

M.2 (S80)

3SE2-P Series

AES Function

Customer: _____

Customer

Part

Number: _____

Innodisk

Part

Number: _____

Innodisk

Model Name: _____

Date: _____

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

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REVISION HISTORY

| Revision | Description | Date |
|----------|---|------------|
| Pre. | First Released | May, 2019 |
| Pre 1.1 | Revised performance | July, 2019 |
| Ver 1.0 | Add caution notice and update REACH, RoHS | Aug, 2019 |
| Ver 1.1 | Update performance and power consumption data | Mar, 2020 |

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1. Product Overview

1.1 Introduction of Innodisk M.2 (S80) 3SE2-P with AES function

Innodisk M.2 (S80) 3SE2-P is designed as the standard M.2 form factor with SATA interface, and supports SATA III standard (6.0Gb/s) with excellent performance. The form factor refers to the M.2(NGFF) specification which established by JEDEC. Regarding of mechanical interference, Innodisk M.2 (S80) 3SE2-P absolutely replaces the traditional hard disk and makes personal computer, in any field, smaller and easier. Innodisk M.2 (S80) 3SE2-P is designed with AES engine, which is a built-in controller. When controller receives the data package from host, AES engine encrypts the data package and saves the encrypted data into NAND flash. Thus, unauthorized personal has no access to decrypt the data in NAND flash.

Innodisk M.2 (S80) 3SE2-P effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD), and complies with ATA protocol, no additional drives are required, and can be configured as a boot device or data storage device.

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 M.2 (S80) 3SE2-P is available in follow capacities within SLC flash ICs. 3SE2-P is followed M.2 2280-D2-B-M standard.

[M.2 \(S80\) 3SE2-P 8GB](#)

[M.2 \(S80\) 3SE2-P 64GB](#)

[M.2 \(S80\) 3SE2-P 16GB](#)

[M.2 \(S80\) 3SE2-P 128GB](#)

[M.2 \(S80\) 3SE2-P 32GB](#)

[M.2 \(S80\) 3SE2-P 256GB](#)

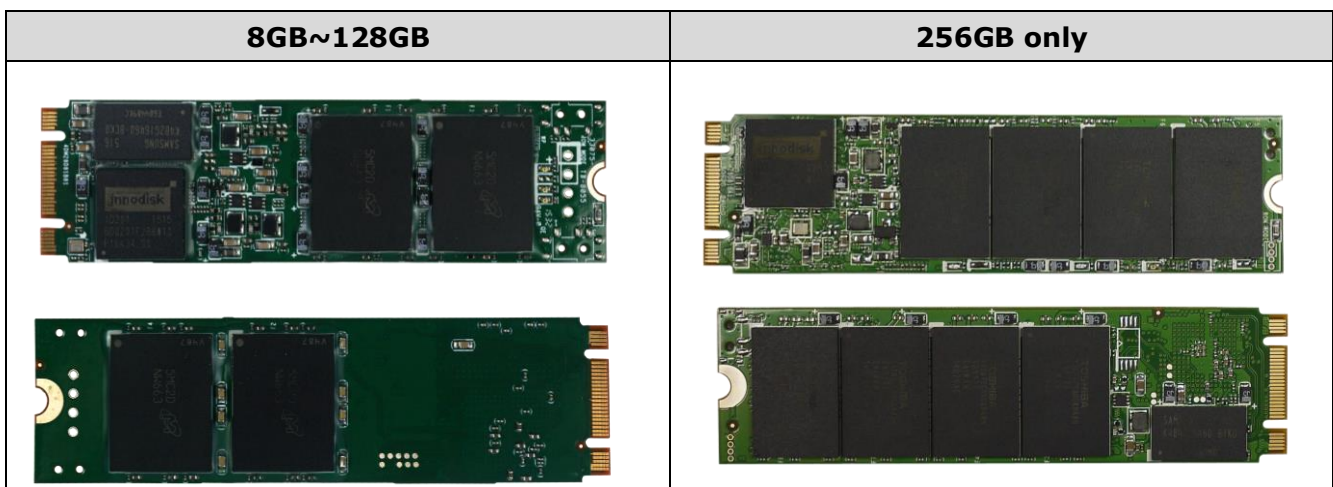


Figure 1: Innodisk M.2 (S80) 3SE2-P (type 2280)

1.3 SATA Interface

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

2. Product Specifications

2.1 Capacity and Device Parameters

M.2 (S80) 3SE2-P device parameters are shown in Table 1.

