innodisk

Total Solution For Industrial Flash Storage

InnoAGE

M.2 (S80) 3TI7

Customer: _____

Customer Part Number: _____

Innodisk Part Number: _____

Innodisk Model Name: _____

Date: _____

Innodisk Approver	Customer Approver

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Revision History

Revision	Description	Date
V1.0	First Release	Apr., 2020
V1.1	Correct part number	July., 2020
V1.2	Correct the typo of pin header 2 Support Private Cloud	July., 2020

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1. Product Overview

1.1 Introduction of Innodisk InnoAGE M.2 (S80) 3TI7

The InnoAGE™ M.2 (S80) 3TI7 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™ M.2 (S80) 3TI7 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™ M.2 (S80) 3TI7 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 M.2 (S80) 3TI7 is available in follow capacities within 3D TLC flash ICs.

InnoAGE M.2 (S80) 3TI7 64GB-512GB

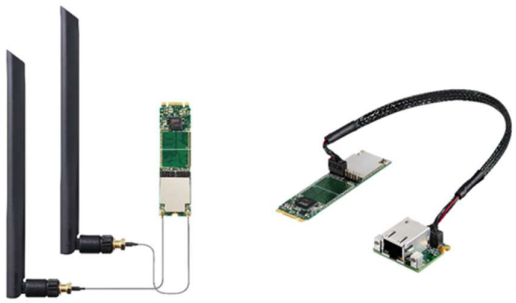


Figure 1: Innodisk InnoAGE M.2 (S80) 3TI7

1.3 SATA Interface

Innodisk InnoAGE M.2 (S80) 3TI7 supports SATA III interface, and compliant with SATA I and SATA II. SATA III interface can work with Serial Attached SCSI (SAS) host system, which is used in server computer. Innodisk InnoAGE M.2 (S80) 3TI7 is compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate).

2. Product Specifications

2.1 Capacity and Device Parameters

InnoAGE M.2 (S80) 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	DTM28-64GDK1*1*2*3DF10G	10	96259888	45.9
	DTM28-64GDK1*1*2*3DF20G	20	75288368	35.9
128GB	DTM28-A28DK1*1*2*3QF10G	10	213470128	101.7
	DTM28-A28DK1*1*2*3QF20G	20	19249860	91.7
	DTM28-A28DK1*1*2*3QF30G	30	171527088	81.7
	DTM28-A28DK1*1*2*3QF40G	40	150555568	71.7
	DTM28-A28DK1*1*2*3QF50G	50	129584048	61.7
256GB	DTM28-B56DK1*1*2*3QF10G	10	447890608	213.5
	DTM28-B56DK1*1*2*3QF20G	20	426919088	203.5
	DTM28-B56DK1*1*2*3QF30G	30	405947568	193.5
	DTM28-B56DK1*1*2*3QF40G	40	384976048	183.5
	DTM28-B56DK1*1*2*3QF50G	50	364004528	173.5
512GB	DTM28-C12DK1*1*2*3QF10G	10	916731568	437.1
	DTM28-C12DK1*1*2*3QF20G	20	895760048	427.1
	DTM28-C12DK1*1*2*3QF30G	30	874788528	417.1
	DTM28-C12DK1*1*2*3QF40G	40	853817008	407.1
	DTM28-C12DK1*1*2*3QF50G	50	832845488	397.1
1TB	DTM28-01TDK1*1*2*3QF10G	10	1854413488	884.2
	DTM28-01TDK1*1*2*3QF20G	20	1833441968	874.2
	DTM28-01TDK1*1*2*3QF30G	30	1812470448	864.2
	DTM28-01TDK1*1*2*3QF40G	40	1791498928	854.2
	DTM28-01TDK1*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	32GB	64GB	128GB	256GB	512GB
Sequential* Read (max.)	185 MB/s	370MB/s	550 MB/s	550 MB/s	540 MB/s
Sequential* Write (max.)	30 MB/s	60 MB/s	125 MB/s	255 MB/s	315 MB/s
4KB Random* Read (QD32)	13500 IOPS	25000 IOPS	48000 IOPS	70000 IOPS	61000 IOPS
4KB Random* Write (QD32)	7700 IOPS	16000 IOPS	32000 IOPS	59000 IOPS	70000 IOPS

