

**innodisk**

# 2.5" SATA SSD

## 3IE7 Series

## Ultra iSLC

## with Innodisk NAND

**Customer:** \_\_\_\_\_

**Customer**

**Part**

**Number:** \_\_\_\_\_

**Innodisk**

**Part**

**Number:** \_\_\_\_\_

**Innodisk**

**Model Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

| <b>Innodisk<br/>Approver</b> | <b>Customer<br/>Approver</b> |
|------------------------------|------------------------------|
|                              |                              |

**Total Solution For  
Industrial Flash Storage**

**Features:**

- SATA III
- Innodisk 3D TLC NAND
- 2.5" SATA SSD
- Standard & Wide-temperature
- Support Ultra iSLC technology
- iPower Guard
- iData Guard
- Dynamic Thermal Management
- Hybrid Write

**Performance:**

- Sequential Read up to 550 MB/s
- Sequential Write up to 500 MB/s

**Power Requirements:**

|                        |       |
|------------------------|-------|
| Input Voltage:         | 5V±5% |
| Max Operating Wattage: | 2.2W  |
| Idle Wattage:          | 1.1W  |

**Reliability:**

| Capacity | TBW   | DWPD |
|----------|-------|------|
| 40GB     | 2500  | 34.2 |
| 80GB     | 5000  | 34.2 |
| 160GB    | 10000 | 34.2 |
| 320GB    | 20000 | 34.2 |
| 640GB    | 40000 | 34.2 |

|                |          |
|----------------|----------|
| Data Retention | 10 Years |
| Warranty       | 5 Years  |

For warranty details, please refer to:

[https://www.innodisk.com/en/support\\_and\\_service/warranty](https://www.innodisk.com/en/support_and_service/warranty)

## Table of contents

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1. PRODUCT OVERVIEW .....</b>                             | <b>8</b>  |
| <b>1.1 INTRODUCTION OF INNODISK 2.5" SATA SSD 3IE7. ....</b> | <b>8</b>  |
| <b>1.2 PRODUCT VIEW AND MODELS .....</b>                     | <b>8</b>  |
| <b>1.3 SATA INTERFACE.....</b>                               | <b>9</b>  |
| <b>1.4 2.5-INCH FORM FACTOR .....</b>                        | <b>9</b>  |
| <b>2. PRODUCT SPECIFICATIONS.....</b>                        | <b>10</b> |
| <b>2.1 CAPACITY AND DEVICE PARAMETERS.....</b>               | <b>10</b> |
| <b>2.2 PERFORMANCE .....</b>                                 | <b>10</b> |
| <b>2.3 ELECTRICAL SPECIFICATIONS .....</b>                   | <b>10</b> |
| <b>2.3.1 Power Requirement.....</b>                          | <b>10</b> |
| <b>2.3.2 Power Consumption .....</b>                         | <b>11</b> |
| <b>2.4 ENVIRONMENTAL SPECIFICATIONS .....</b>                | <b>11</b> |
| <b>2.4.1 Temperature Ranges .....</b>                        | <b>11</b> |
| <b>2.4.2 Humidity.....</b>                                   | <b>11</b> |
| <b>2.4.3 Shock and Vibration .....</b>                       | <b>11</b> |
| <b>2.4.4 Mean Time between Failures (MTBF) .....</b>         | <b>11</b> |
| <b>2.5 CE AND FCC COMPATIBILITY .....</b>                    | <b>12</b> |
| <b>2.6 RoHS COMPLIANCE .....</b>                             | <b>12</b> |
| <b>2.7 RELIABILITY .....</b>                                 | <b>12</b> |
| <b>2.8 TRANSFER MODE .....</b>                               | <b>12</b> |
| <b>2.9 PIN ASSIGNMENT .....</b>                              | <b>13</b> |
| <b>2.10 MECHANICAL DIMENSIONS.....</b>                       | <b>14</b> |
| <b>2.11 ASSEMBLY WEIGHT .....</b>                            | <b>14</b> |
| <b>2.12 SEEK TIME .....</b>                                  | <b>14</b> |
| <b>2.13 NAND FLASH MEMORY.....</b>                           | <b>14</b> |
| <b>3. THEORY OF OPERATION .....</b>                          | <b>15</b> |
| <b>3.1 OVERVIEW.....</b>                                     | <b>15</b> |
| <b>3.2 SATA III CONTROLLER .....</b>                         | <b>15</b> |
| <b>3.3 ERROR DETECTION AND CORRECTION.....</b>               | <b>15</b> |
| <b>3.4 WEAR-LEVELING .....</b>                               | <b>16</b> |
| <b>3.5 BAD BLOCKS MANAGEMENT .....</b>                       | <b>16</b> |
| <b>3.6 iDATA GUARD.....</b>                                  | <b>16</b> |
| <b>3.7 GARBAGE COLLECTION.....</b>                           | <b>16</b> |
| <b>3.8 TRIM .....</b>                                        | <b>16</b> |
| <b>3.9 iPOWER GUARD.....</b>                                 | <b>17</b> |
| <b>3.10 DIE RAID .....</b>                                   | <b>17</b> |
| <b>3.11 THERMAL THROTTLING.....</b>                          | <b>17</b> |

