# 2.5" SATA SSD

## 3SE2-P

## AES Function

**Customer:** _____

**Customer Part Number:** _____

**Innodisk Part Number:** _____

**Innodisk Model Name:** _____

**Date:** _____

| Innodisk Approver | Customer Approver |
|---|---|
|  |  |

**Total Solution For Industrial Flash Storage**

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# REVISION HISTORY

| Revision | Description | Date |
|----------|-------------|------|
| Rev 1.0 | First Released | May, 2017 |
| Rev 1.1 | Add 512GB with Toshiba information;<br>Remove 512GB with Micron information.<br>(Performance/LBA/ Power Consumption/ Mechanical Dimensions). | Nov., 2018 |
| Rev 1.2 | Add TRIM note<br>Update RoHS report | Apr., 2019 |
| Rev 1.3 | Add Quick Erase<br>Add Secure Erase<br>Add Write Protect<br>Update RoHS report to 2019 version | Jun., 2019 |
| Rev 1.4 | Modify Power Consumption Table | Oct., 2019 |
| Rev 1.5 | Update Assembly Torque Information | Mar., 2023 |
| Rev 1.6 | Remove 512GB | Mar., 2025 |

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# 1. Product Overview

## 1.1 Introduction of Innodisk 2.5″ SATA SSD 3SE2-P with AES function

Innodisk 2.5″ SATA SSD 3SE2-P products provide high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA (SATA) standard. It supports SATA III standard (6.0GHz) with high performance. Innodisk 2.5″ SATA SSD 3SE2-P is designed with 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. Innodisk 2.5″ SATA SSD 3SE2-P supports several standard features, including TRIM, NCQ, and S.M.A.R.T and compliant with TCG OPAL 2.0 and IEEE 1667.

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 2.5″ SATA SSD 3SE2-P is available in follow capacities:

2.5″ SATA SSD 3SE2-P 8GB    2.5″ SATA SSD 3SE2-P 64GB

2.5″ SATA SSD 3SE2-P 16GB    2.5″ SATA SSD 3SE2-P 128GB

2.5″ SATA SSD 3SE2-P 32GB    2.5″ SATA SSD 3SE2-P 256GB
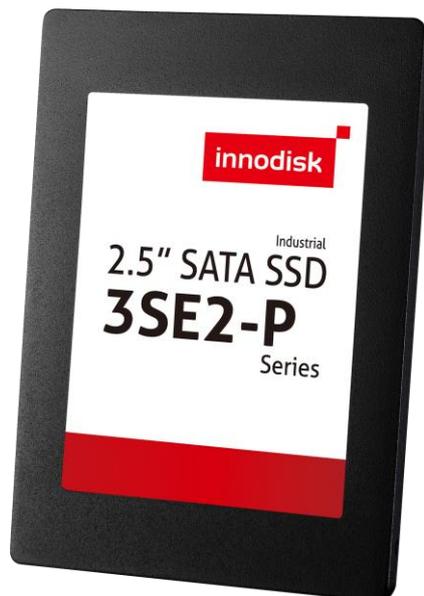


**Figure 1: Innodisk 2.5″ SATA SSD 3SE2-P**

## 1.3 SATA Interface

Innodisk 2.5″ SATA SSD 3SE2-P 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 2.5″ SATA SSD 3SE2-P is compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate). SATA connector uses a 7-pin signal segment and a 15-pin power segment.

## 1.4 2.5-inch Form Factor

The industry-standard 2.5-inch form factor design with metal material case is easy for installation, which has a compact design 69.85mm (W) x100.00mm (L) x 9.2 mm (H)

# 2. Product Specifications

## 2.1 Capacity and Device Parameters

2.5″ SATA SSD 3SE2-P device parameters are shown in Table 1.

**Table 1: Device parameters**

| Capacity | LBA | Cylinders | Heads | Sectors | User Capacity(MB) |
|---|---|---|---|---|---|
| 8GB | 14900256 | 13587 | 16 | 63 | 7275 |
| 16GB | 30367744 | 16383 | 16 | 63 | 14828 |
| 32GB | 61300736 | 16383 | 16 | 63 | 29932 |
| 64GB | 123166720 | 16383 | 16 | 63 | 60140 |
| 128GB | 246898688 | 16383 | 16 | 63 | 120556 |
| 256GB | 494362624 | 16383 | 16 | 63 | 241388 |

## 2.2 Performance

Burst Transfer Rate: 6.0Gbps

**Table 2: Performance**

| Capacity | 8GB | 16GB | 32GB | 64GB | 128GB | 256GB |
|---|---|---|---|---|---|---|
| Sequential* Read (max.) | 460 | 460 | 520 | 520 | 520 | 520 |
| Sequential Write (max.) | 110 | 120 | 240 | 330 | 340 | 340 |
| 4KB Random Read (QD32) | 63,000 IOPS | 65,000 IOPS | 77,000 IOPS | 77,000 IOPS | 76,000 IOPS | 77,000 IOPS |
| 4KB Random Write (QD32) | 34,000 IOPS | 34,000 IOPS | 65,000 IOPS | 72,000 IOPS | 75,000 IOPS | 75,000 IOPS |

