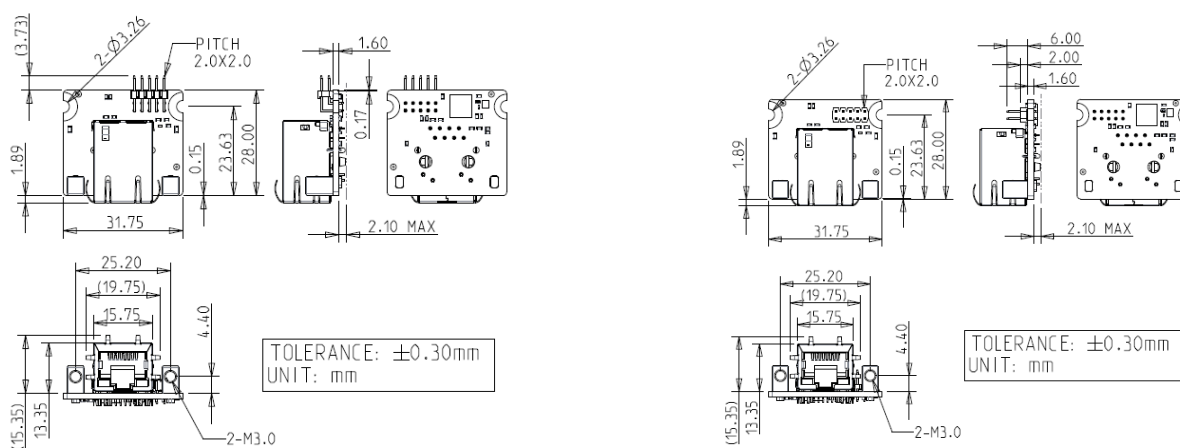
Pin	Function	Direction	Notification
1	INT*	I	Interrupt-capable GPIO
	PWM	O	PWM control, frequency/duty TBD
	GPIO	I/O	Bi-direction, function programmable
3	MISO*	I	MISO of SPI interface, pair with pin 5/6/8
	DATA	I/O	CLK of I2C interface, pair with pin5
	RX	I	RX of UART, pair with pin 5/6/8
	GPIO	I/O	Bi-direction, function programmable
5	CLK*	O	CLK of SPI interface, pair with pin 3/6/8
	TX	O	TX of UART, pair with pin 3/6/8
	GPIO	I/O	Bi-direction, function programmable
6	MOSI*	O	MOSI of SPI interface, pair with pin 3/5/8
	CLK	I/O	CLK of I2C interface, pair with pin 3
	RTS	O	RTS of UART, pair with pin 3/5/8
	GPIO	I/O	Bi-direction, function programmable
7	RST	I	SSD module reset pin, active low
8	CS*	O	CS of SPI interface, pair with pin 3/5/6
	CTS	I	CST of UART, pair with pin 3/5/6
	GPIO	I/O	Bi-direction, function programmable
10	3V3		System power 3.3V
9	GND		System GND
2/4	NC		No internal connection
* Default setting function $V_O$ range: $-0.28 < V_{OL} < 0.4$ ; $2.4 < V_{OH} < 3.63$ (V) $V_I$ range: $-0.28 < V_{IL} < 0.28$ ; $2.0 < V_{IH} < 3.63$ (V)			

## 2.10 Mechanical Dimensions

### 2.10.1 InnoAGE™ 2.5" SATA SSD

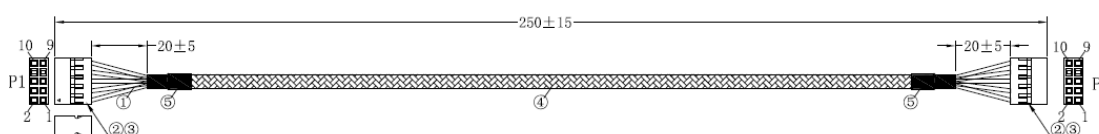


### 2.10.2 Ethernet Daughter Board



## Horizontal Type

## Vertical Type



## Cable Connection to Ethernet Daughter Board

### **2.11 Assembly Weight**

An Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 within flash ICs, 32GB's weight is 8 grams approximately.

### **2.12 Seek Time**

Innodisk InnoAGE™ SATA SSD 3TI7 is not a magnetic rotating design. There is no seek or rotational latency required.