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 M.2 (S80) 3TI7 Power Requirement

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

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Startup	590
Read	420
Write	490
Idle	245

* Target: 512GB InnoAGE M.2 (S80) 3TI7

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for InnoAGE M.2 (S80) 3TI7

Temperature	Range
Operating	Standard Grade: 0°C to +70°C
	Industrial Grade:-40°C to +85°C
Storage	-55°C to +95°C

2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

2.4.3 Shock and Vibration

Table 6: Shock/Vibration Testing for InnoAGE M.2 (S80) 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 M.2 (S80) 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 M.2 (S80) 3TI7 MTBF

Product	Condition	MTBF (Hours)
Innodisk InnoAGE M.2 (S80) 3TI7	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

InnoAGE M.2 (S80) 3TI7 conforms to CE and FCC requirements.

2.6 RoHS Compliance

InnoAGE M.2 (S80) 3TI7 is fully compliant with RoHS directive.

2.7 Reliability

Table 8: InnoAGE M.2 (S80) 3TI7 TBW

Parameter		Value
Read Cycles		Unlimited Read Cycles
Flash endurance		3,000 P/E cycles
Wear-Leveling Algorithm		Support
Bad Blocks Management		Support
Error Correct Code		Support
TBW* (Total Bytes Written) Unit: 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

* 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 M.2 (S80) 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 M.2 SATA pin assignment

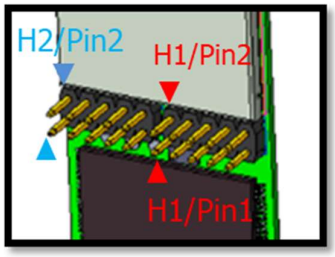
Innodisk InnoAGE M.2 (S80) 3TI7 uses a standard SATA pin-out. See Table 9 for InnoAGE M.2 (S80) 3TI7 pin assignment.

Table 9: Innodisk InnoAGE M.2 (S80) 3TI7 Pin Assignment

Signal Name	Pin #	Pin #	Signal Name
		75	GND
3.3V	74	73	GND
3.3V	72	71	GND
3.3V	70	69	GND
NC	68	67	NC
Notch	66	65	Notch
Notch	64	63	Notch
Notch	62	61	Notch
Notch	60	59	Notch
NC	58		
NC	56	57	GND
NC	54	55	NC
NC	52	53	NC
NC	50	51	GND
NC	48	49	RX+
NC	46	47	RX-
NC	44	45	GND
NC	42	43	TX-
NC	40	41	TX+
NC	38	39	GND
NC	36	37	NC
NC	34	35	NC
NC	32	33	GND
NC	30	31	NC
NC	28	29	NC

NC	26	27	GND
NC	24	25	NC
NC	22	23	NC
NC	20	21	GND
Notch	18	19	Notch
Notch	16	17	Notch
Notch	14	15	Notch
Notch	12	13	Notch
DAS/DSS	10	11	NC
NC	8	9	NC
NC	6	7	NC
3.3V	4	5	NC
3.3V	2	3	GND
		1	GND

2.9.2 InnoAGE™ M.2 pin header definition



Pin header 1 is assigned for trigger PC reset function, while the OS recovery is finished, it will be automatically send commend 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 10 and 11.

