

# 2.5" SATA SSD

## 3SR-P Series

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

<b>Innodisk Approver</b>	<b>Customer Approver</b>

**Total Solution For  
Industrial Flash Storage**

## Table of Contents

<b>LIST OF FIGURES</b> .....	6
<b>1. PRODUCT OVERVIEW</b> .....	7
<b>1.1 INTRODUCTION OF INNODISK 2.5" SATA SSD 3SR-P</b> .....	7
<b>1.2 PRODUCT VIEW AND MODELS</b> .....	7
<b>1.3 SATA INTERFACE</b> .....	8
<b>1.4 2.5-INCH FORM FACTOR</b> .....	8
<b>2. PRODUCT SPECIFICATIONS</b> .....	9
<b>2.1 CAPACITY AND DEVICE PARAMETERS</b> .....	9
<b>2.2 PERFORMANCE</b> .....	9
<b>2.3 ELECTRICAL SPECIFICATIONS</b> .....	9
<b>2.3.1 Power Requirement</b> .....	9
<b>2.3.2 Power Consumption</b> .....	9
<b>2.4 ENVIRONMENTAL SPECIFICATIONS</b> .....	10
<b>2.4.1 Temperature Ranges</b> .....	10
<b>2.4.2 Humidity</b> .....	10
<b>2.4.3 Shock and Vibration</b> .....	10
<b>2.4.4 Mean Time between Failures (MTBF)</b> .....	10
<b>2.5 CE AND FCC COMPATIBILITY</b> .....	11
<b>2.6 RoHS COMPLIANCE</b> .....	11
<b>2.7 RELIABILITY</b> .....	11
<b>2.8 TRANSFER MODE</b> .....	11
<b>2.9 PIN ASSIGNMENT</b> .....	11
<b>2.10 MECHANICAL DIMENSIONS</b> .....	12
<b>2.11 ASSEMBLY WEIGHT</b> .....	13
<b>2.12 SEEK TIME</b> .....	13
<b>2.13 HOT PLUG</b> .....	13
<b>2.14 NAND FLASH MEMORY</b> .....	13
<b>3. THEORY OF OPERATION</b> .....	14
<b>3.1 OVERVIEW</b> .....	14
<b>3.2 SATA III CONTROLLER</b> .....	14
<b>3.3 ERROR DETECTION AND CORRECTION</b> .....	15
<b>3.4 WEAR-LEVELING</b> .....	15
<b>3.5 BAD BLOCKS MANAGEMENT</b> .....	15
<b>3.6 POWER CYCLING</b> .....	15
<b>3.7 GARBAGE COLLECTION/TRIM</b> .....	15
<b>4. INSTALLATION REQUIREMENTS</b> .....	17

<b>4.1 2.5" SATA SSD 3SR-P PIN DIRECTIONS.....</b>	<b>17</b>
<b>4.2 ELECTRICAL CONNECTIONS FOR 2.5" SATA SSD 3SR-P.....</b>	<b>17</b>
<b>4.3 FORM FACTOR.....</b>	<b>18</b>
<b>4.4 DEVICE DRIVE .....</b>	<b>18</b>
<b>5. PART NUMBER RULE .....</b>	<b>19</b>
<b>APPENDIX .....</b>	<b>20</b>

## REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	OCT., 2013
Rev. 1.0	1. Update performance in introduction 2. Update performance 3. Update LBA 4. Add CE/FCC certificate	APR., 2014
Rev. 1.1	Add 512GB information	Dec., 2014
Rev. 1.2	Modify TBW based on NAND Flash specifications	Jan., 2015
Rev. 1.3	Update ME drawing	Jul., 2015