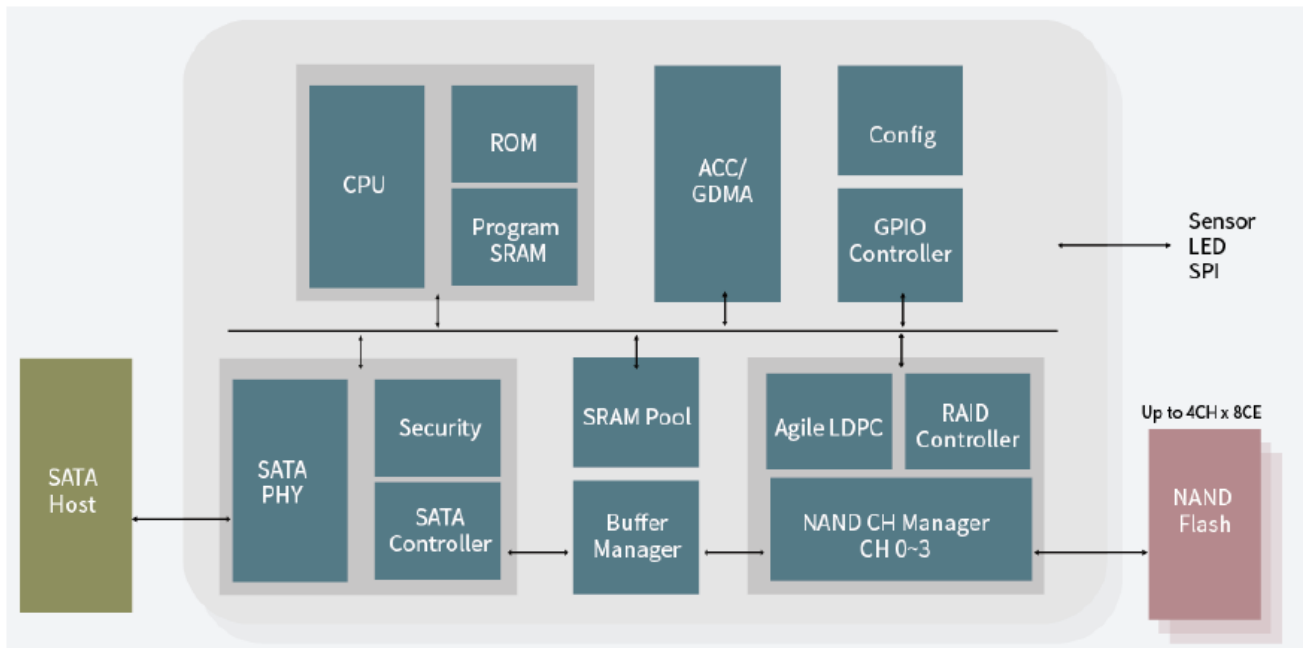
### **2.13 NAND Flash Memory**

Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 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 2 shows the operation of Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 from the system level, including the major hardware blocks.



**Figure 2: Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 Block Diagram**

Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 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.