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

       ** Random performance based on IOmeter with Queue Depth 32

## 2.3 Electrical Specifications

## 2.3.1 Power Requirement

**Table 3: Innodisk 2.5″ SATA SSD 3SE2-P Power Requirement**

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

## 2.3.2 Power Consumption

**Table 4: Power Consumption**

| Mode (unit: mA) | 8GB | 16GB | 32GB | 64GB | 128GB | 256GB |
|-----------------|-----|------|------|------|-------|-------|
| Read (RMS) | 204 | 179 | 181 | 184 | 181 | 174 |
| Write (RMS) | 330 | 273 | 308 | 331 | 347 | 361 |
| Idle | 132 | 131 | 131 | 134 | 126 | 133 |
| Boot Up | 1140 | 1070 | 1080 | 1030 | 1050 | 1030 |

\* Target: 2.5″ SATA SSD 3SE2-P

## 2.4 Environmental Specifications

## 2.4.1 Temperature Ranges

**Table 5: Temperature range for 2.5″ SATA SSD 3SE2-P**

| 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 2.5″ SATA SSD 3SE2-P**

| 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 7 summarizes the MTBF prediction results for various 2.5″ SATA SSD 3SE2-P 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: 2.5″ SATA SSD 3SE2-P MTBF**

| Product | Condition | MTBF (Hours) |
|---|---|---|
| Innodisk 2.5″ SATA SSD 3SE2-P | Telcordia SR-332 GB, 25°C | >3,000,000 |

## 2.5 CE and FCC Compatibility

2.5″ SATA SSD 3SE2-P conforms to CE and FCC requirements.

## 2.6 RoHS Compliance

2.5″ SATA SSD 3SE2-P is fully compliant with RoHS directive.

## 2.7 Reliability

| Parameter | Value | |
|---|---|---|
| Read Cycles | Unlimited Read Cycles | |
| Flash endurance | 60,000 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** |
| 08GB | 426.1 | 187.5 |
| 16GB | 852.3 | 375 |
| 32GB | 1704.5 | 750 |
| 64GB | 3409 | 1500 |
| 128GB | 6818.2 | 3000 |
| 256GB | 13636.4 | 6000 |
| *Note:<br><br>  1. Sequential: Mainly sequential write, tested by Vdbench.<br><br>  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

2.5″ SATA SSD 3SE2-P support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

## 2.9 Pin Assignment

Innodisk 2.5″ SATA SSD 3SE2-P uses a standard SATA pin-out. See Table 8 for 2.5″ SATA SSD 3SE2-P pin assignment.

**Table 8: Innodisk 2.5″ SATA SSD 3SE2-P 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 |
| **Key and Spacing separate signal and power segments** | | |
| 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 |

## 2.10 Mechanical Dimensions
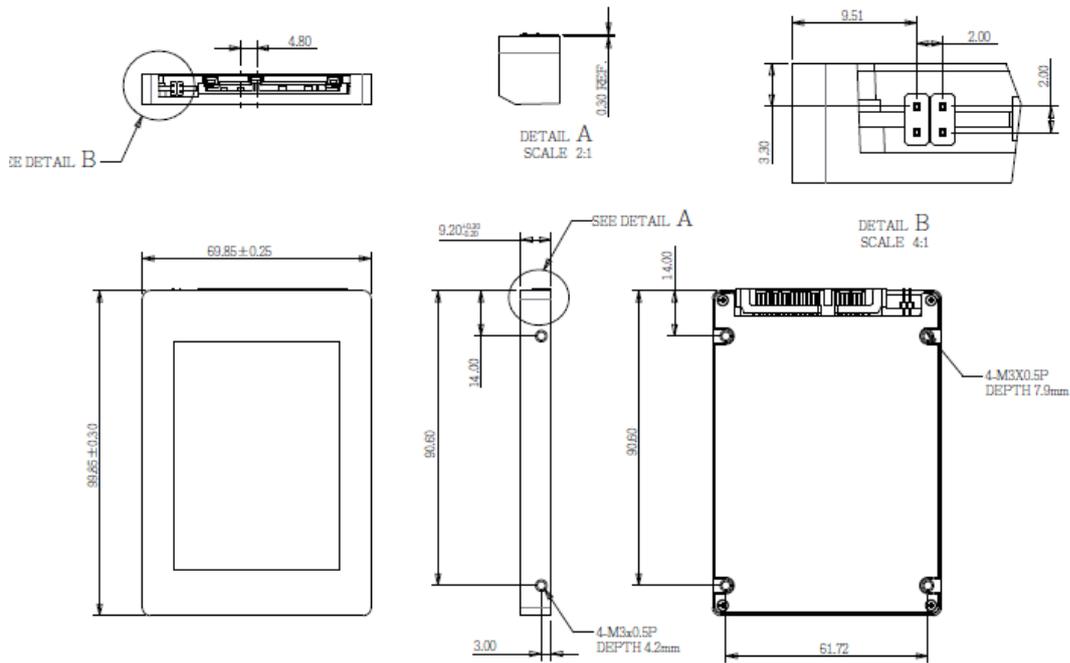


## 2.11 Assembly Weight

An Innodisk 2.5″ SATA SSD 3SE2-P within SLC flash ICs, 32GB's weight is 100 grams approx.

