# USB Drive

## 3SE Series

<table>
<thead>
<tr>
<th>Innodisk Approver</th>
<th>Customer Approver</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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**Customer:**

<table>
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<tr>
<th>Part Number:</th>
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<tbody>
<tr>
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</table>

**Innodisk**

<table>
<thead>
<tr>
<th>Part Number:</th>
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</table>

**Model Name:**

<table>
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<tr>
<th>Date:</th>
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<td></td>
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</tbody>
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*The Total Solution For Industrial Flash Storage*
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<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
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<tr>
<td>Pre.</td>
<td>First Release</td>
<td>April., 2014</td>
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<tr>
<td>1.0</td>
<td>Modify ECC description</td>
<td>May., 2014</td>
</tr>
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<td>1.1</td>
<td>Modify TBW based on NAND Flash specifications</td>
<td>Jan., 2015</td>
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<td>1.2</td>
<td>Modify User Capacity/LBA of 4GB</td>
<td>Oct., 2016</td>
</tr>
<tr>
<td>1.3</td>
<td>Update RoHS/REACH/CE/FCC certification</td>
<td>Nov., 2017</td>
</tr>
<tr>
<td></td>
<td>Modify golden finger</td>
<td></td>
</tr>
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</table>
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1. Product Overview

1.1 Introduction of USB Drive

The Innodisk USB Drive products provide high capacity USB flash memory storage that electrically complies with High-speed USB 3.0 interface & backward compatible with USB 2.0. The device features attractive small form factor and the connectivity over USB3.0 and the NAND flash architecture provide a faster data transmission.

1.2 Product View

![Image of USB Drive 3SE](image)

Figure 1: USB Drive 3SE

1.3 Product Models

USB Drive 3SE is available in follow capacities.

- USB Drive 3SE 4GB
- USB Drive 3SE 8GB
- USB Drive 3SE 16GB
- USB Drive 3SE 32GB

1.4 Capacity

USB Drive 3SE provides unformatted from 4GB up to 32GB capacities within SLC Flash IC.
2. Theory of operation

2.1 Overview

Figure 2 shows the operation of USB Drive 3SE from the system level, including the major hardware blocks.

USB Drive 3SE integrates a USB3.0 controller and NAND flash memories. Communication with the host occurs through the host interface. Communication with the flash device(s) occurs through the flash interface.

2.2 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 60 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.

2.3 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.

USB Drive 3SE 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.

2.4 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 generate 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 and 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. After the reserved block less than 40, the SSD will be locked, and cannot be written anymore.
3. Specifications

3.1 CE and FCC Compatibility
USB Drive 3SE conforms to CE and FCC requirements.

3.2 RoHS Compliance
USB Drive 3SE is fully compliant with RoHS directive.

3.3 Environmental Specifications

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

3.3.2 Humidity
Relative Humidity: 10-95%, non-condensing

3.3.3 Shock and Vibration

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Test Conditions</th>
<th>Reference Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>7 Hz to 2K Hz, 20G, 3 axes</td>
<td>IEC 68-2-6</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>Duration: 0.5ms, 1500G, 3 axes</td>
<td>IEC 68-2-27</td>
</tr>
</tbody>
</table>

Table 1: Shock/Vibration Testing for USB Drive 3SE

3.3.4 Mean Time between Failures (MTBF)
Table 2 summarizes the MTBF prediction results for various USB Drive 3SE 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>
<thead>
<tr>
<th>Product</th>
<th>Condition</th>
<th>MTBF (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Drive 3SE</td>
<td>Telcordia SR-332 GB, 25°C</td>
<td>&gt;3,000,000</td>
</tr>
</tbody>
</table>

Table 2: USB Drive 3SE MTBF

### 3.3.5 Terabyte Written (TBW)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBW (Sequential Write)</td>
<td>Unit:TB</td>
</tr>
<tr>
<td>4GB</td>
<td>216</td>
</tr>
<tr>
<td>8GB</td>
<td>432</td>
</tr>
<tr>
<td>16GB</td>
<td>864</td>
</tr>
<tr>
<td>32GB</td>
<td>1728</td>
</tr>
</tbody>
</table>

Table 3: USB Drive 3SE TBW

### 3.4 Golden finger

Au=3 µ”

### 3.5 Pin Assignment

USB Drive 3SE is designed within USB3.0 Interface. Particularly, its built-in power pin enables the device more compactable. Table 4 demonstrates USB Drive 3SE pin assignments.