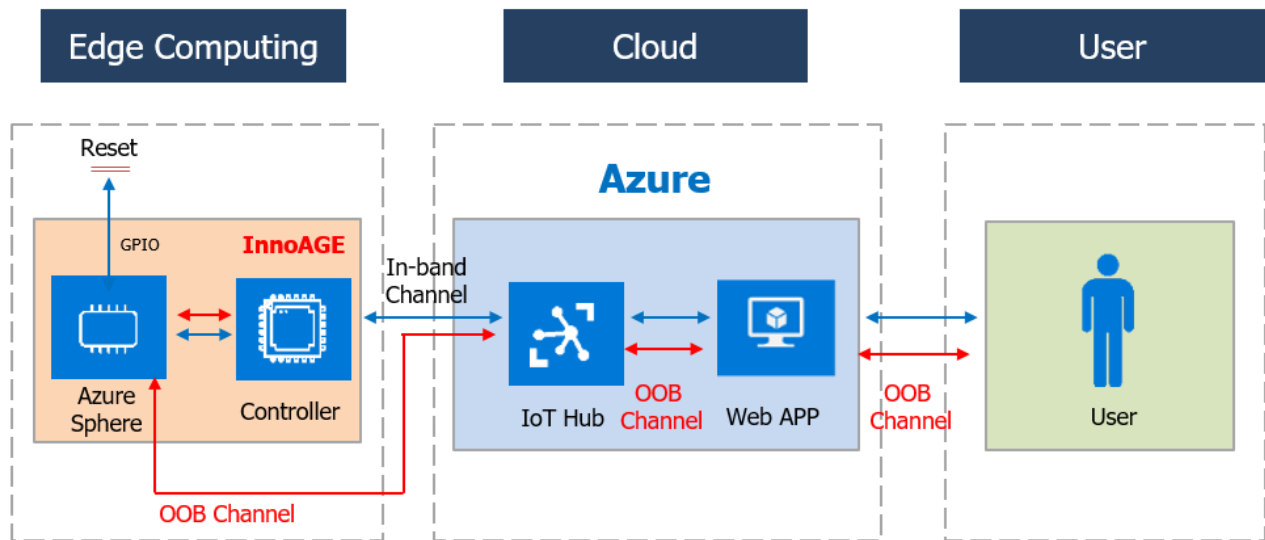
### 3.2 SATA III Controller

Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 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.

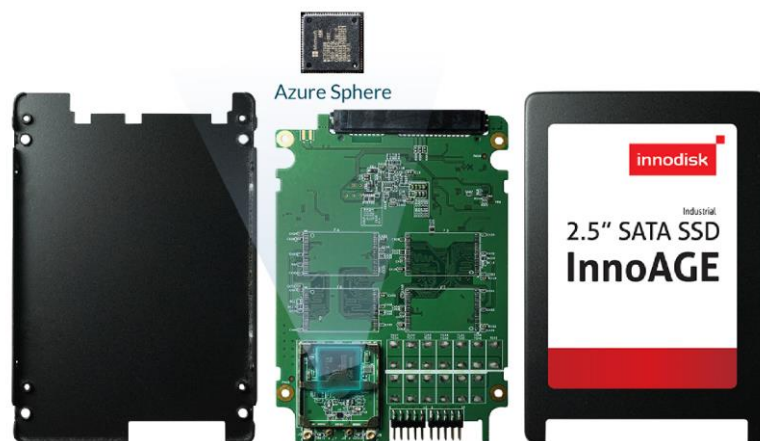
### 3.3 MCU

Innodisk InnoAGE™ 2.5" SATA SSD 3TI7 is with out-of-band signaling, which is integrated MCU to separate connection channel. This independent communication channel is assuring constant access, InnoAGE™ 2.5" SATA SSD 3TI7 is always ready for user to remotely control such as

recovery, backup, and secure erase without depending on the reset of the system being functional. InnoAGE™ 2.5" SATA SSD 3TI7 is embedded Azure Sphere to implement out-of-band function. Azure Sphere is Microsoft-designed MCU intended for use in IOT devices. Functioning as a system itself, the Azure Sphere runs the Azure Sphere OS, which allows the device to operate independently of the host device's OS. To ensure that device remains fully protected against external threats such as unauthorized access attempts, Microsoft has created a powerful security suite to ensure device integrity and to protect the hardware from malicious actors. The security provided by the Azure Sphere also encompasses secure and encrypted access to Azure Cloud services.