## 2.12 Seek Time

Innodisk 2.5″ SATA SSD 3SE2-P 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 2.5″ SATA SSD 3SE2-P uses Single Level Cell (SLC) 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 2.5" SATA SSD 3SE2-P from the system level, including the major hardware blocks.
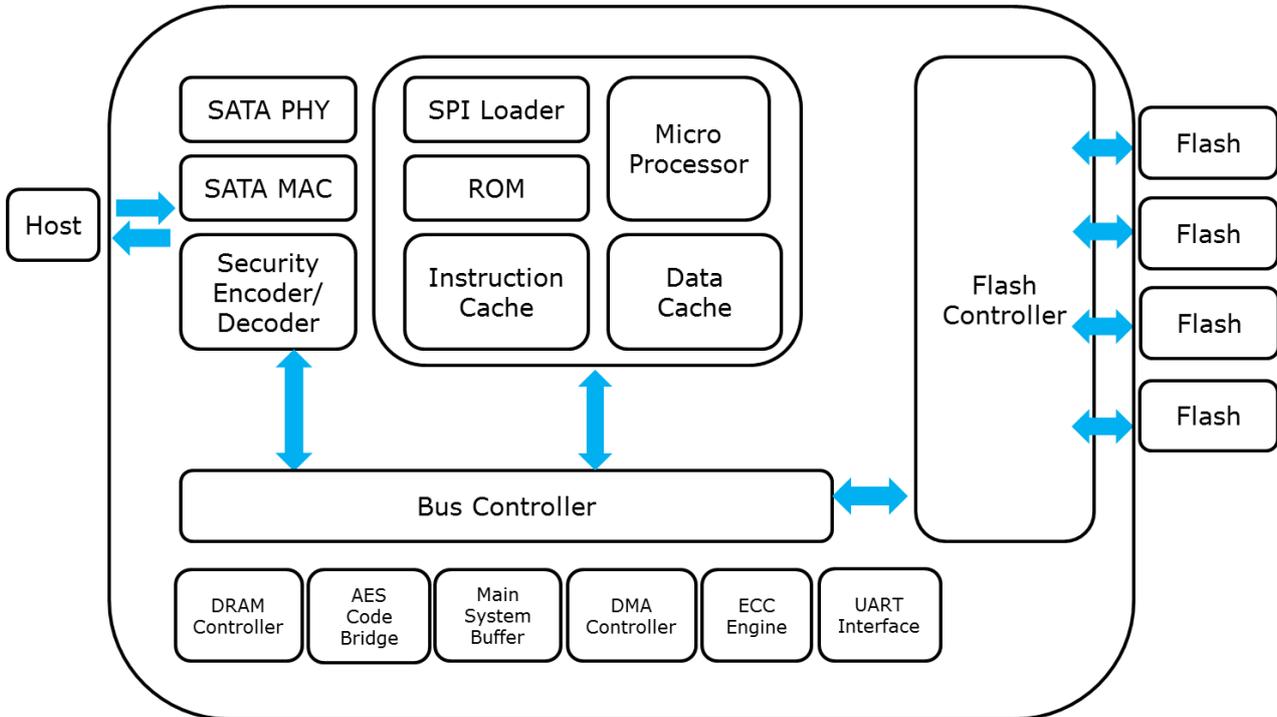


**Figure 2: Innodisk 2.5" SATA SSD 3SE2-P with AES Block Diagram**

Innodisk 2.5" SATA SSD 3SE2-P 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. The AES engine was built-in the ID201 controller. When 2.5" SATA SSD 3SE2-P is initiated with Firmware, AES engine will generate a random number to be an AES key. Each SSD has a unique AES key when it leaves the factory.

* iCell is optional feature with different part number.

## 3.2 SATA III Controller

Innodisk 2.5" SATA SSD 3SE2-P is designed with ID 201 built-in 256bits AES engine, a SATA III 6.0Gbps (Gen3) controller, which supports external DDDR3 DRAM. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen1, Gen2 and Gen3 specification (Gen3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

## 3.3 Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 66 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

## 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 2.5″ SATA SSD 3SE2-P 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/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.

## 3.8 PLP (iCell) Technology (Optional)

iCell circuit is designed with several capacitors to be able to provide power after host power off. The SSD controller can write all DRAM buffer data to flash, so that is why 2.5" SATA SSD 3SE2-P can ensure all data can be written to disk without any data loss.