Table 10: Innodisk InnoAGE™ M.2 (S80) 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 11: Innodisk InnoAGE™ M.2 (S80) 3TI7 Pin Header 2 Assignment

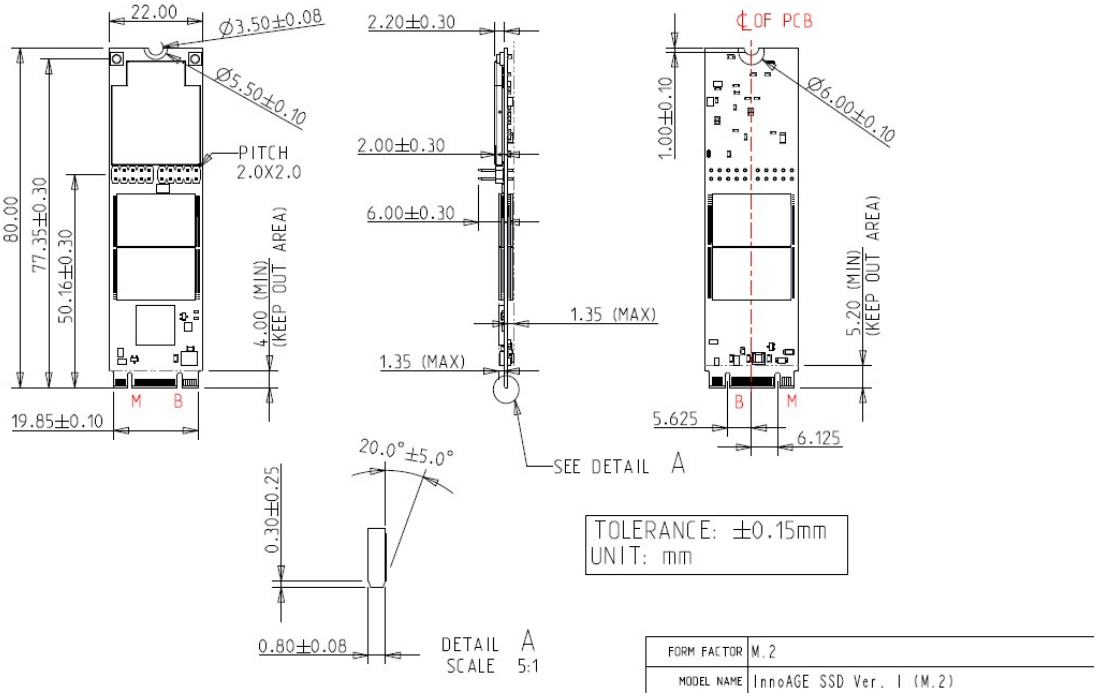
INT	MISO	CLK	RST	GND
H2/Pin 1	H2/Pin 3	H2/Pin 5	H2/Pin 7	H2/Pin 9
H2/Pin 2	H2/Pin 4	H2/Pin 6	H2/Pin 8	H2/Pin 10
NC	NC	MOSI	CS	3.3V

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

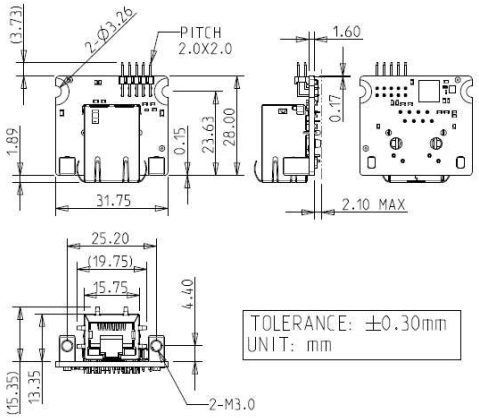
10	3V3		System power 3.3V
9	GND		System GND
2/4	NC		No internal connection
* Default setting function V_O range: -0.28<V_{OL}<0.4; 2.4<V_{OH}<3.63 (V) V_I range: -0.28<V_{IL}<0.28; 2.0<V_{IH}<3.63 (V)			