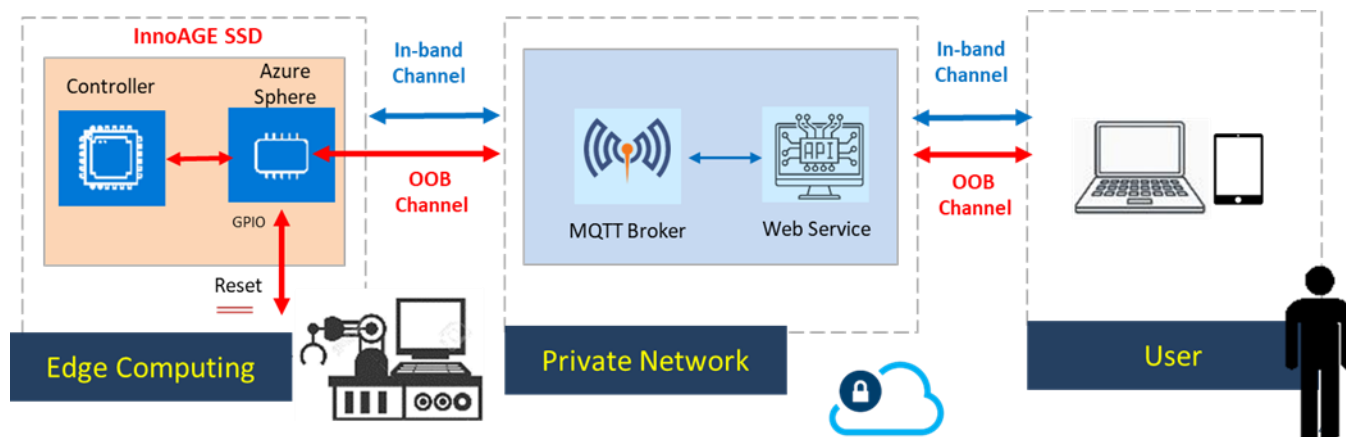


**Figure 3: Edge to Cloud System Architecture**



**Figure 4: InnoAGE SSD with an embedded Azure Sphere**

InnoAGE support out of band feature in private cloud also by MQTT Broker. User can setup Sever for InnoAGE and take Server's IP as static IP 172.16.0.10 (figure 19) from AP or Router that can enable DHCP function to build up private networking. User can take the following table as reference to setup network environment for InnoAGE. And ensure the port 80 (dashboard), 1883 (broker), 8161 (service) can be used for InnoAGE.



**Figure 5: Edge to Private Cloud System Architecture**

Property	Value
Class B	172.16.0.0 ~ 172.31.255.255
Addresses per network	65534
Server IP (InnoAGE default connect to server IP)	172.16.0.10
Ports (Web Service)	80, 1883, 8161
Gateway	255.255.0.0 (/16)

Notice: In Private cloud, InnoAGE doesn't support Azure sphere OS update and InnoAGE App OTA now.

### 3.4 Error Detection and Correction

Innodisk InnoAGE 2.5" SATA SSD 3TI7 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.

### 3.5 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 InnoAGE InnoAGE 2.5" SATA SSD 3TI7 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.

### 3.6 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.

### 3.7 iData Guard

Innodisk's 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. Innodisk's iData Guard provides effective power cycling management, preventing data stored in flash from degrading with use.

### 3.8 Garbage Collection/TRIM

Garbage collection and TRIM technology 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.

### 3.9 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.

### 3.10 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.

### 3.11 Die RAID

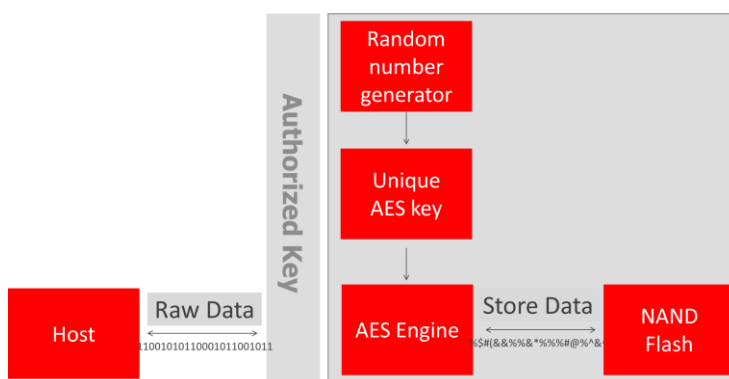
Die RAID is a controller function which leveraged user capacity to back up the data in NAND flash. Die RAID supported can ensure the user data in the NAND Flash more consistent in certain scenario. Innodisk M.2 (S80) 3TE7 series is default enable the Die RAID function for the industrial application.

### 3.12 Hardware-based 256-bit AES (Optional)

Innodisk InnoAGE 2.5" SATA SSD 3TI7 is designed with 256-bit AES engine, which is built-in the controller. When controller receives the data package from host, AES engine encrypts the data package and save the encrypted data into NAND flash. Thus, unauthorized personal has no access to decrypt the data in NAND flash. Hardware-encryption also means that the process is fully OS independent, as it does not require compliance with any system or software.