## 3.9 2.5" SATA SSD 3SE2-P AES function flow chart

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.



**Figure 3: Innodisk 2.5" SATA SSD 3SE2-P AES flow chart**

## 3.9.1 Encrypted Key Management

Innodisk 3SE2-P SSD 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.

## 3.9.2 Authorized Key Management

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 |

### 3.9.3 TCG OPAL

OPAL is a set of specifications for features of data storage devices that enhance security. These specifications are published by the Trusted Computing Group's Storage Work Group. Innodisk 3SE2-P is compliant with TCG OPAL 2.0[*1]. The capability of TCG OPAL Security mode allows multiple users with independent access control to read/write/erase independent data areas (LBA ranges). Each locking range adjusts by authenticated authority. Note that by default there is a single "Global Range" that encompasses the whole user data area. In TCG Opal Security Mode, Revert, Revert SP and GenKey command can erase all of data including global range and locking range; in the meantime, generate the new encrypted key.

* You need to install TCG OPAL software to implement OPAL function, which is supplied by TCG OPAL software developed company

## 3.10 Quick Erase

Quick Erase function is designed for emergency data erase in few seconds by providing ATA command

### 3.10.1 Quick Erase Command

**- Protocol: No Data**

**- Inputs**

**Table 9: Execute Quick Erase command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 21h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**- Normal Outputs**

**Table 10: Quick Erase command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 3.11 Security Erase

Secure Erase function is designed for emergency data erase to comply with military standard. Erase functions can be triggered by sending ATA Command. All Data Block of flash chip will be erased by sending flash erase command.

Innodisk provides the following Security Erase for options:

(1) AFFSI 5020

(2) DoD 5220.22-M

(3) USA Navy NAVSO P-5239-26

(4) NSA Manual 130-2

(5) USA-Army 380-19

(6) NISPOMSUP Chap 8, Sect. 8-501

(7) NSA Manual 9-12

(8) IRIG 106

## 3.11.1 Secure Erase Command

**Identify Information**

Word 159 of Identify Table shows the SE pin's function. Identify Table can be read by sending ECh ATA command.

**Table 11: Identify Information**

| | | |
|---|---|---|
| 154 | Secure Function Support | |
| | 7-15      Reserved | 0 |
| | 6          1= Secure Erase ATA Vendor Command Supported | X |
| | 5          Reserved | 0 |
| | 4          1=Quick Erase ATA Vendor Command Supported | X |
| | 3          1=Destroy ATA Vendor Command Supported | X |
| | 1=Jumper Secure Erase Supported | X |
| | 1          1=Jumper Write Protect Supported | X |
| | 0          1=Jumper Quick Erase Supported | X |
| 155 | Secure Function Status(Enable/Disable) | |
| | 2-15      Reserved | |
| | 1= Write Protect Enabled | X |
| | 0        Reserved | 0 |
| 156-158 | Vendor Specific | |
| 159 | 8~15 Function of Jumper "QE" 0x20: Destroy 0x21 or Others: Quick Erase 0~7 Secure Erase Function of Jumper "SE" **0x22: AFFSI 5020** **0x23: DoD 5220.22-M** **0x24: USA Navy NAVSO P-5239-26** **0x25: NSA Manual 130-2** **0x26: USA-Army 380-19** | XXXXh |

| | |
|---|---|
| **0x27: NISPOMSUP Chap 8, Sect. 8-501** | |
| **0x28: NSA Manual 9-12** | |
| **0x29: IRIG106** | |

## *1. AFFSI5020*

This function is compliant with AFFSI 5020 specification.

Steps:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with random data.

**-Protocol: Non Data Command**

**-Inputs**

### Table 12: Execute AFFSI 5020 command for inputs information

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 22h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

### Table 13: AFFSI 5020 command for normal output information

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

   **DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## *2. DoD 5220.22-M*

This function is compliant with DoD 5220.22-M specification.

Steps:

1. The whole disk is filled with fixed character pattern 0x55.

2. The whole disk is erased using Flash Erase Command.

**-Protocol: Non Data Command**

**-Inputs**

**Table 14: Execute DoD 5220.22-M command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 23h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 15: DoD 5220.22-M command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## *3. USA Navy NAVSO P-5239-26*

This function is compliant with USA Navy NAVSO P-5239-26 specification.

Steps:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with random data.

3. The whole disk is erased using Flash Erase Command.

**-Protocol: Non Data Command**

**-Inputs**

**Table 16: Execute USA Navy NAVSO P-5239-26 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 24h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 17: USA Navy NAVSO P-5239-26 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |

| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
|--------|-----|------|-----|-----|-----|-----|-----|-----|
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

> **DEV** shall specify the selected device.

Status register

> **BSY** will be cleared to zero indicating command completion

> **DRDY** will be set to one.

> **DF** (Device Fault) will be cleared to zero.

> **DRQ** will be cleared to zero

> **ERR** will be cleared to zero.