2.10 Mechanical Dimensions

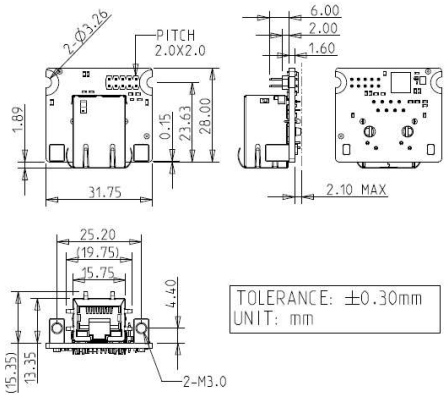
2.10.1 InnoAGETM M.2 (S80)



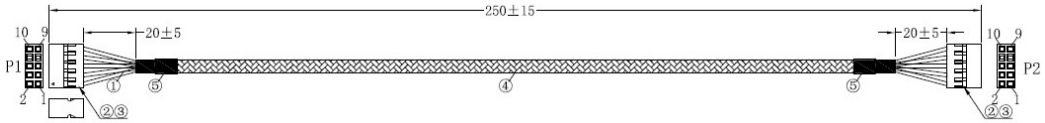
2.10.2 Ethernet Daughter Board



Horizontal Type



Vertical Type



Cable Connection to Ethernet Daughter Board

2.11 Assembly Weight

An Innodisk InnoAGE M.2 (S80) 3TI7 within flash ICs, 64GB's weight is 8 grams approximately.

2.12 Seek Time

Innodisk InnoAGE M.2 (S80) 3TI7 is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 Hot Plug

The SSD support hot plug function and can be removed or plugged-in during operation. User has to avoid hot plugging the SSD which is configured as boot device and installed operation system.

Surprise hot plug : The insertion of a SATA device into a backplane (combine signal and power) that has power present. The device powers up and initiates an OOB sequence.

Surprise hot removal: The removal of a SATA device from a powered backplane, without first being placed in a quiescent state.

2.14 NAND Flash Memory

Innodisk InnoAGE M.2 (S80) 3TI7 uses 3D Triple Level Cell (TLC) NAND flash memory, 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 M.2 (S80) 3TI7 from the system level, including the major hardware blocks.