|                                                                |           |
|----------------------------------------------------------------|-----------|
| <b>4. INSTALLATION REQUIREMENTS .....</b>                      | <b>18</b> |
| <b>4.1 2.5" SATA SSD 3IE7 PIN DIRECTIONS .....</b>             | <b>18</b> |
| <b>4.2 ELECTRICAL CONNECTIONS FOR 2.5" SATA SSD 3IE7 .....</b> | <b>18</b> |
| <b>4.3 FORM FACTOR .....</b>                                   | <b>18</b> |
| <b>4.4 DEVICE DRIVE .....</b>                                  | <b>19</b> |
| <b>5. SMART FEATURE SET .....</b>                              | <b>20</b> |
| <b>5.1 SMART ATTRIBUTES.....</b>                               | <b>20</b> |
| <b>6. PART NUMBER RULE .....</b>                               | <b>22</b> |

## REVISION HISTORY

| Revision | Description                     | Date       |
|----------|---------------------------------|------------|
| Rev 1.0  | Official Release                | Oct., 2022 |
| Rev 1.1  | Add 640GB                       | Dec., 2022 |
| Rev 1.2  | Rename the series to Ultra iSLC | Dec., 2023 |
| Rev 1.3  | Update Warranty Period          | Jan., 2024 |

## List of Tables

|                                                                                        |    |
|----------------------------------------------------------------------------------------|----|
| <b>TABLE 1: DEVICE PARAMETERS</b> .....                                                | 10 |
| <b>TABLE 2 : PERFORMANCE - 112 LAYERS 3D TLC<sup>1</sup></b> .....                     | 10 |
| <b>TABLE 3: INNODISK 2.5" SATA SSD 3IE7 WITH INNODISK NAND POWER REQUIREMENT</b> ..... | 10 |
| <b>TABLE 4: TYPICAL POWER CONSUMPTION</b> .....                                        | 11 |
| <b>TABLE 5: TEMPERATURE RANGE FOR 2.5" SATA SSD 3IE7 WITH INNODISK NAND</b> .....      | 11 |
| <b>TABLE 6: SHOCK/VIBRATION TESTING FOR 2.5" SATA SSD 3IE7</b> .....                   | 11 |
| <b>TABLE 7: 2.5" SATA SSD 3IE7 MTBF</b> .....                                          | 11 |
| <b>TABLE 8: INNODISK 2.5" SATA SSD 3IE7 PIN ASSIGNMENT</b> .....                       | 13 |

List of Figures

**FIGURE 1: INNODISK 2.5" SATA SSD 3IE7 .....8**

**FIGURE 2: INNODISK 2.5" SATA SSD 3IE7 BLOCK DIAGRAM .....15**

**FIGURE 3: SIGNAL SEGMENT AND POWER SEGMENT .....18**

# 1. Product Overview

## 1.1 Introduction of Innodisk 2.5" SATA SSD 3IE7.

Innodisk 2.5" SATA SSD 3IE7 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, achieves excellent performance up to 4CH standard by cost effective controller with 4CH.