## List of Tables

<b>TABLE 1: DEVICE PARAMETERS .....</b>	<b>9</b>
<b>TABLE 2: PERFORMANCE .....</b>	<b>9</b>
<b>TABLE 3: INNODISK 2.5" SATA SSD 3SR-P POWER REQUIREMENT .....</b>	<b>9</b>
<b>TABLE 4: POWER CONSUMPTION.....</b>	<b>9</b>
<b>TABLE 5: TEMPERATURE RANGE FOR 2.5" SATA SSD 3SR-P .....</b>	<b>10</b>
<b>TABLE 6: SHOCK/VIBRATION TESTING FOR 2.5" SATA SSD 3SR-P .....</b>	<b>10</b>
<b>TABLE 7: 2.5" SATA SSD 3SR-P MTBF.....</b>	<b>10</b>
<b>TABLE 8: INNODISK 2.5" SATA SSD 3SR-P PIN ASSIGNMENT.....</b>	<b>11</b>

## List of Figures

<b>FIGURE 1: INNODISK 2.5" SATA SSD 3SR-P .....</b>	<b>7</b>
<b>FIGURE 2: INNODISK 2.5" SATA SSD 3SR-P BLOCK DIAGRAM .....</b>	<b>14</b>
<b>FIGURE 3: SIGNAL SEGMENT AND POWER SEGMENT .....</b>	<b>17</b>

# 1. Product Overview

## 1.1 Introduction of Innodisk 2.5" SATA SSD 3SR-P

Innodisk 2.5" SATA SSD 3SR-P is a SATA III 6.0Gb/s flash based disk, which delivers excellent performance and reliability. Especially, it comes with several data security functions, including QEraser/ SEraser/ Destroy and also Write Protect. All the security functions can be triggered both by hardware and software approaches. 2.5" SATA SSD 3SR-P is compliant with MIL-STD-810F/G standards. The SSD is equipped ruggedized hardware design and thus it can perform well in the harsh environment.

Innodisk 2.5" SATA SSD 3SR-P products provide high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA (SATA) standard. Innodisk 2.5" SATA SSD 3SR-P delivers sustain read speeds of up to 490MB/s and sustain write speeds of up to 340MB/s. Beside sequential read/ write performance, Innodisk 2.5" SATA SSD 3SR-P also enhances random data access for small files. Furthermore, Innodisk 2.5" SATA SSD 3SR-P supports TRIM for windows 7, which can improve performance when deleting files. 2.5" SATA SSD 3SR-P is developed with Innodisk owned technical knowhow to ensure the data integrity and highest levels of reliability.

## 1.2 Product View and Models

Innodisk 2.5" SATA SSD 3SR-P is available in follow capacities within SLC flash ICs.

- |  |   |
|--|---|
| <a href="#">2.5" SATA SSD 3SR-P 8GB</a>  | <a href="#">2.5" SATA SSD 3SR-P 128GB</a> |
| <a href="#">2.5" SATA SSD 3SR-P 16GB</a> | <a href="#">2.5" SATA SSD 3SR-P 256GB</a> |
| <a href="#">2.5" SATA SSD 3SR-P 32GB</a> | <a href="#">2.5" SATA SSD 3SR-P 512GB</a> |
| <a href="#">2.5" SATA SSD 3SR-P 64GB</a> |   |



**Figure 1: Innodisk 2.5" SATA SSD 3SR-P**

### **1.3 SATA Interface**

Innodisk 2.5" SATA SSD 3SR-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 3SR-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 because 2.5-inch is a popular form factor in industrial field. 2.5-inch is most laptop's hard disk's form factor. Innodisk 2.5" SATA SSD 3SR-P can easy install in laptop. Innodisk 2.5" SATA SSD 3SR-P has a compact design 69.85mm (W) x99.85mm (L) x 9.20mm (H).



## 2. Product Specifications

### 2.1 Capacity and Device Parameters

2.5" SATA SSD 3SR-P device parameters are shown in Table 1.