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>Power</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>USB 2.0 differential pair</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground for power return</td>
</tr>
<tr>
<td>5</td>
<td>StdA_SSRX-</td>
<td>SuperSpeed receiver differential pair</td>
</tr>
<tr>
<td>6</td>
<td>StdA_SSRX+</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GND_DRAIN</td>
<td>Ground for signal return</td>
</tr>
<tr>
<td>8</td>
<td>StdA_SSTX-</td>
<td>SuperSpeed transmitter differential pair</td>
</tr>
<tr>
<td>9</td>
<td>StdA_SSTX+</td>
<td></td>
</tr>
<tr>
<td>Shell</td>
<td>Shield</td>
<td>Connector metal shell</td>
</tr>
</tbody>
</table>

Note: Tx and Rx are defined from the host perspective

Table 4: USB Drive 3SE Pin Assignment
3.6 Mechanical Dimensions

![USB Drive 3SE mechanical dimensions](image)

3.7 Weight

10g±2

3.8 Performance

<table>
<thead>
<tr>
<th>Product name</th>
<th>4GB</th>
<th>8GB</th>
<th>16GB</th>
<th>32GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Drive 3SE</td>
<td>Sequential Read (Max.)</td>
<td>100 MB/S</td>
<td>100 MB/S</td>
<td>100 MB/S</td>
</tr>
<tr>
<td></td>
<td>Sequential Write (Max.)</td>
<td>60 MB/S</td>
<td>75 MB/S</td>
<td>85 MB/S</td>
</tr>
</tbody>
</table>

3.9 NAND Flash Memory

USB Drive 3SE uses Single Level Cell (SLC) NAND flash memory, which is non-volatility and high reliability.
4. Electrical Specifications

4.1 Power Requirement

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td>+5 DC +/- 5%</td>
<td>V</td>
</tr>
</tbody>
</table>

Table 5: USB Drive 3SE Power Requirement

4.2 Power Consumption

<table>
<thead>
<tr>
<th>Mode</th>
<th>Power Consumption (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td>131 (max.)</td>
</tr>
<tr>
<td>Write</td>
<td>155 (max.)</td>
</tr>
<tr>
<td>Idle</td>
<td>67 (max.)</td>
</tr>
</tbody>
</table>

Table 6: Power Consumption

4.3 Device Parameters

<table>
<thead>
<tr>
<th>Capacity</th>
<th>LBA</th>
<th>User capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4GB</td>
<td>8105984</td>
<td>3860MB</td>
</tr>
<tr>
<td>8GB</td>
<td>16211968</td>
<td>7916MB</td>
</tr>
<tr>
<td>16GB</td>
<td>32473088</td>
<td>15856MB</td>
</tr>
<tr>
<td>32GB</td>
<td>64962560</td>
<td>31720MB</td>
</tr>
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</table>

Table 7: Device parameters
# 5. Part Number Rule

<table>
<thead>
<tr>
<th>Description</th>
<th>Disk</th>
<th>Form Factor</th>
<th>Capacity</th>
<th>Category</th>
<th>Flash mode</th>
<th>Operation Temp.</th>
<th>PCB Version</th>
<th>Channel</th>
<th>Flash</th>
<th>Customized Code</th>
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</thead>
<tbody>
<tr>
<td>Code 1&lt;sup&gt;st&lt;/sup&gt; (Disk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D: Disk</td>
</tr>
<tr>
<td>Code 2&lt;sup&gt;nd&lt;/sup&gt; ~ 5&lt;sup&gt;th&lt;/sup&gt; (Form Factor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EUA1: USB Drive</td>
</tr>
<tr>
<td>Code 7&lt;sup&gt;th&lt;/sup&gt; ~9&lt;sup&gt;th&lt;/sup&gt; (Capacity)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Code 15&lt;sup&gt;th&lt;/sup&gt; (Internal control)</td>
</tr>
<tr>
<td>Code 10&lt;sup&gt;th&lt;/sup&gt; ~12&lt;sup&gt;th&lt;/sup&gt; (Category)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Code 16&lt;sup&gt;th&lt;/sup&gt; (Channel)</td>
</tr>
<tr>
<td>Code 13&lt;sup&gt;th&lt;/sup&gt; (Flash mode)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Code 17&lt;sup&gt;th&lt;/sup&gt; (Flash)</td>
</tr>
</tbody>
</table>