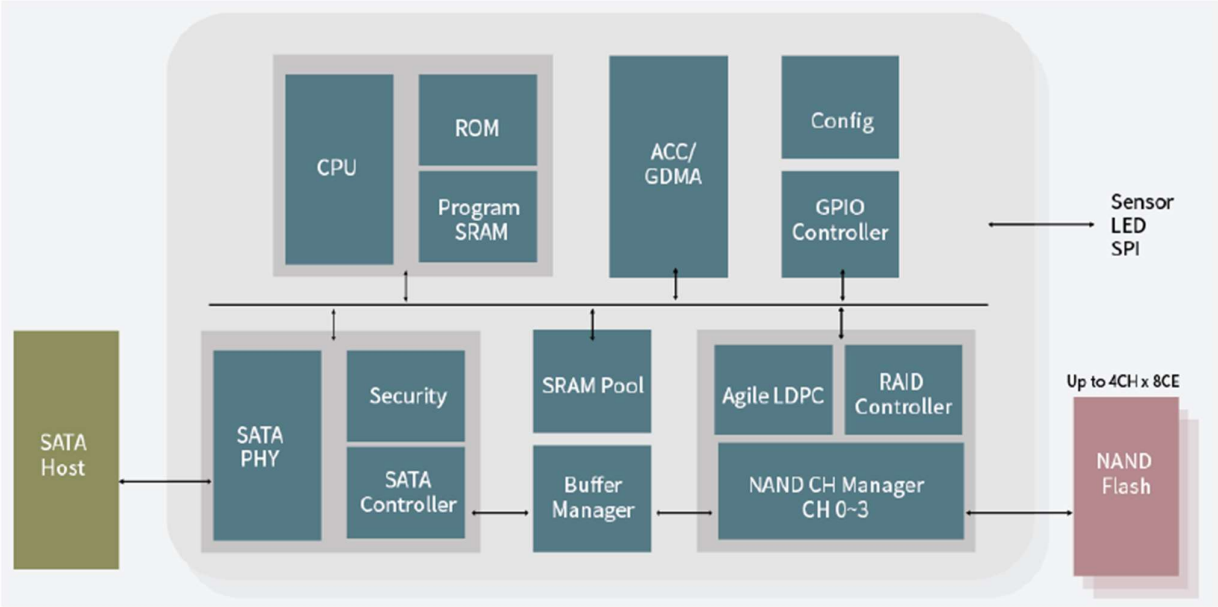


Figure 2: Innodisk InnoAGE M.2 (S80) 3TI7 Block Diagram

Innodisk InnoAGE M.2 (S80) 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 M.2 (S80) 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 M.2 (S80) 3TI7 is with out-of-band signaling, which is integrated MCU to separate connection channel. This independent communication channel is assuring constant access, InnoAGE M.2 (S80) 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 M.2 (S80) 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 ad to protect the hardware form malicious actors. The security provided by the Azure Sphere also encompasses secure and encrypted access to Azure Cloud services.

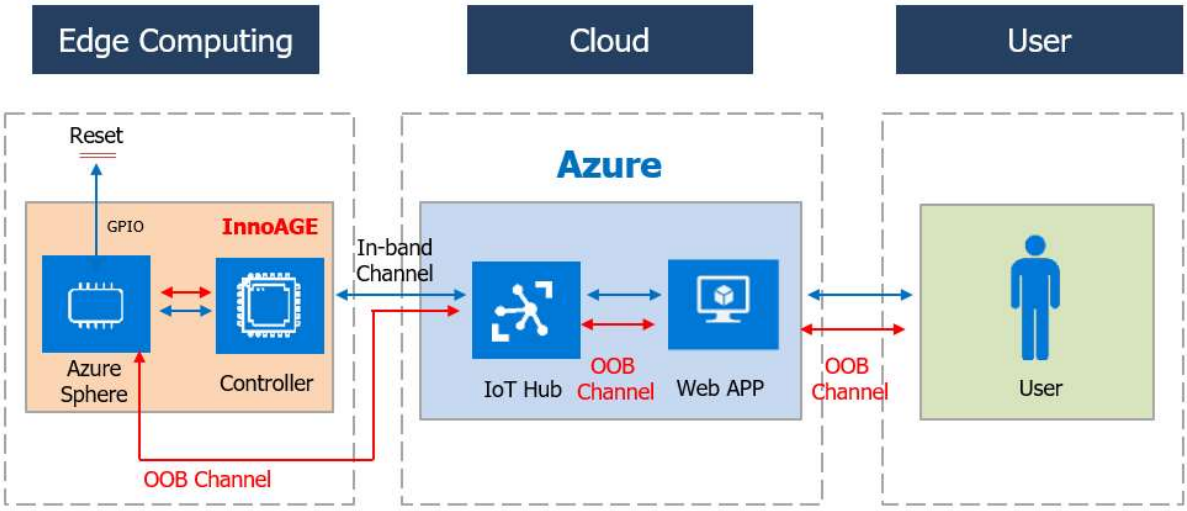


Figure 3: Edge to Azure Cloud System Architecture

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.