With Innodisk L<sup>3</sup> FW architecture, combining our signature 4K mapping algorithm L<sup>2</sup> FW architecture with powerful LDPC technology, 3IE7 series has outstanding high IOPS, better data integrity and extended lifespan through reducing the bad block number happening.

For real industrial application, 3IE7 series has built-in thermal sensor to monitor the environment temperature. iData Guard, the power loss management mechanism developed by Innodisk, ensures data integrity while power sudden loss happened.

**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 3IE7 is available in follow capacities.

2.5" SATA SSD 3IE7 40GB

2.5" SATA SSD 3IE7 80GB

2.5" SATA SSD 3IE7 160GB

2.5" SATA SSD 3IE7 320GB

2.5" SATA SSD 3IE7 640GB



**Figure 1: Innodisk 2.5" SATA SSD 3IE7**

### **1.3 SATA Interface**

Innodisk 2.5" SATA SSD 3IE7 supports SATA III(6.0Gb/s) interface, and compliant with SATA I (1.5Gb/s) and SATA II(3.0Gb/s).

### **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) x 100.00mm (L) x 6.90mm (H)

## 2. Product Specifications

### 2.1 Capacity and Device Parameters

2.5" SATA SSD 3IE7 device parameters are shown in Table 1.

**Table 1: Device parameters**

| Capacity | LBA        | Cylinders | Heads | Sectors | User Capacity(MB) |
|----------|------------|-----------|-------|---------|-------------------|
| 40GB     | 78161328   | 16383     | 16    | 63      | 38165             |
| 80GB     | 156301488  | 16383     | 16    | 63      | 76319             |
| 160GB    | 312581808  | 16383     | 16    | 63      | 152628            |
| 320GB    | 625142448  | 16383     | 16    | 63      | 305245            |
| 640GB    | 1250263728 | 16383     | 16    | 63      | 610480            |

### 2.2 Performance

Burst Transfer Rate: 6.0Gbps

**Table 2 : Performance - 112 Layers 3D TLC<sup>1</sup>**

| Capacity                                 | Unit | 40GB   | 80GB<br>(2CH) | 80GB<br>(4CH) | 160GB  | 320GB  | 640GB  |
|------------------------------------------|------|--------|---------------|---------------|--------|--------|--------|
| Sequential <sup>2</sup><br>Read (Q32T1)  | MB/s | 420    | 420           | 550           | 550    | 550    | 550    |
| Sequential <sup>2</sup><br>Write (Q32T1) |      | 250    | 260           | 490           | 490    | 490    | 500    |
| 4KB Random <sup>2</sup><br>Read (Q32T1)  | IOPS | 36,000 | 34,000        | 70,000        | 67,000 | 88,000 | 88,000 |
| 4KB Random <sup>2</sup><br>Write (Q32T1) |      | 61,000 | 61,000        | 76,000        | 76,000 | 76,000 | 77,000 |

Note:

1. Performance may vary based on various firmware version or test platform.
2. Performance results are based on CrystalDiskMark 6.0.2 with file size 1000MB of Queue Depth32.
3. Performance results are based on AIDA 64 v5.98 with block size 1MB of Linear Read & Write Test Item

### 2.3 Electrical Specifications

#### 2.3.1 Power Requirement

**Table 3: Innodisk 2.5" SATA SSD 3IE7 with innodisk NAND Power Requirement**

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

## 2.3.2 Power Consumption

**Table 4: Typical Power Consumption**

| Mode                     | Power Consumption(W) |
|--------------------------|----------------------|
| Read (RMS) <sup>1</sup>  | 2.2                  |
| Write (RMS) <sup>1</sup> | 2.1                  |
| Idle                     | 1.1                  |
| Boot Up                  | 5.6                  |