**Table 1: Device parameters**

Capacity	LBA	Cylinders	Heads	Sectors	User Capacity(MB)
8GB	13695696	13587	16	63	6687
16GB	29323728	16383	16	63	14318
32GB	60579792	16383	16	63	29580
64GB	121138416	16383	16	63	59150
128GB	242255664	16383	16	63	118289
256GB	484490160	16383	16	63	236567
512GB	968959152	16383	16	63	473124

### 2.2 Performance

Burst Transfer Rate: 6.0Gbps

**Table 2: Performance**

Capacity	8GB	16GB	32GB	64GB	128GB	256GB	512GB
Sequential Read (max.)	400 MB/sec	400 MB/sec	480 MB/sec	480 MB/sec	490 MB/sec	490 MB/sec	490 MB/sec
Sequential Write (max.)	110 MB/sec	130 MB/sec	240 MB/sec	320 MB/sec	340 MB/sec	340 MB/sec	390 MB/sec

Note: Based on CrystalDiskMark 3.01 with file size 1000MB

### 2.3 Electrical Specifications

#### 2.3.1 Power Requirement

**Table 3: Innodisk 2.5" SATA SSD 3SR-P Power Requirement**

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

#### 2.3.2 Power Consumption

**Table 4: Power Consumption**

Mode	Power Consumption (mA)
Read	460 (max.)
Write	650 (max.)
Idle	190 (max.)

\* Target: 2.5" SATA SSD 3SR-P 256GB