#### 3.12.1 InnoAGE SSD with AES Flow Chart (Optional)

In order to complete the physical security layer of protection, encryption needs to be paired with an ATA user password by ATA security command. After setting the authorized key by ATA security command, every time when you power on the system with SSD encrypted, you will be requested for a password to access the SSD. If the password is correct, the SSD will run well; if not, then you will not be able to access the SSD then.



#### 3.12.2 Encrypted Key Management (Optional)

Innodisk InnoAGE 2.5" SATA SSD 3TI7 includes two methods of key management to apply to different applications. The first is a standard approach that allows the firmware to generate a random number and a unique key when it leaves the factory. This method ensures that the user can easily apply the SSD with the data encrypted key. Another approach is to meet unique customer requirements with an encrypted key generated by an SSD from the SATA interface host.

The SSD must keep the encrypted key value when receiving the reset commands. This method works best for the SSD as a removable device in different systems. Innodisk provides the test tool to execute the AES hardware encryption. This user-friendly tool, developed by Innodisk Corporation, allows the customer to use/test encryption functions.

### 3.12.3 Authorized Key Management (Optional)

In order to complete the physical security layer of protection, encryption needs to be bundled with an ATA user password provided by an ATA Security command. Unlike the AES key, the authorized key must be set by the user via the BIOS configuration. Every time you power on the system with SSD encryption, a password request prompt is sent to access the SSD. If the password is correct, the SSD will run well; if not, you will not be able to access the SSD.

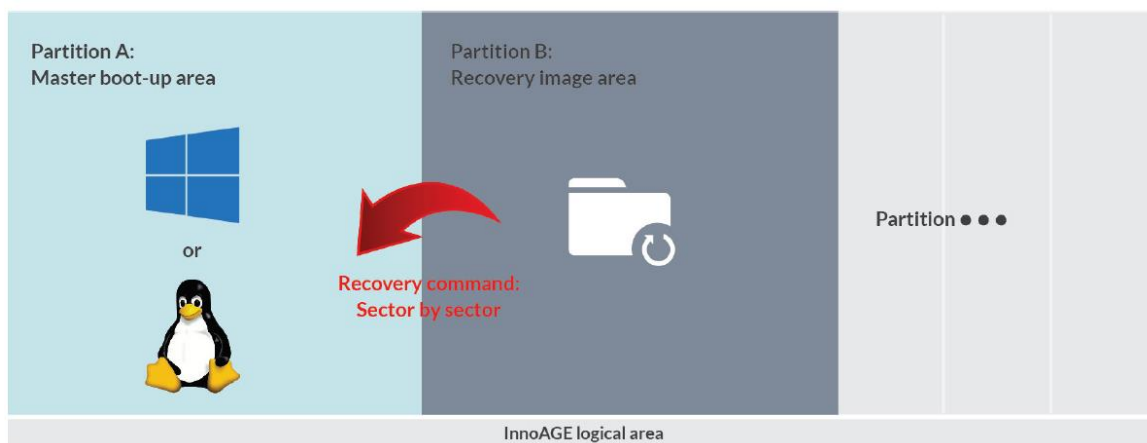
Command	Command Code
SECURITY SET PASSWORD	0XF1
SECURITY UNLOCK	0XF2
SECURITY ERASE PREPARE	0XF3
SECURITY ERASE UNIT	0XF4
SECURITY FREEZE LOCK	0XF5
SECURITY DISABLE PASSWORD	0XF6

### 3.12 FW Recovery Function\*<sup>1</sup>

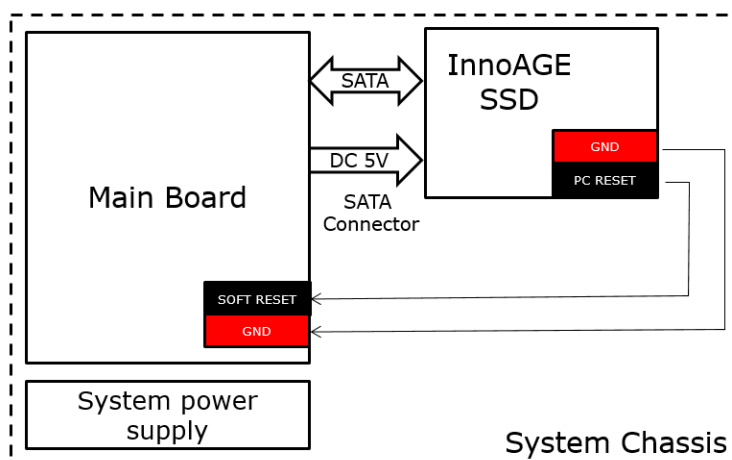
InnoAGE SSD has one drive partition dedicated to recovery, meaning that recovery image for the device OS is available at all time. User can set a partition to install backup\*<sup>1</sup> image in advance. While the master boot-up area is crashed, the recovery command would designate the partition with backup image to recovery the master boot-up partition. When the execution of recovery is finished, FW will send the PC reset\*<sup>2</sup> command to the system automatically. This function can be triggered remotely through both in-band and out-of-band channels to rapidly restore edge system. It is independent OS and platform to recovery system due to LBA movement.