Table 1: Device parameters

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

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

| Capacity | 8GB | 16GB | 32GB | 64GB | 128GB | 256GB |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Sequential Read (QD32)* | 240 MB/s | 460 MB/s | 520 MB/s | 520 MB/s | 520 MB/s | 520 MB/s |
| Sequential Write (QD32)* | 60 MB/s | 120 MB/s | 240 MB/s | 330 MB/s | 340 MB/s | 340 MB/s |
| 4KB Random Read (QD32)* | 33,700 IOPS | 65,000 IOPS | 74,000 IOPS | 76,000 IOPS | 76,000 IOPS | 76,000 IOPS |
| 4KB Random Write (QD32)* | 15,800 IOPS | 34,000 IOPS | 65,000 IOPS | 72,000 IOPS | 75,000 IOPS | 75,000 IOPS |

Note: * Performance is based on CrystalDiskMark 5.1.2 with file size 1000MB of Queue Depth 32

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk M.2 (S80) 3SE2-P Power Requirement

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

2.3.2 Power Consumption

Table 4: Power Consumption

| Mode | Power Consumption (mA) |
|-------|------------------------|
| Peak | 324 (max.) |
| Read | 560 (max.) |
| Write | 670 (max.) |
| Idle | 110 (max.) |

* Target: 256GB M.2 (S80) 3SE2-P AES

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for M.2 (S80) 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 M.2 (S80) 3SE2-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 M.2 (S80) 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: M.2 (S80) 3SE2-P MTBF

| Product | Condition | MTBF (Hours) |
|---------------------------|---------------------------|--------------|
| Innodisk M.2 (S80) 3SE2-P | Telcordia SR-332 GB, 25°C | >3,000,000 |

2.5 CE and FCC Compatibility

M.2 (S80) 3SE2-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

M.2 (S80) 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 |
| (Total Bytes Written) Unit:TB | | |
| Capacity | Sequential workload | Client workload |
| 8GB | 426.1 | 187.5 |
| 16GB | 852.3 | 375 |
| 32GB | 1704.5 | 750 |
| 64GB | 3409 | 1500 |
| 128GB | 6818.2 | 3000 |
| 256GB | 13636.4 | 6000 |
| * Note: | | |
| 1. Sequential: Mainly sequential write, tested by Vdbench. | | |
| 2. Client: Follow JESD218 Test method and JESD219A Workload, tested by ULINK. (The capacity lower than 64GB client workload is not specified in JEDEC219A, the values are estimated.) | | |
| 3. Based on out-of-box performance. | | |

2.8 Transfer Mode

M.2 (S80) 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 M.2 (S80) 3SE2-P uses a standard SATA pin-out. See Table 8 for M.2 (S80) 3SE2-P pin assignment.

Table 8: Innodisk M.2 (S80) 3SE2-P Pin Assignment

| Signal Name | Pin # | Pin # | Signal Name |
|-------------|-------|-------|-------------|
| | | 75 | GND |
| 3.3V | 74 | 73 | GND |
| 3.3V | 72 | 71 | GND |
| 3.3V | 70 | 69 | GND |
| NC | 68 | 67 | NC |
| Notch | 66 | 65 | Notch |
| Notch | 64 | 63 | Notch |
| Notch | 62 | 61 | Notch |
| Notch | 60 | 59 | Notch |
| NC | 58 | | |
| NC | 56 | 57 | GND |
| NC | 54 | 55 | NC |
| NC | 52 | 53 | NC |
| NC | 50 | 51 | GND |
| NC | 48 | 49 | RX+ |
| NC | 46 | 47 | RX- |
| NC | 44 | 45 | GND |
| NC | 42 | 43 | TX- |
| NC | 40 | 41 | TX+ |
| DEVSLP | 38 | 39 | GND |
| NC | 36 | 37 | NC |
| NC | 34 | 35 | NC |
| NC | 32 | 33 | GND |
| NC | 30 | 31 | NC |
| NC | 28 | 29 | NC |
| NC | 26 | 27 | GND |
| NC | 24 | 25 | NC |
| NC | 22 | 23 | NC |
| NC | 20 | 21 | GND |
| Notch | 18 | 19 | Notch |
| Notch | 16 | 17 | Notch |
| Notch | 14 | 15 | Notch |
| Notch | 12 | 13 | Notch |
| DAS/DSS | 10 | 11 | NC |
| NC | 8 | 9 | NC |
| NC | 6 | 7 | NC |
| 3.3V | 4 | 5 | NC |