## *4. NSA Manual 130-2*

This function is compliant with NSA Manual 130-2 specification.

Steps:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with random data.

3. The whole disk is filled with random data again.

4. The whole disk is erased using Flash Erase Command. The whole disk is filled with fixed character pattern 0x55.

**-Protocol: Non Data Command**

**-Inputs**

**Table 18: Execute NSA Manual 130-2 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|---|---|---|---|---|---|---|---|
| Features | 25h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 19: NSA Manual 130-2 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 5. USA-Army 380-19

This function is compliant with USA-Army 380-19 specification.

Step:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with random data.

3. The whole disk is filled with fixed character pattern 0x55.

4. The whole disk is filled with fixed character pattern 0xAA.

**-Protocol: Non Data Command**

**-Inputs**

**Table 20: Execute USA Army 380-19 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 26h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |

| LBA Mid | Na | | | | |
|---|---|---|---|---|---|
| LBA High | Na | | | | |
| Device | 1 | 1 | 1 | 0 | Na |
| Command | 82h | | | | |

**-Normal Outputs**

**Table 21: USA Army 380-19 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 6. NISPOMSUP Chap 8, Sect. 8-501

This function is compliant with NISPOMSUP Chap 8, Sect. 8-501 specification.

Steps:

1. The whole disk is filled with fixed character pattern 0x55.

2. The whole disk is filled with fixed character pattern 0xAA.

3. The whole disk is filled with random data.

**-Protocol: Non Data Command**

**-Inputs**

**Table 22: Execute NISPOMSUP Chap 8, Sect. 8-501 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 27h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 23: NISPOMSUP Chap 8, Sect. 8-501 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## *7. NSA Manual 9-12*

This function is compliant with NSA Manual 9-12 specification.

Step:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with unclassified pattern.

3. Verify the overwrite procedure by randomly rereading the overwritten information.

**-Protocol: Non Data Command**

**-Inputs**

**Table 24: Execute NSA Manual 9-12 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 28h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 25: NSA Manual 9-12 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## *8. IRIG1006*

This function is compliant with IRIG106 specification.

Step:

1. The whole disk is erased using Flash Erase Command.

2. The whole disk is filled with pattern 0x55, and read back to verify.

3. The whole disk is erased using Flash Erase Command.

4. The whole disk is filled with pattern 0xAA, and read back to verify.

5. The whole disk is erased using Flash Erase Command.

6. Write 0x00 to all bad blocks. If there is any bit is still 1, the page is re-written 0 again. This procedure this repeated up to 16 times.

7. Erase all bad blocks and checked to determine if any zero are found. If any zeros are found, erase this block again. This procedure this repeated up to 16 times.

8. Write "Secure Erase" string to all blocks.

**-Protocol: Non Data Command**

**-Inputs**

**Table 26: Execute IRIG160 command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 29h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 27: IRIG160 command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

   **DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 3.12 Destroy (Firmware Destroy)

Innodisk Unrecoverable FW Destroy function implements an ultimate data erase of the SSD. Once Unrecoverable Destroy is triggered, beside all the user data and SSD information, also SSD firmware will be erased and which is unusable. Triggered pin definition is set for optional and available for customization (Pin 1/2 or Pin 3/4).

### 3.12.1 Unrecoverable Destroy Command

**-Protocol: Non Data Command**

**-Inputs**

**Table 28: Execute Unrecoverable Destroy command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 20h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 29: Unrecoverable Destroy command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 3.13 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.

### 3.13.1 Enable Write Protect Command

This command enable SSD into write protect mode, which is read-only. The SSD under write protect will overpass any write command.

**-Protocol: Non Data Command**

**-Inputs**

**Table 30: Execute Enable Write Protect command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|---|---|---|---|---|---|---|---|
| Features | 17h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 31: Execute Enable Write Protect command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |

| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
|---|---|---|---|---|---|---|---|---|
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion

**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

## 3.13.2 Disable Write Protect Command

This command disable SSD's write protect feature.

**-Protocol: Non Data Command**

**-Inputs**

**Table 32: Execute Disable Write Protect command for inputs information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Features | 18h | | | | | | | |
| Sector Count | 41h | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | 1 | 1 | 1 | 0 | Na | | | |
| Command | 82h | | | | | | | |

**-Normal Outputs**

**Table 33: Execute Disable Write Protect command for normal output information**

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error | Na | | | | | | | |
| Sector Count | Na | | | | | | | |
| LBA Low | Na | | | | | | | |
| LBA Mid | Na | | | | | | | |
| LBA High | Na | | | | | | | |
| Device | obs | Na | obs | DEV | Na | Na | Na | Na |
| Status | BSY | DRDY | DF | Na | DRQ | Na | Na | ERR |