Target: 2.5" SSD 3IE7 640GB

## 2.4 Environmental Specifications

### 2.4.1 Temperature Ranges

**Table 5: Temperature range for 2.5" SATA SSD 3IE7 with Innodisk NAND**

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

### 2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

### 2.4.3 Shock and Vibration

**Table 6: Shock/Vibration Testing for 2.5" SATA SSD 3IE7**

| 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 3IE7 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 condition

**Table 7: 2.5" SATA SSD 3IE7 MTBF**

| Product                     | Condition                 | MTBF (Hours) |
|-----------------------------|---------------------------|--------------|
| Innodisk 2.5" SATA SSD 3IE7 | Telcordia SR-332 GB, 25°C | >3,000,000   |

## 2.5 CE and FCC Compatibility

2.5" SATA SSD 3IE7 conforms to CE and FCC requirements.

## 2.6 RoHS Compliance

2.5" SATA SSD 3IE7 is fully compliant with RoHS directive.

## 2.7 Reliability

| Parameter                                                                                                                                                                                                                                                                                             |                     | Value                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|
| Read Cycles                                                                                                                                                                                                                                                                                           |                     | Unlimited Read Cycles |
| Flash endurance                                                                                                                                                                                                                                                                                       |                     | 100,000 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       |
| 40GB                                                                                                                                                                                                                                                                                                  | 3400                | 2500                  |
| 80GB                                                                                                                                                                                                                                                                                                  | 6800                | 5000                  |
| 160GB                                                                                                                                                                                                                                                                                                 | 13600               | 10000                 |
| 320GB                                                                                                                                                                                                                                                                                                 | 27200               | 20000                 |
| 640GB                                                                                                                                                                                                                                                                                                 | 54400               | 40000                 |
| * Note:<br>1. Sequential: Mainly sequential write, tested by Vdbench.<br>2. Client: Follow JESD218 Test method and JESD219A Workload, tested by ULINK. (The capacity lower than 40GB client workload is not specified in JEDEC219A, the values are estimated.)<br>3. Based on out-of-box performance. |                     |                       |