**Code 1<sup>st</sup> (Disk)**
- **D**: Disk

**Code 2<sup>nd</sup> ~ 5<sup>th</sup> (Form Factor)**
- EUA1: USB Drive

**Code 7<sup>th</sup> ~9<sup>th</sup> (Capacity)**
- 04G: 4GB
- 08G: 8GB
- 16G: 16GB
- 32G: 32GB

**Code 10<sup>th</sup> ~12<sup>th</sup> (Category)**
- I61: USB 3SE series

**Code 13<sup>th</sup> (Flash mode)**
- S: Sync. Flash

**Code 14<sup>th</sup> (Operation Temperature)**
- **C**: Standard Grade (0℃ ~ +70℃)
- **W**: Industrial Grade (-40℃ ~ +85℃)

**Code 15<sup>th</sup> (Internal control)**
- A~Z: BGA PCB version.

**Code 16<sup>th</sup> (Channel)**
- S: Single

**Code 17<sup>th</sup> (Flash)**
- B: Toshiba SLC
Appendix

RoHS

Manufacturer Product: All Innodisk EM Flash and Dram products

1. 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.

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

<table>
<thead>
<tr>
<th>Name of hazardous substance</th>
<th>Limited of RoHS ppm (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>銅 (Pb)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>汞 (Hg)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>鎘 (Cd)</td>
<td>&lt; 100 ppm</td>
</tr>
<tr>
<td>六價鉻 (Cr 6+)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>多溴聯苯 (PBBs)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>多溴聯苯醚 (PBDEs)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>邻苯二甲酸二(2-乙基己基)酯 (DEHP)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>邻苯二甲酸丁酯邻苯二甲酸 (BBP)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>邻苯二甲酸二丁酯 (DBP)</td>
<td>&lt; 1000 ppm</td>
</tr>
<tr>
<td>邻苯二甲酸二异丁酯 (DIBP)</td>
<td>&lt; 1000 ppm</td>
</tr>
</tbody>
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Guarantor

Company name: Innodisk Corporation

Company Representative: Randy Chien

Company Representative Title: Chairman

Date: 2017 / 01 / 18
REACH Declaration of Conformity

Manufacturer Product: All Innodisk EM Flash and Dram products

1. We Innodisk Corporation hereby declare that our products are in compliance with the requirements according to the (EC) No 1907/2006 REACH Regulation and restricted substances in Annex XIV (http://www.echa.europa.eu/de/candidate-list-table last updated: 12/01/2017, SVHC’s 173).

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

立保書人 (Guarantor)

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

Company Representative 公司代表人： Randy Chien 簡川勝

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

Date 日期： 2017/02/08
VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

Technical Standard: EMC DIRECTIVE 2014/30/EU
(EN55032 / EN55024)

General Information
Applicant: Immodisk Corporation
5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)

Product Description
EUT Description: USB
Brand Name: Immodisk
Model Number: USB Drive 35**
$-Flash type: (S:SLC, l:dSLC, M:MLC, T:3D TLC, A–Z:Others)
*Product line: (E:Embedded, G:EverGreen,
R:ImmoRobust, S:Server, V:ImmoREC, A–Z:Others)
#:Product Generation: (empty, 0–9)

Measurement Standard
EN 55032: 2012 / AC: 2013
CISPR 32: 2012
EN 61000-3-2: 2014
EN 61000-3-3: 2013
IEC 61000-4-2; 2008; IEC 61000-4-3; 2004; + A1; 2007 + A2; 2010; IEC 61000-4-4: 2012;
IEC 61000-4-5; 2014; IEC 61000-4-6: 2013; IEC 61000-4-8: 2009; IEC 61000-4-11: 2004)

Measurement Facilities
Xindian Lab.: Compliance Certification Services Inc.
No.168-1, Jianguoeng Rd., Xindian Dist., New Taipei City, 23131 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: TT0406D01-E

Sam Hu / Assistant Manager
Date: April 30, 2017
VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

Technical Standard: FCC Part 15 Class B
IC ICES-003

General Information
Applicant: InnoDisk Corporation
5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)

Product Description
EUT Description: USB
Brand Name: InnoDisk
Model Number: USB Drive 35*#
Flash type: (S:SLC, LiSLC, M:MLC, T:3D TLC, A~Z:Others)
Product Line: (E:Embedded, G:EverGreen,
R:InnoRobust, S:Server, V:InnoREC, A~Z:Others)
Product Generation: (empty, 0~9)

Measurement Facilities
Xindian Lab.: Compliance Certification Services Inc.
No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City: 23151 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22174029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T70406D01-D

Sam Hsu / Assistant Manager
Date April 10, 2017