\*1. The implementation of recovery and backup can refer to user guide of APP tool.

\*2. User MUST to connect the PC reset pin to the pin header 1 of InnoAGE SSD (See table 9).



**Figure 6: InnoAGE SSD partitioned for future recovery purposes**



**Figure 7: PC reset pin connection to InnoAGE SSD Block Diagram**

### 3.13 Quick Erase

Quick Erase function is designed for emergency data erase in few seconds by providing ATA command. This function can be triggered from cloud to InnoAGE SSD remotely through both in-band and out-of-band channels.

### 3.14 Write Protect

When Write Protect pins are shorted, Write Protect function would be enabled, and ATA write command would be aborted, which can prevent the disk from data modification or data deletion. Write-protected data in disk is read-only, that is, users could not write to it, edit it, append data to it, or delete it. This function can be triggered from cloud to InnoAGE SSD remotely through both in-band and out-of-band channels.

### 3.15 Sanitizing InnoAGE SSD

Sanitizing means rendering encrypted data useless by changing the AES encryption key. This operation is initiated through the ATA Cryptographic Erase command. After the key has been altered, the data written with the previous key would appear to be random, incomprehensible data. This function also allows the user to verify that hardware encryption actually works. The purpose of ATA Cryptographic Erase command is to sanitize all user data and make it unreadable, leaving out time-consuming normal erase procedure that requires many cycles of data over writing. This function can be triggered from cloud to InnoAGE SSD remotely through both in-band and out-of-band channels.

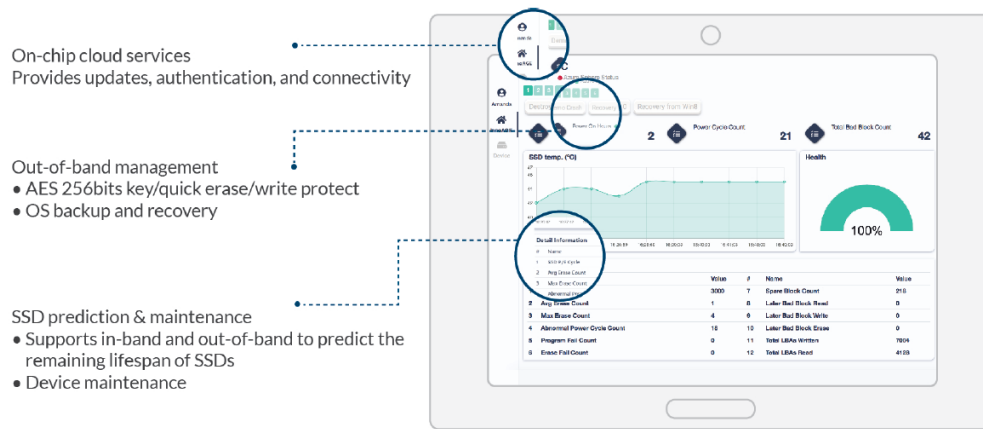
Field	Description	
FEATURE	0011h	
COUNT	Bit	Description
	15:5	Reserved
	4	FAILURE MODE bit
	3:0	Reserved
LDA	Bit	Description
	47:32	Reserved
	31:0	Shall be set to 4372_7970h(DWord)
DEVICE	Bit	Description
	7	Obsolete
	6	N/A
	5	Obsolete
	4	Transport Dependent
	3:0	Reserved
COMMAND	7:0 B4h	

**Figure 8: ATA Cryptographic Erase command**

### 3.16 Intuitive Management Platform\*

InnoAGE SSD can be presented through a simple browser-based user interface; the information is easily accessible for all users, regardless of factors such as device and location. By establishing thresholds for pertinent parameters, for example temperature or the number of SSD write cycles, the management system also offers predictability, which in turn makes it easier to plan future work on the system's deices.