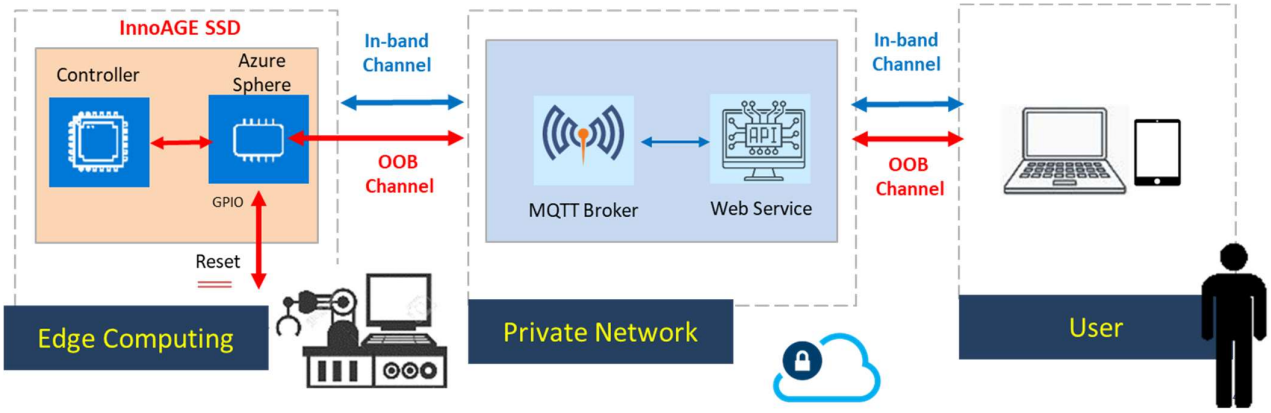


Figure 4: Edge to Private Cloud System Architecture

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 M.2 (S80) 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 M.2 (S80) 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

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.

3.9 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

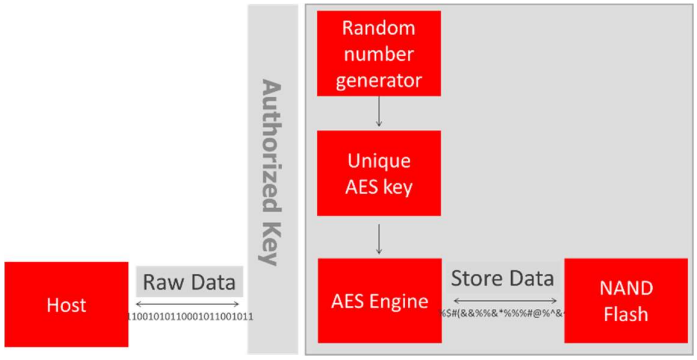
Die RAID is a controller function which leveraged user capacity to back up the data in NAND flash. Die RAID supported can ensure the user data in the NAND Flash more consistent in certain scenario. Innodisk InnoAGE M.2 (S80) 3TI7 series is default enable the Die RAID function for the industrial application.

3.12 Hardware-based 256-bit AES (Optional)

Innodisk InnoAGE M.2 (S80) 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 M.2 (S80) 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*1

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*1 image in advance. While the master boot-up area is crashed, the recovery command would designate the partition with backup image to recovery the mast boot-up partition. When the execution of recovery is finished, FW will send the PC reset*2 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).