| | | | |
|------|---|---|-----|
| 3.3V | 2 | 3 | GND |
| | | 1 | GND |

2.10 Mechanical Dimensions

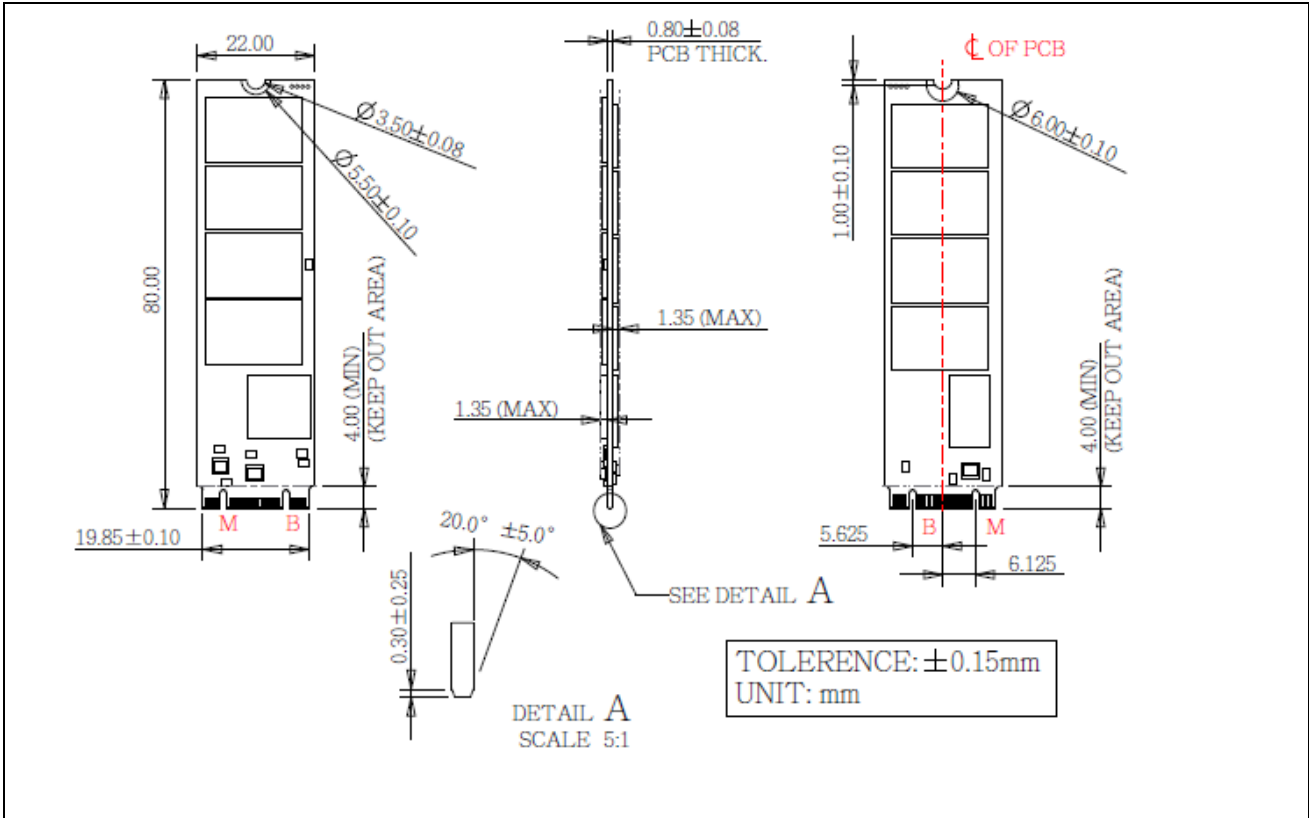


Figure 2: DEM28-B56D82SQC(256GB)**

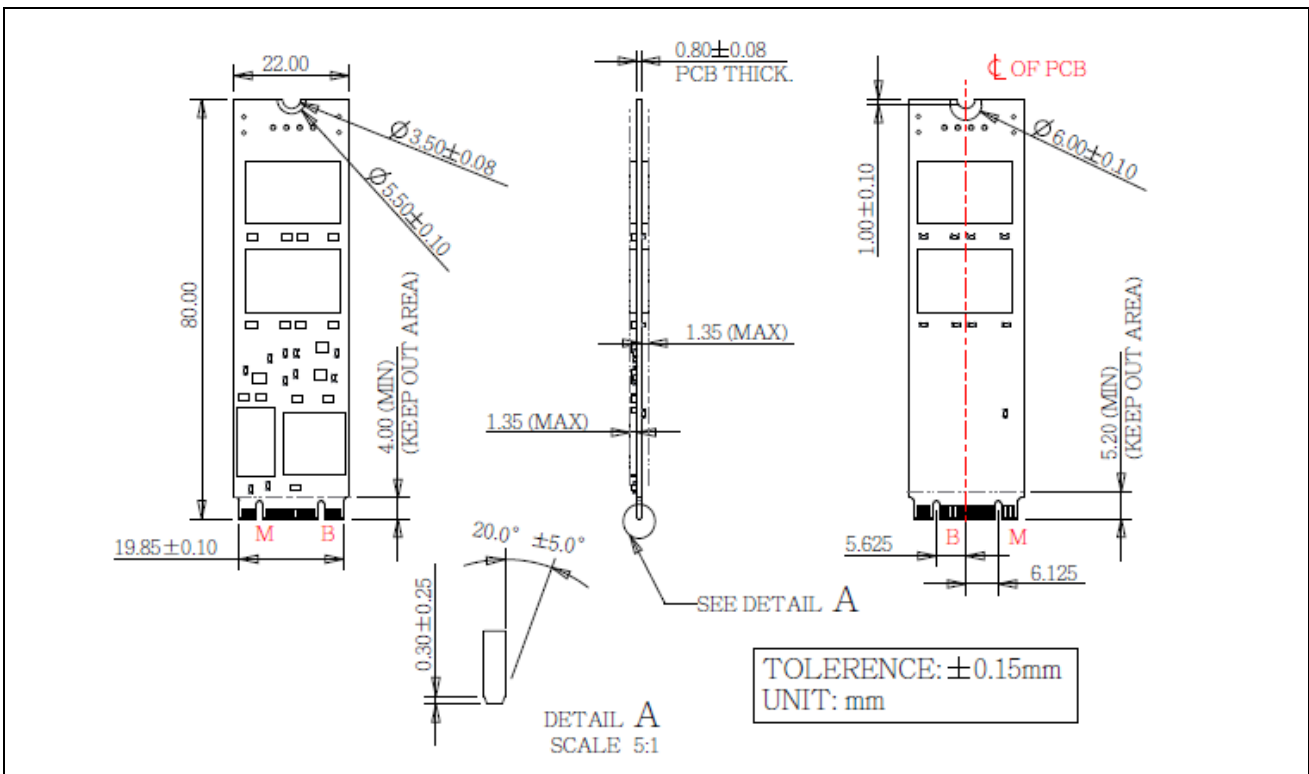


Figure 3: DEM28-*D82***** (8GB~128GB)**

2.11 Assembly Weight

An Innodisk M.2 (S80) 3SE2-P within flash ICs, 256GB's weight is 12 grams approximately.

2.12 Seek Time

Innodisk M.2 (S80) 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 M.2 (S80) 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 4 shows the operation of Innodisk M.2 (S80) 3SE2-P from the system level, including the major hardware blocks.