## 2.4 Environmental Specifications

### 2.4.1 Temperature Ranges

**Table 5: Temperature range for 2.5" SATA SSD 3SR-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 3SR-P**

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 2.5" SATA SSD 3SR-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 3SR-P MTBF**

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

## 2.5 CE and FCC Compatibility

2.5" SATA SSD 3SR-P conforms to CE and FCC requirements.

## 2.6 RoHS Compliance

2.5" SATA SSD 3SR-P is fully compliant with RoHS directive.

## 2.7 Reliability

Parameter	Value
Read Cycles	Unlimited Read Cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
TBW (Unit: TB)	
8GB	432 (Sequential Write)
16GB	864 (Sequential Write)
32GB	1728 (Sequential Write)
64GB	3456 (Sequential Write)
128GB	6912 (Sequential Write)
256GB	13824 (Sequential Write)
512GB	27648 (Sequential Write)

## 2.8 Transfer Mode

2.5" SATA SSD 3SR-P support the following transfer modes,

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

## 2.9 Pin Assignment

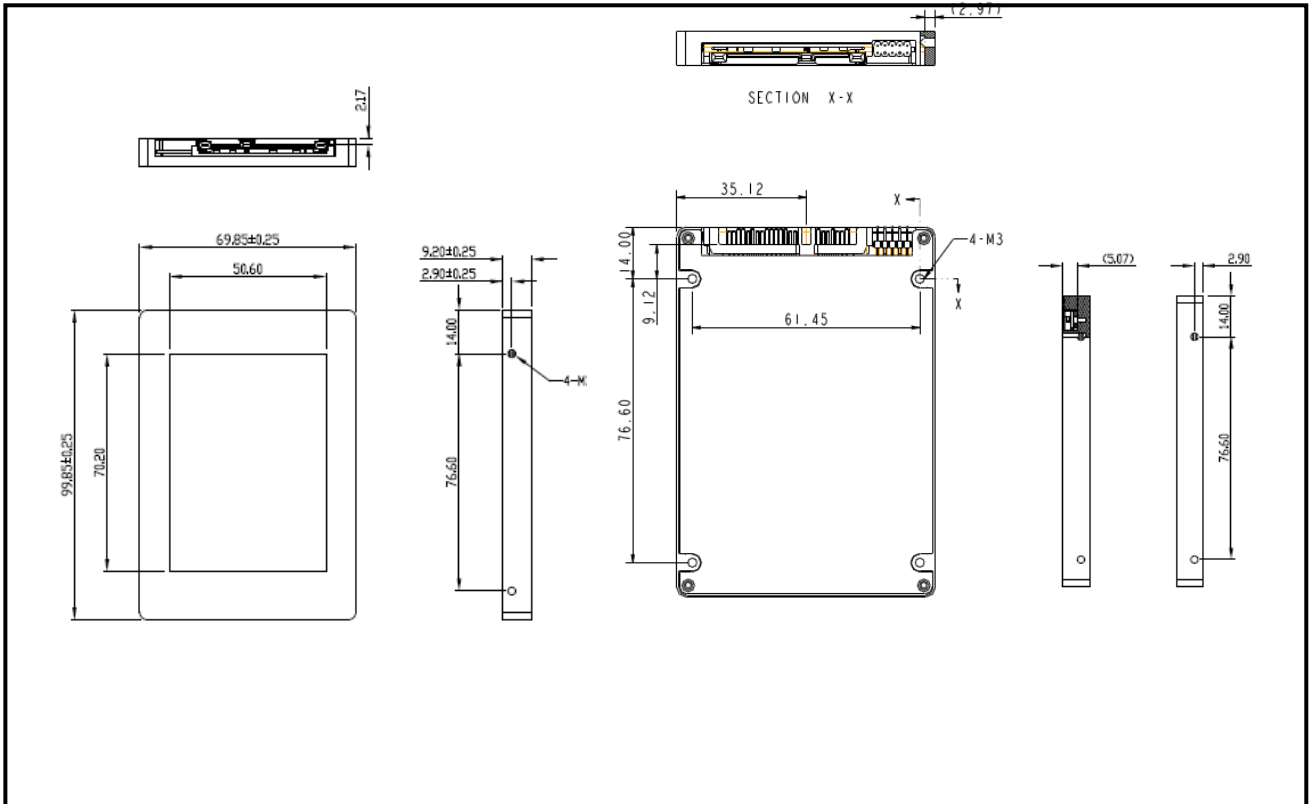
Innodisk 2.5" SATA SSD 3SR-P uses a standard SATA pin-out. See Table 8 for 2.5" SATA SSD 3SR-P pin assignment.