## 2.8 Transfer Mode

2.5" SATA SSD 3IE7 support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

## 2.9 Pin Assignment

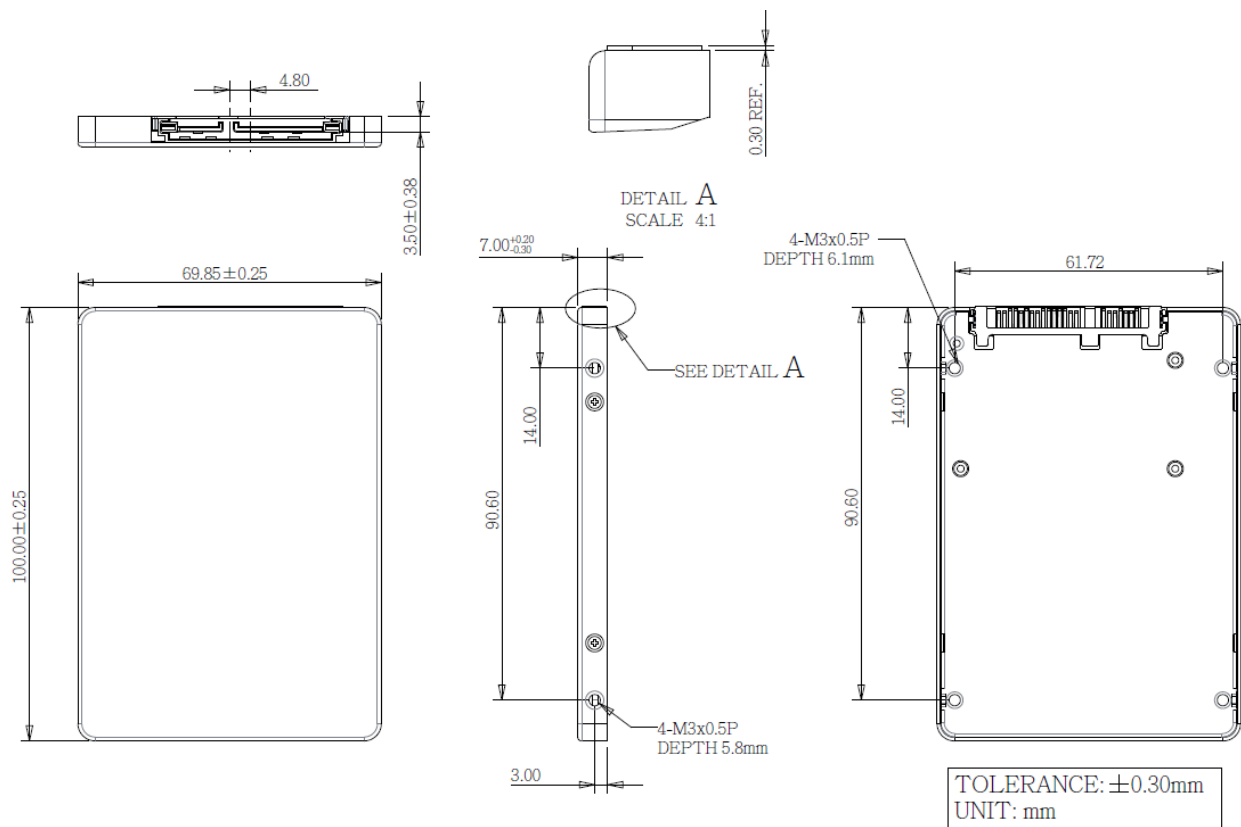
Innodisk 2.5" SATA SSD 3IE7 uses a standard SATA pin-out.

See Table 8 for 2.5" SATA SSD 3IE7 pin assignment.

**Table 8: Innodisk 2.5" SATA SSD 3IE7 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                                         |

## 2.10 Mechanical Dimensions



## 2.11 Assembly Weight

An Innodisk 2.5" SATA SSD 3IE7 within flash ICs, 640GB's weight is 42 grams approximately.

## 2.12 Seek Time

Innodisk 2.5" SATA SSD 3IE7 is not a magnetic rotating design. There is no seek or rotational latency required.