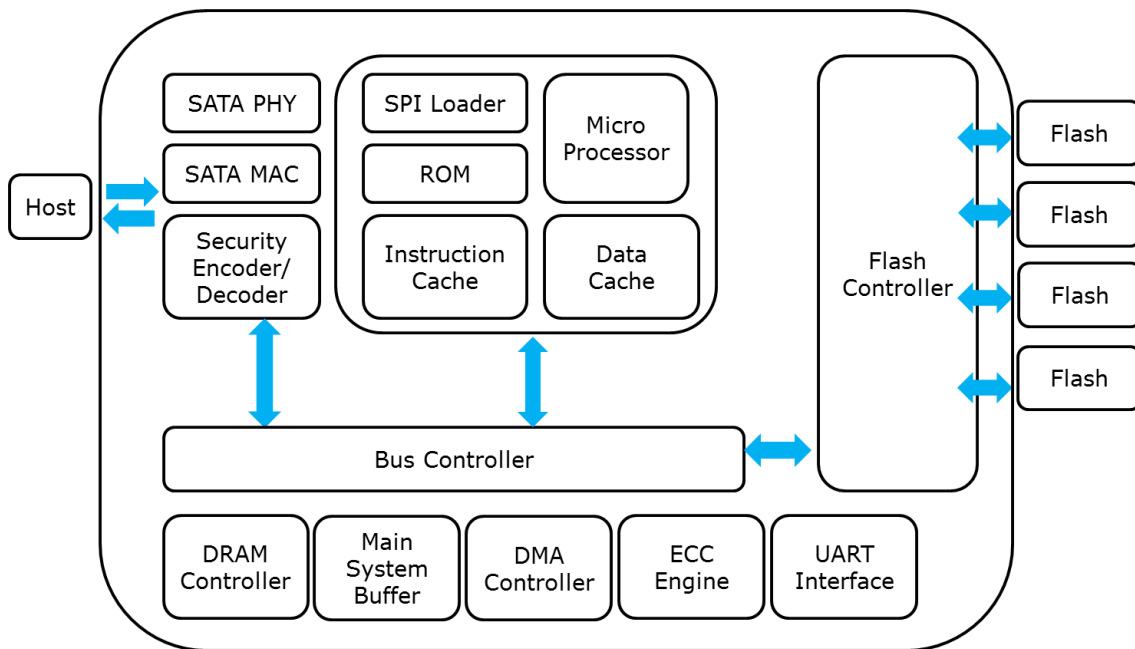


Figure 4: Innodisk M.2 (S80) 3SE2-P Block Diagram

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

3.2 SATA III Controller

Innodisk M.2 (S80) 3SE2-P is designed with ID201 built-in 256bits AES engine, 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 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 M.2 (S80) 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

Innodisk's iData Guard is a comprehensive data protection mechanism that functions before and after a sudden power outage to M.2. Low-power detection terminates data writing before an abnormal power-off, while table-remapping after power-on deletes corrupt data and maintains data integrity. Innodisk's iData Guard provides effective power cycling management, preventing data stored in flash from degrading with use.

3.7 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 M.2 (S80) 3SE2-P AES function flow chart

In order to complete the physical security layer of protection, encryption needs to be paired with an ATA user password by ATA security command. After setting the authorized key by ATA security command, every time when you power on the system with SSD encrypted, you will be requested for a password to access the SSD. If the password is correct, the SSD will run well; if not, then you will not be able to access the SSD then.

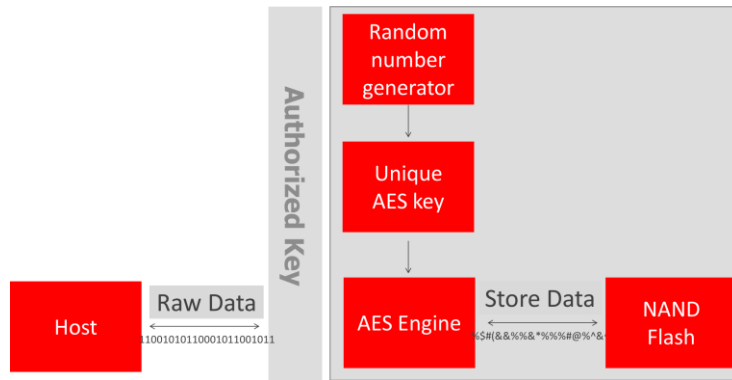


Figure 5: Innodisk M.2 (S80) 3SE2-P AES flow chart

3.8.1 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.

3.8.2 Authorized Key Management

In order to complete the physical security layer of protection, encryption needs to be bundled with an ATA user password provided by an ATA Security command. Unlike the AES key, the authorized key must be set by the user via the BIOS configuration. Every time you power on the system with SSD encryption, a password request prompt is sent to access the SSD. If the password is correct, the SSD will run well; if not, you will not be able to access the SSD.

| Command | Command Code |
|---------------------------|--------------|
| SECURITY SET PASSWORD | 0XF1 |
| SECURITY UNLOCK | 0XF2 |
| SECURITY ERASE PREPARE | 0XF3 |
| SECURITY ERASE UNIT | 0XF4 |
| SECURITY FREEZE LOCK | 0XF5 |
| SECURITY DISABLE PASSWORD | 0XF6 |

3.8.3 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.