**Table 8: Innodisk 2.5" SATA SSD 3SR-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 3SR-P within SLC flash ICs, 32GB's weight is 100 grams approx. The total weight of SSD will be less than 110 grams.

## 2.12 Seek Time

Innodisk 2.5" SATA SSD 3SR-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.

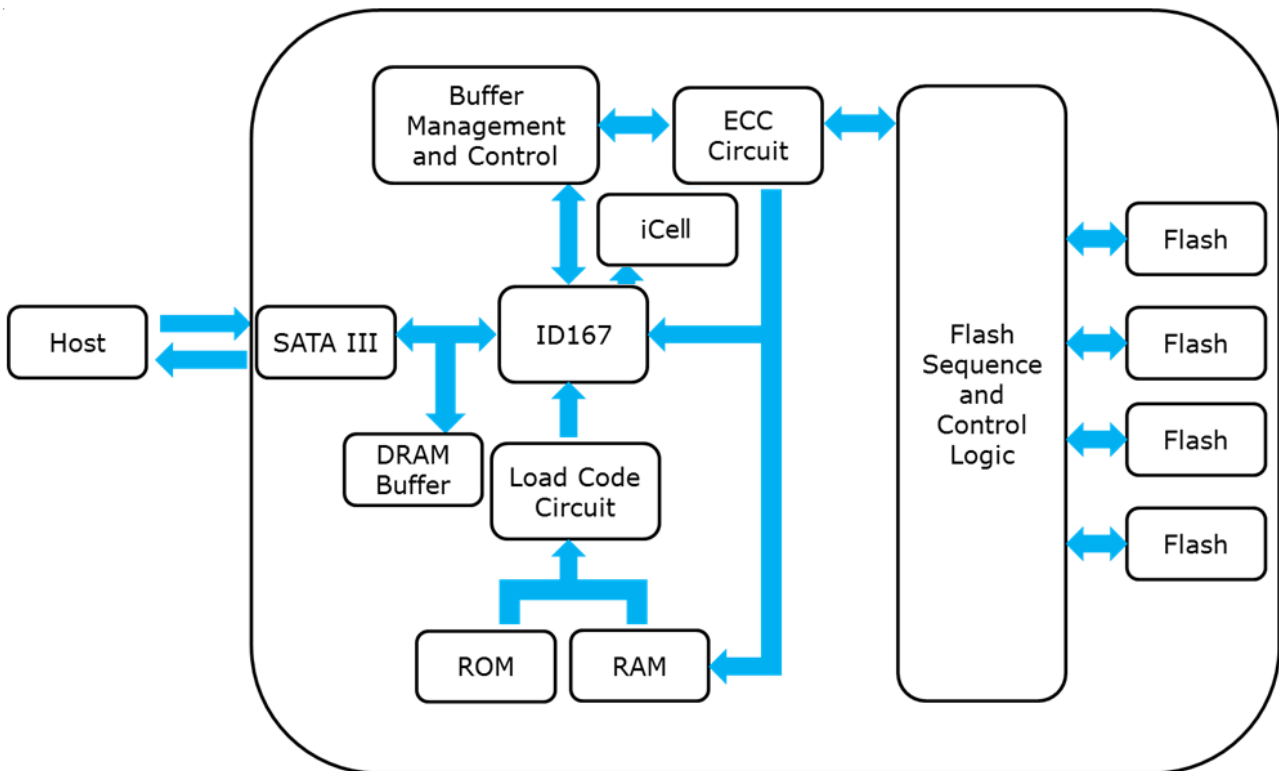
## 2.14 NAND Flash Memory

Innodisk 2.5" SATA SSD 3SR-P uses Single Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage. There are only two statuses 0 or 1 of one cells. Read or Write data to flash memory for SSD is control by microprocessor.

### 3. Theory of Operation

#### 3.1 Overview

Figure 2 shows the operation of Innodisk 2.5" SATA SSD 3SR-P from the system level, including the major hardware blocks.



**Figure 2: Innodisk 2.5" SATA SSD 3SR-P Block Diagram**

Innodisk 2.5" SATA SSD 3SR-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.

#### 3.2 SATA III Controller

Innodisk 2.5" SATA SSD 3SR-P is designed with ID 167, a SATA III 6.0Gbps (Gen. 3) controller, which supports external DDR3 DRAM. 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

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 40 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 3SR-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 Power Cycling

Innodisk's power cycling management 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 power cycling 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 iCell Technology

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 3SR-P can ensure all data can be written to disk without any data loss.