Device register-

**DEV** shall specify the selected device.

Status register

**BSY** will be cleared to zero indicating command completion
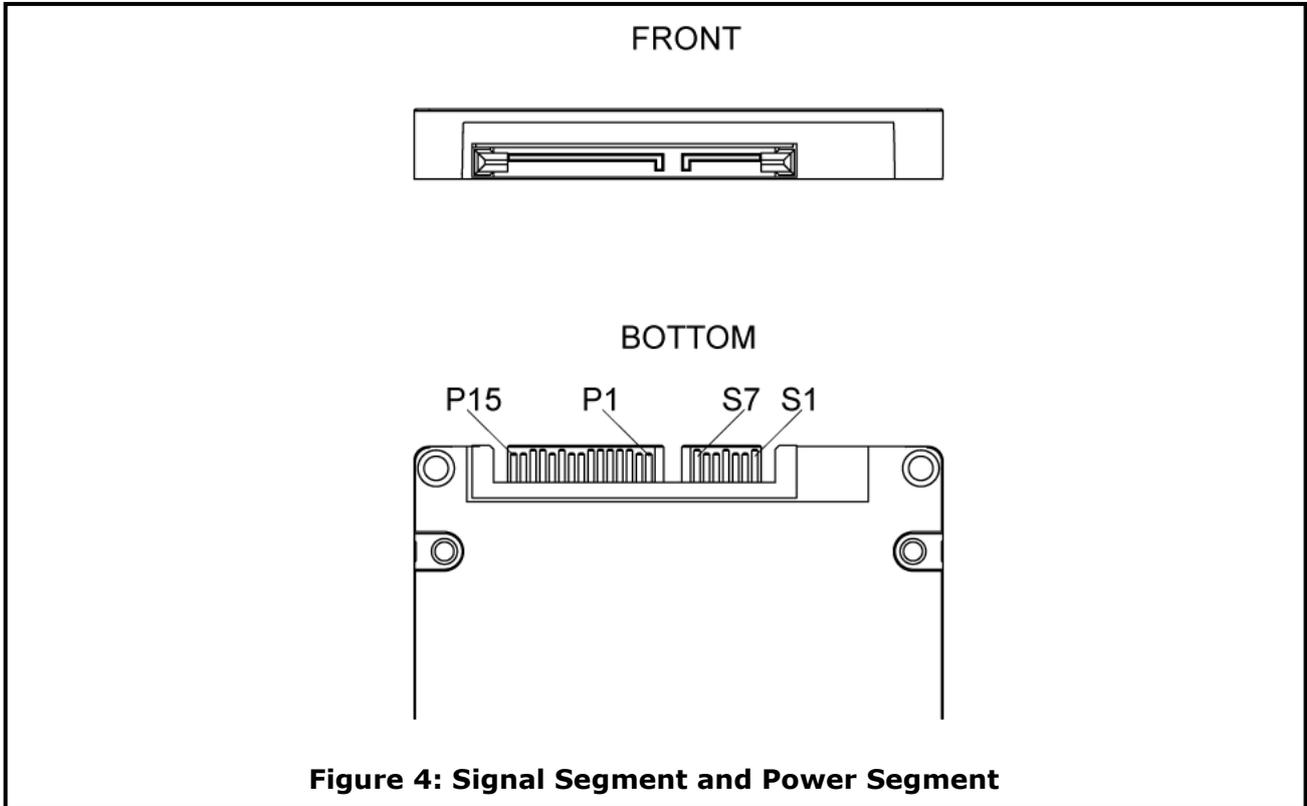
**DRDY** will be set to one.

**DF** (Device Fault) will be cleared to zero.

**DRQ** will be cleared to zero

**ERR** will be cleared to zero.

# 4. Installation Requirements

## 4.1 2.5″ SATA SSD 3SE2-P Pin Directions



**Figure 4: Signal Segment and Power Segment**

## 4.2 Electrical Connections for 2.5″ SATA SSD 3SE2-P

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 Form Factor

Please prepare following things:

➢ Screw driver.

➢ Four M3 screws. (Torque value is 2.0 ~ 2.5 Kgf.cm)

➢ SATA single cable (7-pin, Maximum length l 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. Fix the SSD with the screws. Plug in the SATA single cable, and power cable. Please boot the installation Operation System from CD-ROM, and install Operation System into SSD.
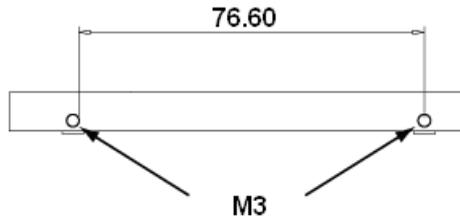
**Figure 5: 2.5″ SATA SSD 3SE2-P Mechanical Screw Hole**

## 4.4 Device Drive

No additional device drives are required. Innodisk 2.5″ SATA SSD 3SE2-P can be configured as a boot device.