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

4. Installation Requirements

4.1 M.2 (S80) 3SE2-P Pin Directions

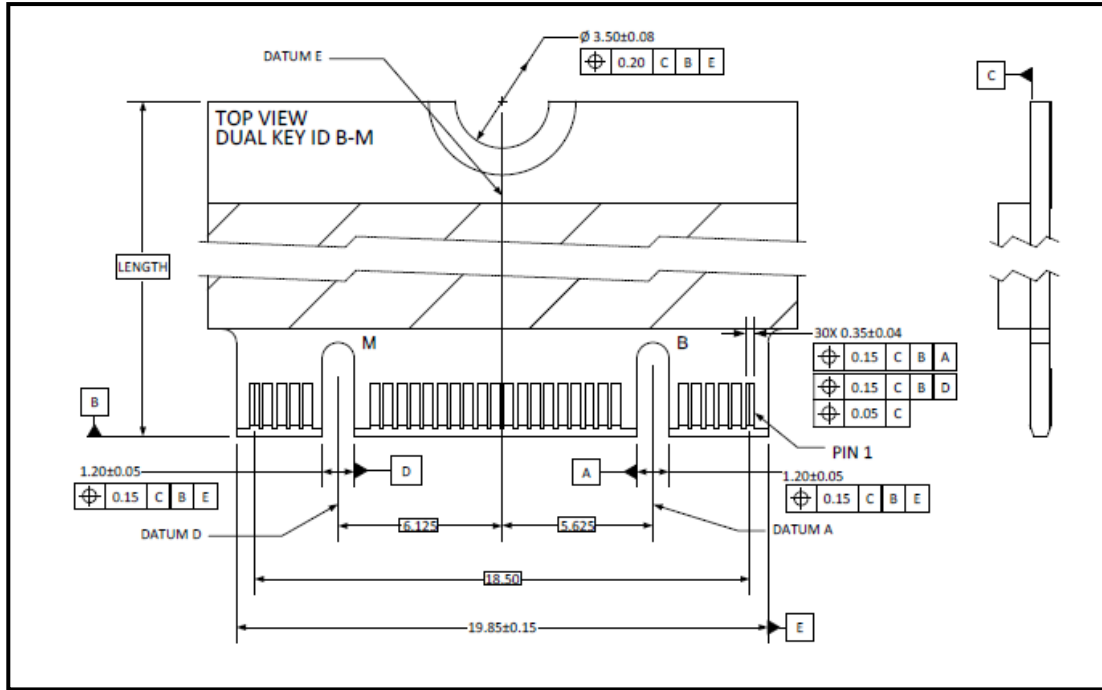


Figure 6: Signal Segment and Power Segment

4.2 Electrical Connections for M.2 (S80) 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 1 meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Device Drive

No additional device drives are required. The Innodisk M.2 (S80) 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 |
|--------------------|---------------------|-----|----|-----|----|----|----|--|
| | MSB | | | | | | | |
| 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 | Maximum 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 simulator v10.20 | May/24/2013 | Has been validated as confirming to the Secure Hash Algorithm specified in Federal Information Processing Standard (FIPS) 180-3, Secure Hash 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 | M | 2 | 8 | - | B | 5 | 6 | D | 8 | 2 | S | C | A | Q | B | - | X | X | X |
| Definition | | | | | | | | | | | | | | | | | | | | | |
| Code 1 st (Disk) | | | | | | | | | | | Code 14 th (Operation Temperature) | | | | | | | | | | |
| D: Disk | | | | | | | | | | | C: Standard Grade (0°C ~ +70°C) | | | | | | | | | | |
| Code 2 nd (Disk) | | | | | | | | | | | W: Industrial Grade (-40°C ~ +85°C) | | | | | | | | | | |
| E: Embedded series | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Code 3 rd ~5 th (Form factor) | | | | | | | | | | | Code 15 th (Internal control) | | | | | | | | | | |
| M28: M.2-SATA Type 2280-D2-B-M | | | | | | | | | | | A~Z: PCB version. | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Code 7 th ~9 th (Capacity) | | | | | | | | | | | Code 16 th (Channel of data transfer) | | | | | | | | | | |
| 08G: 8GB | | | | 64G: 64GB | | | | | | | D: Dual Channels | | | | | | | | | | |
| 16G: 16GB | | | | A28: 128GB | | | | | | | Q: Quad Channels | | | | | | | | | | |
| 32G: 32GB | | | | B56: 256GB | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Code 10 th ~12 th (Controller) | | | | | | | | | | | Code 17 th (Flash Type) | | | | | | | | | | |
| D82: M.2 (S80) 3SE2-P with AES engine | | | | | | | | | | | B: Toshiba SLC | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Code 13 th (Flash mode) | | | | | | | | | | | Code 19 th ~21 st (Customize code) | | | | | | | | | | |
| S: Synchronous Flash | | | | | | | | | | | | | | | | | | | | | |