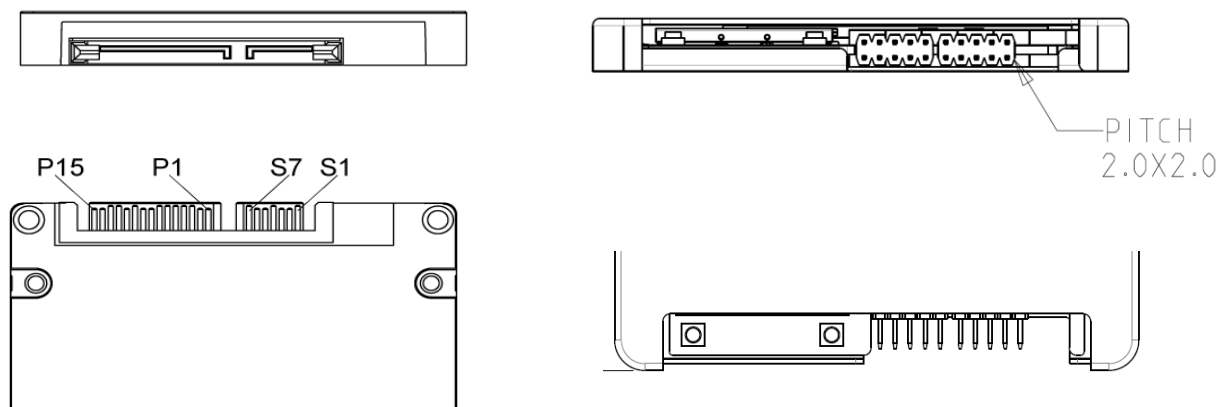
\* The implementation of management platform can refer to user guide of APP tool.



**Figure 9: Screenshot of InnoAGE SSD management platform**

## 4. Installation Requirements

### 4.1 InnoAGE 2.5" SATA SSD 3TI7 Pin Directions



**Figure 10: Signal Segment and Power Segment**

### 4.2 Electrical Connections for InnoAGE 2.5" SATA SSD 3TI7

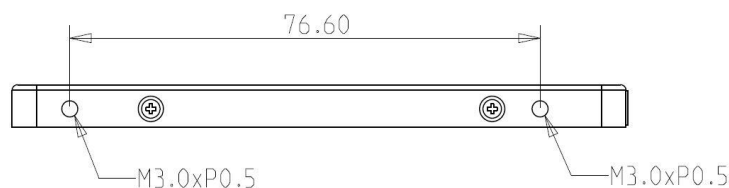
A Serial ATA device may be either directly connected to a host or connected to a host through an adaptor card. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

### 4.3 Form Factor

Please prepare following things:

- Screw driver.
- Four M3 screws. (Torque value 2.0 kgf-cm ~ 2.5 kgf-cm)
- SATA single cable (7-pin, Maximum length 1 meter).
- SATA power cable (15-pin).

Please turn off your computer, and open your computer's case. Find one of available 2.5-inch slot, and plug the SSD in. To use the screws fix the SSD. Plug in the SATA single cable, and power cable. Please boot the installation Operation System from CD-ROM, and install Operation System into SSD.



**Figure 11: InnoAGE 2.5" SATA SSD 3TI7 Mechanical Screw Hole**

## 4.4 Device Drive

No additional device drives are required. Innodisk InnoAGE 2.5" SATA SSD 3TI7 can be configured as a boot device.

## 5. SMART Feature Set

Innodisk 3TI7 series support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

**Table 11: 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 3TI7 series SMART data attributes are listed in following table.