# 5. SMART Feature Set

Innodisk 3SE2-P series support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

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

## 5.1 SMART Attributes

Innodisk 3SE2-P series SMART data attributes are listed in following table.

| Attribute ID (hex) | Raw Attribute Value | | | | | | | Attribute Name |
|---|---|---|---|---|---|---|---|---|
| 1 (01h) | MSB | 00 | 00 | 00 | 00 | 00 | 00 | Raw Read Error Rate |
| 5 (05h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Reallocated Sector Count |
| 9 (09h) | LSB | | | MSB | 00 | 00 | 00 | Power-on Hours |
| 12 (0Ch) | LSB | | | MSB | 00 | 00 | 00 | Power Cycle Count |
| 160 (A0h) | LSB | | | MSB | 00 | 00 | 00 | Uncorrectable sector count when read/write |
| 161 (A1h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Number of valid spare block |
| 163 (A3h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Number of initial invalid block |
| 164 (A4h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Total erase count |
| 165 (A5h) | LSB | | | MSB | 00 | 00 | 00 | Maxumum erase count |
| 166 (A6h) | LSB | | | MSB | 00 | 00 | 00 | Minimum erase count |
| 167 (A7h) | LSB | | | MSB | 00 | 00 | 00 | Average erase count |
| 168 (A8h) | LSB | | | MSB | 00 | 00 | 00 | Max erase count of spec |
| 169 (A9h) | LSB | | | MSB | 00 | 00 | 00 | Reman Life (percentage) |
| 175 (AFh) | LSB | | | MSB | 00 | 00 | 00 | Program fail count in worst die |

| 176 (B0h) | LSB | | | MSB | 00 | 00 | 00 | Erase fail count in worst die |
|---|---|---|---|---|---|---|---|---|
| 177 (B1h) | LSB | | | MSB | 00 | 00 | 00 | Total wear level count |
| 178 (B2h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Runtime invalid block count |
| 181 (B5h) | LSB | | | MSB | 00 | 00 | 00 | Total program fail count |
| 182 (B6h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Total erase fail count |
| 187 (BBh) | LSB | | | MSB | 00 | 00 | 00 | Uncorrectable error count |
| 192 (C0h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Power-Off Retract Count |
| 194 (C2h) | MSB | 00 | 00 | 00 | 00 | 00 | 00 | Controlled temperature |
| 195 (C3h) | LSB | | | MSB | 00 | 00 | 00 | Hardware ECC recovered |
| 196 (C4h) | LSB | | | MSB | 00 | 00 | 00 | Reallocation event count |
| 198 (C6h) | LSB | | | MSB | 00 | 00 | 00 | Uncorrectable error count off-line |
| 199 (C7h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | UltraDMA CRC error count |
| 225 (E1h) | LSB | | | | | | MSB | Total LBAs written (each write unit = 32MB) |
| 232 (E8h) | LSB | MSB | 00 | 00 | 00 | 00 | 00 | Available reserved space |
| 241 (F1h) | LSB | | | | | | MSB | Total LBAs written (each write unit = 32MB) |
| 242 (F2h) | LSB | | | | | | MSB | Total LBAs read (each write unit = 32MB) |

# 6. AES Algorithm Certification

The following provides technical information about controller implementations that have been validated as confirming to the Advanced Encryption Standard (AES) Algorithm, Deterministic Random Bit Generator (DRBG) Algorithm, and Secure Hash Standard (SHS).

## 6.1 AES Algorithm

| Val. No | Operational Environment | Val. Date | Modes/States/Key sizes/Description/Notes |
|---|---|---|---|
| 2474 | Cadence NC-verilog hardware simulator v10.20 | May/24/2013 | Using the tests found in The Advanced Encryption Standard Algorithm Validation Suite (AESAVS). This testing is performed by NVLAP accredited Cryptographic And Security Testing (CST) Laboratories. ECB (e/d; 128, 192, 256) XTS (KS: XTS_128) KS: XTS_256 |

## 6.2 DRBG Algorithm

| Val. No | Operational Environment | Val. Date | Modes/States/Key sizes/Description/Notes |
|---|---|---|---|
| 337 | Cadence NC-verilog hardware simulator v10.20 | May/24/2013 | Using the tests found in The DRBG Validation Suite (DRBGVS). This testing is performed by NVLAP accredited Cryptographic And Security Testing (CST) Laboratories. HashBased DRBG: Prediction Resistance Tested: enabled and not enabled (SHA-256) |

## 6.3 SHS Algorithm

| Val. No | Operational Environment | Val. Date | Modes/States/Key sizes/Description/Notes |
|---|---|---|---|
| 2093 | Cadence NC-verilog hardware | May/24/2013 | Has been validated as confirming to the Secure Hash Algorithm specified in Federal Information Processing Standard (FIPS) 180-3, Secure Hash |

| | simulator v10.20 | | Standard (SHS), using tests described in the Secure Hash Algorithm Validation System (SHAVS). This testing is performed by NVLAP accredited Cryptographic And Security Testing (CST) Laboratories. SHA-256 |
|---|---|---|---|