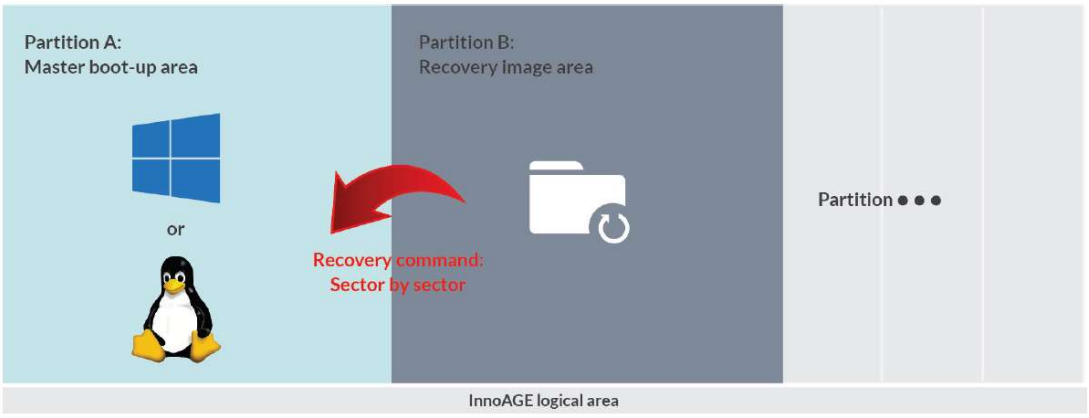


Figure 5: InnoAGE SSD partitioned for future recovery purposes

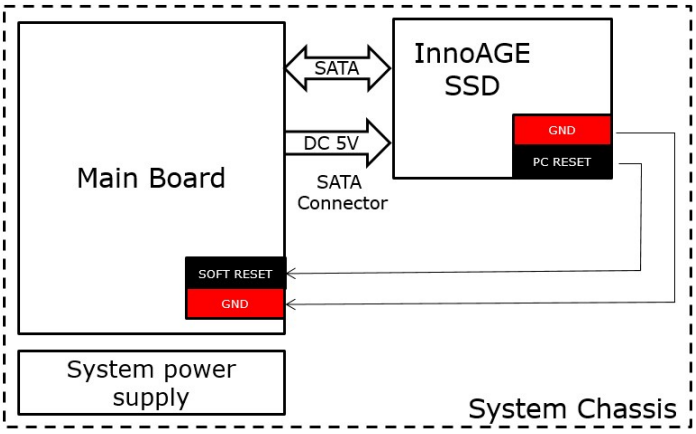


Figure 6: PC reset pin connection to InnoAGE SSD Block Diagram

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 7: 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.