8. Appendix

REACH



宜鼎國際股份有限公司 Innodisk Corporation REACH Declaration

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: <http://www.innodisk.com/>

We hereby confirm that the product(s) delivered to

| Innodisk P/N | Description |
|--------------------------------|-------------|
| All Innodisk EM FLASH 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 201 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 / 07 / 24

RoHS



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 EP products

- 一、宜鼎國際股份有限公司（以下稱本公司）特此保證售予貴公司之所有產品，皆符合歐盟 2011/65/EU 及(EU) 2015/863 關於 RoHS 之規範要求。
Innodisk Corporation declares that all products sold to the company, are complied with European Union RoHS Directive (2011/65/EU) and (EU) 2015/863 requirement.
- 二、本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。
Innodisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

| Name of hazardous substance | Limited of RoHS ppm (mg/kg) |
|-----------------------------|-----------------------------|
| 鉛 (Pb) | < 1000 ppm |
| 汞 (Hg) | < 1000 ppm |
| 鎘 (Cd) | < 100 ppm |
| 六價鉻 (Cr 6+) | < 1000 ppm |
| 多溴聯苯 (PBBs) | < 1000 ppm |
| 多溴二苯醚 (PBDEs) | < 1000 ppm |
| 鄰苯二甲酸二(2-乙基己基)酯 (DEHP) | < 1000 ppm |
| 鄰苯二甲酸丁酯苯甲酯 (BBP) | < 1000 ppm |
| 鄰苯二甲酸二丁酯 (DBP) | < 1000 ppm |
| 鄰苯二甲酸二異丁酯 (DIBP) | < 1000 ppm |

立保證書人 (Guarantor)

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

Company Representative 公司代表人： Randy Chien 顏川盛

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

Date 日期： 2018 / 07 / 01



CE



VERIFICATION OF COMPLIANCE

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

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

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

Product Description
 EUT Description: M.2
 Brand Name: Innodisk
 Model Number: M.2 (S80) 3S*#-&
 ‡Flash type: (S:SLC, I:ISLC, 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);
 &Product line: (empty, P:Plus)

Measurement Standard
 EN 55032: 2012 / AC: 2013
 CISPR 32: 2012
 EN 61000-3-2: 2014
 EN 61000-3-3: 2013
 EN 55024: 2010 + A1: 2015
 (IEC 61000-4-2: 2008; IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010; IEC 61000-4-4: 2012;
 IEC 61000-4-5: 2014; IEC 61000-4-6: 2013; IEC 61000-4-8: 2009; IEC 61000-4-11: 2004)

Measurement Facilities
 Xindian Lab.: Compliance Certification Services Inc.
 No.163-1, Zhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
 Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T170504D05-E



Sam Hu / Assistant Manager
 Date: May 10, 2017



CCSRF
 隆盛科技股份有限公司
 Compliance Certification Services Inc.

FCC

FCC

VERIFICATION OF COMPLIANCE

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

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

General Information

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

Product Description

EUT Description: M.2
Brand Name: Innodisk
Model Number: M.2 (S80) 3S*#-&
S:Flash type: (S:SLC, I:iSLC, 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);
&:Product line: (empty, P:Plus)

Measurement Facilities

Xindian Lab.: Compliance Certification Services Inc.
No.163-1, Zhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T170504D05-D



Sam Hu / Assistant Manager
Date: May 10, 2017

CCSRF
程颢科技股份有限公司
Compliance Certification Services Inc.