# 7. 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 | S | 2 | 5 | - | 3 | 2 | G | D | 8 | 2 | S | C | A | Q | B | P | - | X | X |

| Definition | |
|---|---|
| **Code 1st (Disk)** | **Code 14th (Operation Temperature)** |
| D: Disk | C: Standard Grade (0℃～ +70℃) |
| | W: Industrial Grade (-40℃～ +85℃) |
| **Code 2nd ~ 5th (Form Factor)** | **Code 15th (Internal control)** |
| GS25: 2.5″ SATA SSD 3SE2-P | A~Z: PCB version |
| | |
| **Code 7th ~9th (Capacity)** | **Code 16th (Channel of data transfer)** |
| 08G: 8GB | Q: Quad Channels |
| 16G: 16GB | |
| 32G: 32GB | **Code 17th (Flash Type)** |
| 64G: 64GB | B: Toshiba SLC |
| A28: 128GB | |
| B56: 256GB | |
| **Code 10th ~12th (Series)** | **Code 18th PLP(iCell) (Optional)** |
| D82: 2.5″ SATA SSD 3SE2-P with AES engine | P: PLP (iCell) |
| | |
| **Code 13th (Firmware version)** | **Code 20th ~21st (Customized code)** |
| S: Synchronous Flash | |
| | |

# Appendix

**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.

三、 本公司聲明我們的產品符合 RoHS 指令的附件中(7a)、(7c-I)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-I) 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

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

Date 日期： 2018 / 07 / 01

Rev 1.6                    TPS, Mar., 2025

# 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 .
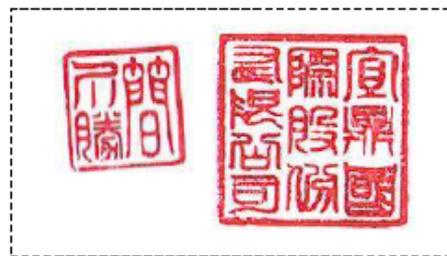
☑ Comply with REACH Annex XVII.

## 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

# *Certificate*

Product Name   : 2.5" SATA SSD
Model(s)          : 2.5" SATA SSD 3$*#-&
                  ($:Flash type: (S:SLC,I:iSLC,M:MLC) *: Product line: (E:Embedded, G: EverGreen, R: InnoRobust) #:controller: ( empty:106/107/167/170, 2: 201/ 202, 3:108/109) &: Product feature: (P: with DRAM, empty: without DRAM))
Responsible Party : Innodisk Corporation
Address          : 5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in European Council Directive- EMC Directive 2004/108/EC. The device was passed the test performed according to :

# C E

**Standards:**
   EN 55022: 2010+AC2011 and CISPR 22: 2008 (modified)
   EN 61000-3-2: 2006+A1:2009 +A2:2009 and IEC 61000-3-2: 2005+A1:2008 +A2:2009
   EN 61000-3-3: 2013 and IEC 61000-3-3: 2013
   EN 55024: 2010 and CISPR 24: 2010
   EN 61000-4-2: 2009 and IEC 61000-4-2: 2008
   EN 61000-4-3: 2006+A1: 2008 +A2: 2010 and
   IEC 61000-4-3:2006+A1: 2007+A2: 2010
   EN 61000-4-4:2012 and IEC 61000-4-4:2012

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**International Standards Laboratory**

*Jim Chu*
Jim Chu / Director

☐ **Hsi-Chih LAB:**
No. 65, Gu Dai Keng Street, Hsi-Chih Dist., New Taipei City 221, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641
Ⓝ **Nemko**
ELA113A

☒ **Lung-Tan LAB:**
No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd., Lung-Tan Hsiang, Tao Yuan County 325, Taiwan
Tel: 886-3-407-1718; Fax: 886-3407-1738
**TAF**    Ⓝ **Nemko**
ELA113B

# *Certificate*

Issue Date: January 16, 2015
Ref. Report No. ISL-15LE018FB

Product Name : 2.5" SATA SSD
Model(s) : 2.5" SATA SSD 3$*#-& ($:Flash type: (S:SLC,I:iSLC,M:MLC) *: Product line: (E:Embedded, G: EverGreen, R: InnoRobust) #:controller: ( empty:106/107/167/170, 2: 201/ 202, 3:108/109) &: Product feature: (P: with DRAM, empty: without DRAM))
Applicant : Innodisk Corporation
Address : 5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified. (refer to Test Report if any modifications were made for compliance).

**FC**

**Standards:**

FCC CFR Title 47 Part 15 Subpart B: 2012- Section 15.107 and 15.109
ANSI C63.4-2009
Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 5: 2012

**Class B**

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**International Standards Laboratory**

*Jim Chu*
Jim Chu / Director

☐ **Hsi-Chih LAB:**
No. 65, Gu Dai Keng Street, Hsi-Chih Dist.,
New Taipei City 221, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641

☒ **Lung-Tan LAB:**
No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd.,
Lung-Tan Hsiang, Tao Yuan County 325, Taiwan
Tel: 886-3-407-1718; Fax: 886-3407-1738