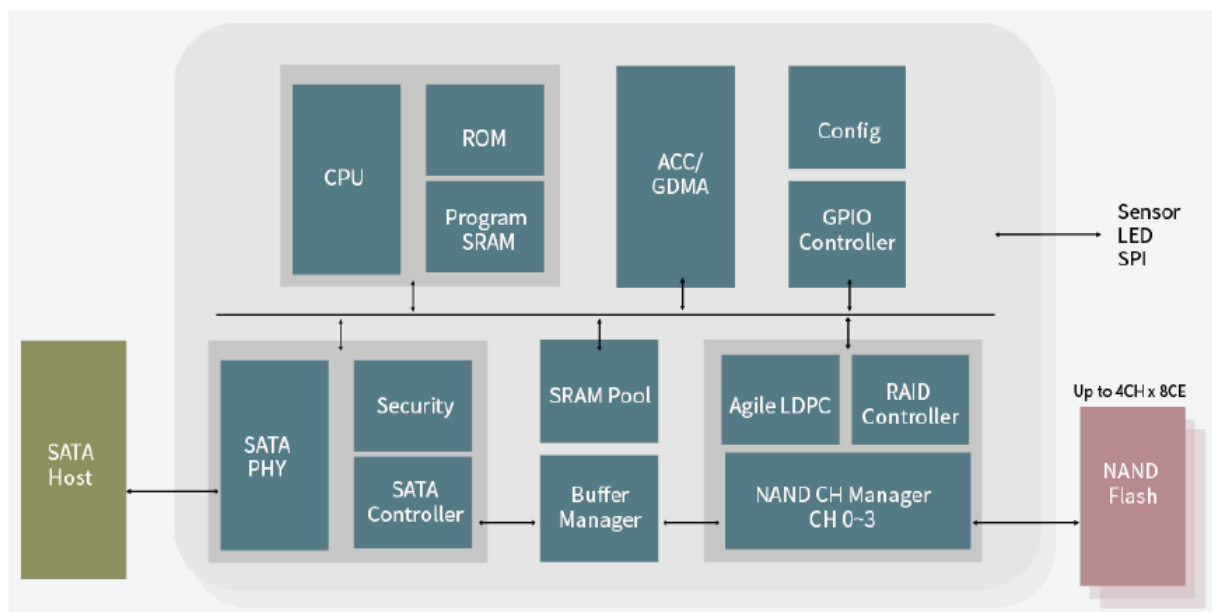
## 2.13 NAND Flash Memory

Innodisk 2.5" SATA SSD 3IE7 uses 3D TLC NAND flash memory, with 100,000 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 2.5" SATA SSD 3IE7 from the system level, including the major hardware blocks.



**Figure 2: Innodisk 2.5" SATA SSD 3IE7 Block Diagram**

Innodisk 2.5" SATA SSD 3IE7 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 2.5" SATA SSD 3IE7 is designed with a SATA III 6.0Gbps (Gen. 3) controller. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

### 3.3 Error Detection and Correction

Innodisk 2.5" SATA SSD 3IE7 is designed with hardware LDPC ECC engine with hard-decision and Soft-decision decoding. Low-density parity-check (LDPC) codes have excellent error correcting Performance close to the Shannon limit when decoded with the belief-propagation (BP) algorithm using soft-decision information.

### 3.4 Wear-Leveling

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

Innodisk 2.5" SATA SSD 3IE7 uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

### 3.5 Bad Blocks Management

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

### 3.6 iData Guard

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

### 3.7 Garbage Collection

Garbage collection is used to maintain data consistency and perform continual data cleansing on SSDs. It runs as a background process, freeing up valuable controller resources while sorting good data into available blocks, and deleting bad blocks. It also significantly reduces write operations to the drive, thereby increasing the SSD's speed and lifespan.