# 4. Installation Requirements

## 4.1 2.5" SATA SSD 3SR-P Pin Directions

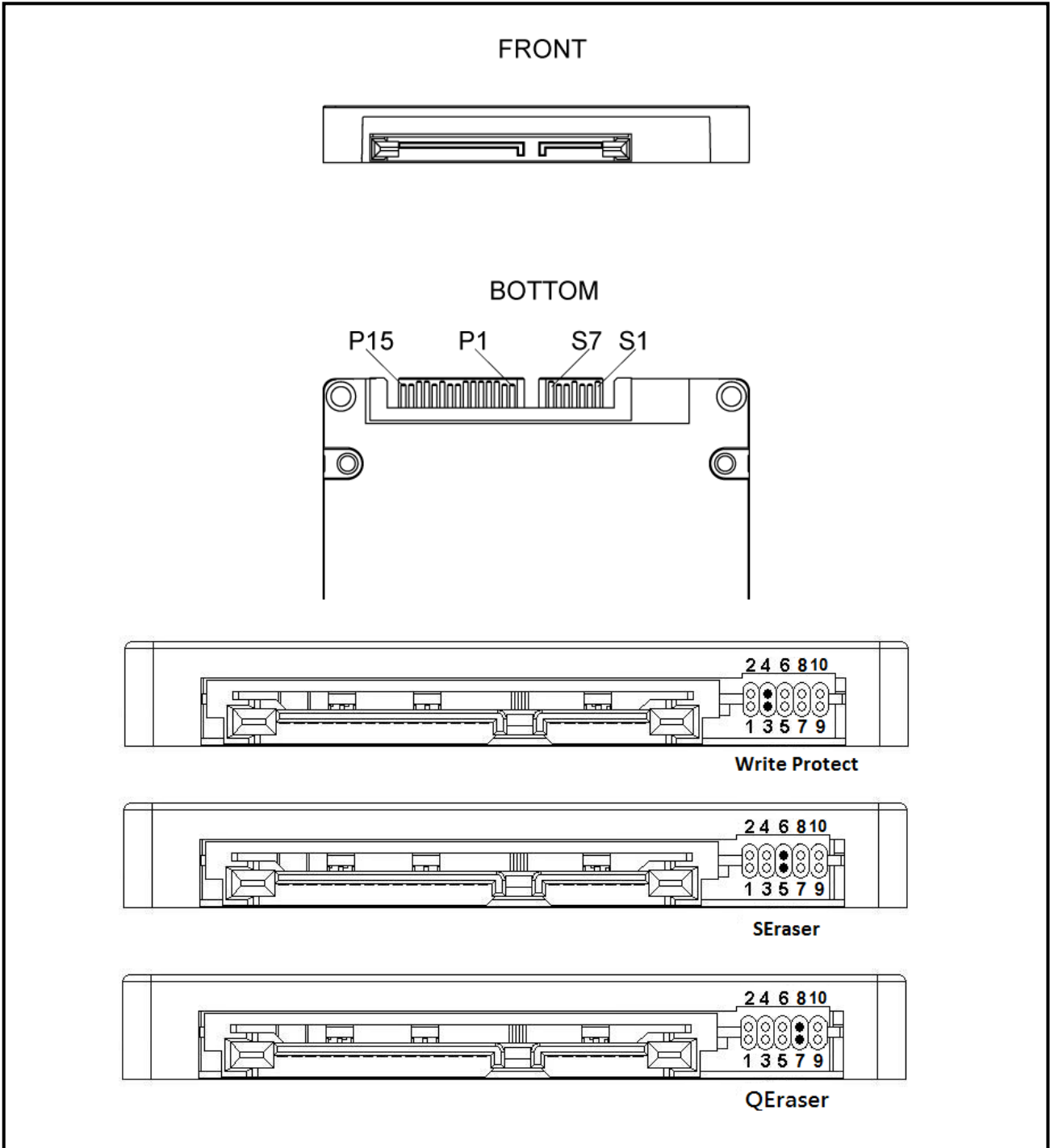


Figure 3: Signal Segment and Power Segment

## 4.2 Electrical Connections for 2.5" SATA SSD 3SR-P

A Serial ATA device may be either directly connected to a host or connected to a host through a

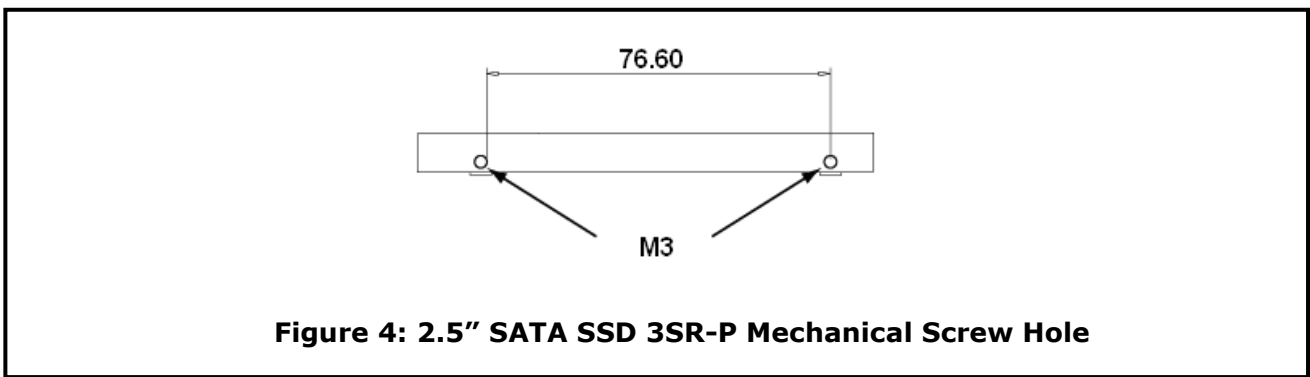
cable. For connection via cable, the cable should be no longer than 1meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

### 4.3 Form Factor

Please prepare following things:

- Screw driver.
- Four M3 screws.
- 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.