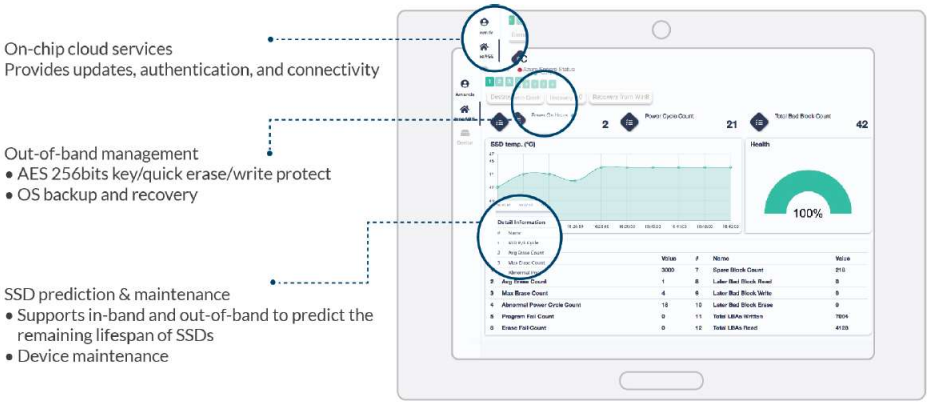


Figure 8: Screenshot of InnoAGE SSD management platform

4. Installation Requirements

4.1 InnoAGE M.2 (S80) 3TI7 Pin Directions

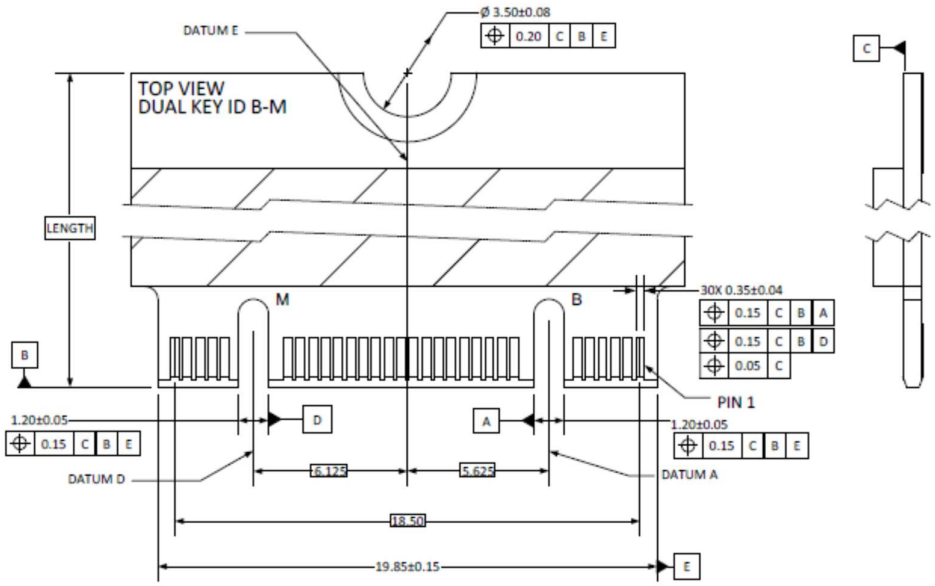


Figure 9: Signal Segment and Power Segment

4.2 Electrical Connections for InnoAGE M.2 (S80) 3TI7

A Serial ATA device may be either directly connected to a host or connected to a host through a cable. For connection via cable, the cable should be no longer than 1meter. 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 InnoAGE M.2 (S80) 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 12: 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 13: 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**	**M**	**2**	**8**	**-**	**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 1st (Disk)	**Code 13th (Flash Mode)**
D : Disk	E: Supported in Azure Cloud (IOT Hub)
	J: Supported in Private Cloud (MQTT)
Code 2nd ~ 5th (Form Factor)	**Code 14th (Operation Temperature)**
TM28: InnoAGE M.2 Type 2280-D2-B-M	C: Standard Grade (0℃~ +70℃)
	W: Industrial Grade (-40℃~ +85℃)
Code 7th ~9th (Capacity)	**Code 15th (Internal control)**
64G: 64GB	1: Equipped with Ethernet Daughter Board
A28: 128GB	2: Equipped with Wi-Fi Antenna
B56: 256GB	**Code 16th (Channel of data transfer)**
C12: 512GB	D: Dual Channels
	Q: Quad Channels
	Code 17th (Flash Type)
Code 10th ~12th (Controller)	F: Toshiba 3D TLC
DK1: SATA 3TI7	**Code 18th~20th (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 18th~20th (Customized Code)

7. Appendix

REACH

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 and Dram 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 191 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 & B.

☑ Comply with REACH Annex XVII.

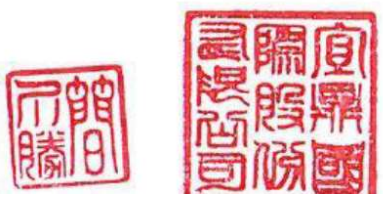
Guarantor

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： 2018 / 02 / 08



RoHS

innodisk

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 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.

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

MSL

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	<=30/60%	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

數位簽署者：Yi Chuan Chen
DN：cn=Yi Chuan Chen, o=Innodisk Corporation, ou=QA Div, email=yichuan_chen@innodisk.com, c=TW
日期：2018.09.21 13:39:10 +08'00'

CE

CE

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: M.2
Brand Name: Innodisk
Model Number: M.2 (S80) 3$*#-&
($:Flash type: (S:SLC,I:iSLC,M:MLC);
*:Product line: (E:Embedded, G:EverGreen, R:InnoRobust);
#:Controller: (empty:106/107/167, 2:20U/ 202, 3:108/109/170, 4~9:Others);
&:Product feature: (P:with DRAM, empty:without DRAM))

Measurement Standard

EN 55022: 2010 / AC: 2011
EN 61000-3-2: 2014
EN 61000-3-3: 2013
EN 55024: 2010
(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: TI607UD02-E

Sam Hu / Assistant Manager
Date: July 15, 2016

CCSRF
程馨科技股份有限公司
Compliance Certification Services Inc.

FCC

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: M.2
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*:Product line: (E:Embedded, G:EverGreen, R:InnoRobust);
#:Controller: (empty:106/107/167, 2:201/ 202, 3:108/109/170, 4~9:Others);
&:Product feature: (P:with DRAM, empty:without DRAM))

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: T160711D02-D

Sam Hu

Sam Hu / Assistant Manager
Date: July 15, 2016

CCSRF
程驊科技股份有限公司
Compliance Certification Services Inc.