### 3.8 Trim

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

### **3.9 iPower Guard**

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

### **3.10 Die RAID**

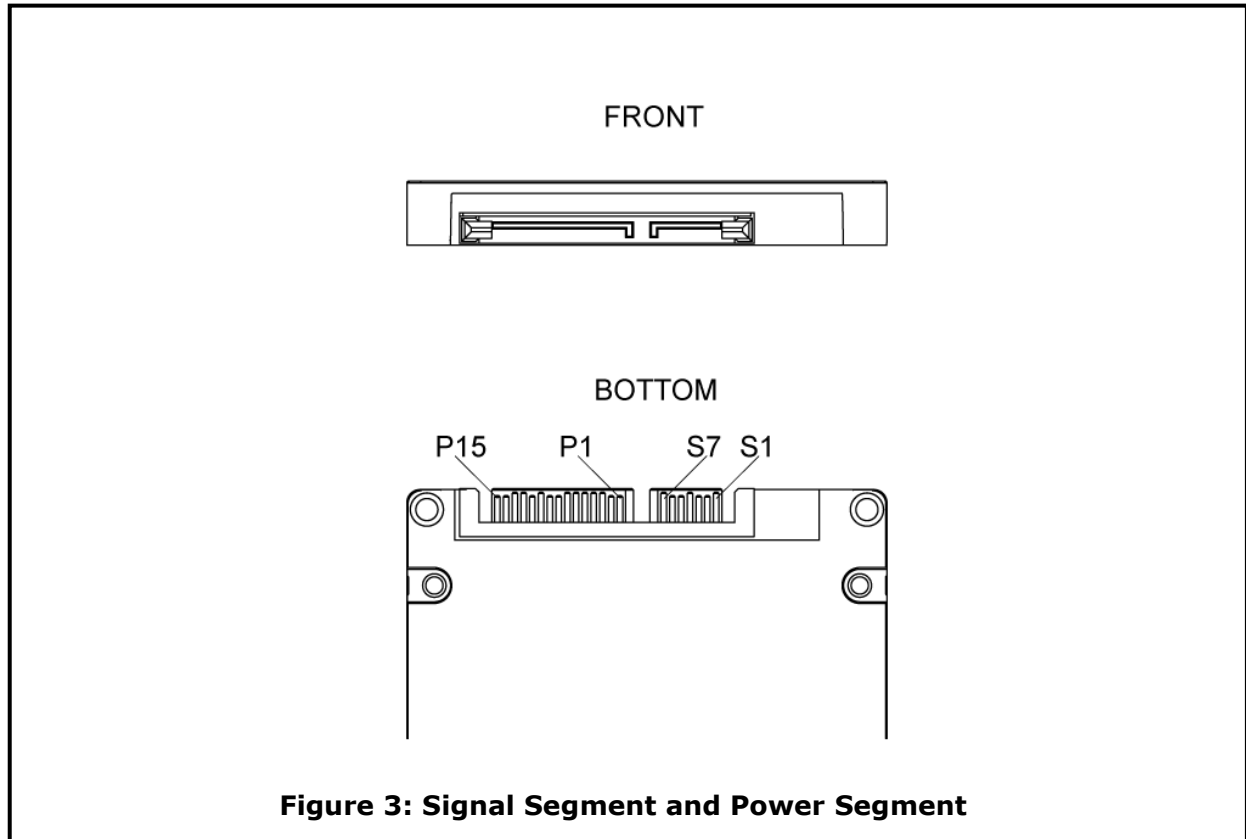
Die RAID is a controller function which leveraged user capacity to back up the data in NAND flash. Die RAID supported can ensure the user data in the NAND Flash more consistent in certain scenario. Innodisk 2.5" SATA SSD 3IE7 series is default enable the Die RAID function for the industrial application.

### **3.11 Thermal Throttling**

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

## 4. Installation Requirements

### 4.1 2.5" SATA SSD 3IE7 Pin Directions



### 4.2 Electrical Connections for 2.5" SATA SSD 3IE7

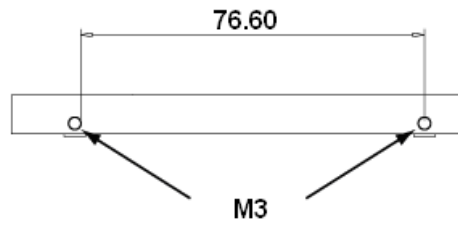
A Serial ATA device may be either directly connected to a host or connected to a host through an adaptor card. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

### 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 4: 2.5" SATA SSD 3IE7 Mechanical Screw Hole**

#### 4.4 Device Drive

No additional device drives are required. Innodisk 2.5" SATA SSD 3IE7 can be configured as a boot device.

## 5. SMART Feature Set

Innodisk 3IE7 series support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

**Table 1: 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 3IE7 series SMART data attributes are listed in following table.