**Table 12: 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	22	23	24
	D	T	S	2	5	-	6	4	G	D	K	1	E	C	1	Q	F	1	0	G	-	X	X	X
Description	Disk	2.5" SATA SSD					Capacity			Category			Flash mode	Operation Temp.	Internal Control	CH.	Flash	OS back up capacity				Customized Code		
Definition																								
Code 1 <sup>st</sup> (Disk)													Code 13 <sup>th</sup> (Flash Mode)											
D : Disk													E: Supported in Azure Cloud (IOT Hub)											
													J: Supported in Private Cloud (MQTT)											
Code 2 <sup>nd</sup> ~ 5 <sup>th</sup> (Form Factor)													Code 14 <sup>th</sup> (Operation Temperature)											
TS25: InnoAGE 2.5" SATA SSD													C: Standard Grade (0℃ ~ +70℃)											
													W: Industrial Grade (-40℃ ~ +85℃)											
Code 7 <sup>th</sup> ~9 <sup>th</sup> (Capacity)													Code 15 <sup>th</sup> (Internal control)											
64G: 64GB													1: Equipped with Ethernet Daughter Board											
A28: 128GB													2: Equipped with Wi-Fi Antenna											
B56: 256GB													Code 16 <sup>th</sup> (Channel of data transfer)											
C12: 512GB													D: Dual Channels											
01T:1TB													Q: Quad Channels											
													Code 17 <sup>th</sup> (Flash Type)											
Code 10 <sup>th</sup> ~12 <sup>th</sup> (Controller)													F: Toshiba 3D TLC											
DK1: SATA 3TI7													Code 18 <sup>th</sup> ~20 <sup>th</sup> (OS backup capacity)											
													10G: 10GB for OS backup area											
													20G: 20GB for OS backup area											
													30G: 30GB for OS backup area											
													40G: 40GB for OS backup area											
													50G: 50GB for OS backup area											
													Code 18 <sup>th</sup> ~20 <sup>th</sup> (Customized Code)											

## 7. Appendix

### RoHS 自我宣告書 (RoHS Declaration of Conformity)

#### Manufacturer Product: All Innodisk EM Flash and Dram 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.
- 三、 本公司聲明我們的產品符合 RoHS 指令的附件中 (7a)、(7c-1) 允許豁免。  
We declare, our products permitted by the following exemptions specified in the Annex of the RoHS directive.
- ※ (7a) Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead).
- ※ (7c-1) Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound.

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

innodisk

宜鼎國際股份有限公司  
**Innodisk Corporation**

Page 2/2

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

Date 日期： 2018 / 07 / 01



innodisk

宜鼎國際股份有限公司  
Innodisk Corporation  
REACH Declaration

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

We hereby confirm that the product(s) delivered to

Innodisk P/N	Description
All Innodisk EM FLASH Products	

- ☐ contain(s) no hazardous substances or constituents exceeding the defined threshold 0.1 % by weight in homogenous material if not otherwise specified, as described in the candidate list table currently including 197 substances and shown on the ECHA website (<http://echa.europa.eu/de/candidate-list-table>).
- ☒ contain(s) one or more hazardous substances or constituents exceeding 0.1 % by weight in homogenous material if not otherwise specified in candidate list table. Where the threshold value is exceeded, the substances in question are to be declared in accompanying Appendix A.
- ☒ Comply with REACH Annex XVII.

**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: 2019 / 01 / 31

**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

		Soak Requirements				
	Floor Life	Standard		Accelerated		
Level	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	<=30/80%	168+5/-0	85/80	n/a	n/a
2a	4 weeks	<=30/80%	888+5/-0	30/80	120+1/-0	80/80
3	168 hours	<=30/80%	192+5/-0	30/80	40+1/-0	80/80
4	72 hours	<=30/80%	96+2/-0	30/80	20+0.5/-0	80/80
5	48 hours	<=30/80%	72+2/-0	30/80	15+0.5/-0	80/80
5a	24 hours	<=30/80%	48+2/-0	30/80	10+0.5/-0	80/80
6	TOL	<=30/80%	TOL	30/80	n/a	80/80

Innodisk Corporation

Quality Assurance Div

Manager

Yi Chuan Chen

Date: 2018.09.21



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USA Office: [usasales@innodisk.com](mailto:usasales@innodisk.com) / Europe: [eusales@innodisk.com](mailto:eusales@innodisk.com) / Japan: [jpsales@innodisk.com](mailto:jpsales@innodisk.com) / China: [sales\\_cn@innodisk.com](mailto:sales_cn@innodisk.com)



## 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)

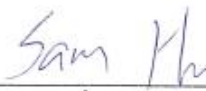
### Measurement Standard

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, Zhongsheng 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



## 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, Zhongsheng 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



## 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*