### 4.4 Device Drive

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

## 5. Part Number Rule

CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	D	R	S	2	5	-	B	5	6	D	6	7	S	C	B	Q	B	-	X	X
Definition																				
Code 1 <sup>st</sup> (Disk)											Code 10 <sup>th</sup> ~12 <sup>th</sup> (Controller)									
D : Disk											D67: ID167									
Code 2 <sup>nd</sup> (Feature Set)											Code 13 <sup>th</sup> (Flash Mode)									
R: InnoRobust											S: Sync. Flash									
Code 3 <sup>rd</sup> ~5 <sup>th</sup> (Form Factor)											Code 14 <sup>th</sup> (Operation Temperature)									
S25: 2.5" SATA SSD											C: Standard Grade (0°C~ +70°C)									
Code 7 <sup>th</sup> ~9 <sup>th</sup> (Capacity)											Code 15 <sup>th</sup> (Internal Control)									
8G: 8GB											Code 16 <sup>th</sup> (Channel of Data Transfer)									
16G: 16GB											Q: Quad Channels									
32G: 32GB											Code 17 <sup>th</sup> (Flash Type)									
64G: 64GB											B: Toshiba SLC									
A28: 128GB											T: Micron SLC									
B56: 256GB											Code 19 <sup>th</sup> ~20 <sup>th</sup> (Customized Code)									
C12: 512GB																				

# 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 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) 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)
Cd	< 100 ppm
Pb	< 1000 ppm
Hg	< 1000 ppm
Chromium VI (Cr+6)	< 1000 ppm
Polybromodiphenyl ether (PBDE)	< 1000 ppm
Polybrominated Biphenyls (PBB)	< 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：Richard Lee 李鐘亮

Company Representative Title 公司代表人職稱：CEO 執行長

Date 日期：2014 / 07 / 29



innodisk

宜鼎國際股份有限公司  
Innodisk Corporation

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## REACH Declaration of Conformity

### Manufacturer Product: All Innodisk EM Flash and Dram products

1.宜鼎國際股份有限公司（以下稱本公司）特此保證此售予貴公司之產品，皆符合歐盟化學品法案(Registration , Evaluation and Authorization of Chemicals ; REACH)之規定  
(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/05/2014)。所提供之產品包含：(1) 產品或產品所使用到的所有原物料；(2)包裝材料；(3)設計、生產及重工過程中所使用到的所有原物料。

We Innodisk Corporation hereby declare that our products are in compliance with the requirements according to the REACH Regulation

(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/06/2014).

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

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

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

### 立保證書人 (Guarantor)

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

Company Representative 公司代表人： Richard Lee 李鐘亮

Company Representative Title 公司代表人職稱： CEO 執行長

Date 日期： 2014 / 07 / 29



**Verification of Compliance**

Product Name : 2.5" SATA SSD 3SR-P /2.5" SATA SSD 3MR-P  
Model Number : DRS25-XXXD67\*#%※&/DRS25-XXXD67\*#%※&  
XXX: 8GB~512GB  
\* : Flash Mode  
# : Temperature (C : Commercial Temp W : Industrial Temp)  
% : PCB Version (A, B, C.... or 1, 2, 3...)  
※ : Channel (S : Single, D : Dual, Q : Quad, E : Eight)  
& : Flash Vender (T : Micron SLC, S : Samsung SLC,  
M : Samsung MLC, N : Micron MLC, B : Toshiba SLC,  
C : Toshiba MLC)

Applicant : Innodisk Corporation  
Address : 9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221,  
Taiwan

Report Number : O22-U070-1310-291  
Issue Date : November 4, 2013

Applicable Standards : EN 55022:2010+AC:2011 Class B ITE  
AS/NZS CISPR22:2009+A1:2010 Class B ITE  
EN 55024:2010  
EN 61000-4-2:2009  
EN 61000-4-3:2006+A1:2008+A2:2010  
EN 61000-4-4:2012

Based on the EMC Directive 2004/108/EC and the specifications of the customer, one sample of the designated product has been tested in our laboratory and found to be in compliance with the EMC standards cited above.



TAF 0905  
FCC CAB Code TW1053  
NVLAP Lab Code 200575-0  
IC Code 4699A  
VCCI Accep. No. R-1527, C-1609, T-1441, G-10,  
C-4400, T-1334, G-614



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\_\_\_\_\_  
(Tsun-Yu Shih/ General Manager)  
Date: November 4, 2013