**Table 2: 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 |     |      | <b>MSB</b> | <b>LSB</b> | <b>MSB</b> | <b>LSB</b> | <b>MSB</b> | <b>LSB</b> | Later bad block info<br>( <b>Read/Write/Erase</b> ) |
| F1 | 00  | LSB  |            |            | MSB        | 00         | 00         | 00         | Total LBA<br>written(LBA=32MB)                      |
| F2 | 00  | LSB  |            |            | MSB        | 00         | 00         | 00         | Total LBA<br>read(LBA=32MB)                         |

## 6. Part Number Rule

| CODE                                                 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11                                                        | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|-----------------------------------------------------------|----|----|----|----|----|----|----|----|----|----|
|                                                      | D | H | S | 2 | 5 | - | 4 | 0 | G | D  | K                                                         | 1  | K  | C  | C  | Q  | L  | -  | X  | X  | X  |
| Definition                                           |   |   |   |   |   |   |   |   |   |    |                                                           |    |    |    |    |    |    |    |    |    |    |
| Code 1 <sup>st</sup> (Disk)                          |   |   |   |   |   |   |   |   |   |    | Code 13 <sup>th</sup> (Flash Mode)                        |    |    |    |    |    |    |    |    |    |    |
| D : Disk                                             |   |   |   |   |   |   |   |   |   |    | K: 112 Layers 3D TLC                                      |    |    |    |    |    |    |    |    |    |    |
|                                                      |   |   |   |   |   |   |   |   |   |    |                                                           |    |    |    |    |    |    |    |    |    |    |
| Code 2 <sup>nd</sup> (Feature Set)                   |   |   |   |   |   |   |   |   |   |    | Code 14 <sup>th</sup> (Operation Temperature)             |    |    |    |    |    |    |    |    |    |    |
| H: iSLC series                                       |   |   |   |   |   |   |   |   |   |    | C: Standard Grade (0°C~ +70°C)                            |    |    |    |    |    |    |    |    |    |    |
|                                                      |   |   |   |   |   |   |   |   |   |    | W: Industrial Grade (-40°C~ +85°C)                        |    |    |    |    |    |    |    |    |    |    |
| Code 3 <sup>rd</sup> ~ 5 <sup>th</sup> (Form Factor) |   |   |   |   |   |   |   |   |   |    | Code 15 <sup>th</sup> (Internal control)                  |    |    |    |    |    |    |    |    |    |    |
| S25: 2.5" SATA SSD                                   |   |   |   |   |   |   |   |   |   |    | C: Slim PCBA version                                      |    |    |    |    |    |    |    |    |    |    |
|                                                      |   |   |   |   |   |   |   |   |   |    |                                                           |    |    |    |    |    |    |    |    |    |    |
| Code 7 <sup>th</sup> ~9 <sup>th</sup> (Capacity)     |   |   |   |   |   |   |   |   |   |    | Code 16 <sup>th</sup> (Channel of data transfer)          |    |    |    |    |    |    |    |    |    |    |
| 40G: 40GB                                            |   |   |   |   |   |   |   |   |   |    | S: Single Channel                                         |    |    |    |    |    |    |    |    |    |    |
| 80G: 80GB                                            |   |   |   |   |   |   |   |   |   |    | D: Dual Channels                                          |    |    |    |    |    |    |    |    |    |    |
| A60: 160GB                                           |   |   |   |   |   |   |   |   |   |    | Q: Quad Channels                                          |    |    |    |    |    |    |    |    |    |    |
| D2G: 320GB                                           |   |   |   |   |   |   |   |   |   |    |                                                           |    |    |    |    |    |    |    |    |    |    |
| F4G: 640GB                                           |   |   |   |   |   |   |   |   |   |    | Code 17 <sup>th</sup> (Flash Type)                        |    |    |    |    |    |    |    |    |    |    |
|                                                      |   |   |   |   |   |   |   |   |   |    | L: Innodisk 3D TLC                                        |    |    |    |    |    |    |    |    |    |    |
| Code 10 <sup>th</sup> ~12 <sup>th</sup> (Controller) |   |   |   |   |   |   |   |   |   |    | Code 19 <sup>th</sup> ~21 <sup>th</sup> (Customized Code) |    |    |    |    |    |    |    |    |    |    |
| DK1: SATA 3IE7                                       |   |   |   |   |   |   |   |   |   |    |                                                           |    |    |    |    |    |    |    |    |    |    |