

M.2 (S80)

3TG6-P with

Innodisk NAND

Customer:

\_\_\_\_\_

Customer

Part Number:

\_\_\_\_\_

Innodisk

Part Number:

\_\_\_\_\_

Innodisk

Model Name:

\_\_\_\_\_

Date:

\_\_\_\_\_

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

### Features:

- SATA III
- Innodisk 3D TLC NAND
- M.2 2280-D2-B+M Single-sided
- Standard & Wide-temperature
- iPowerguard
- iDataguard
- Dynamic Thermal Management

### Performance:

- Sequential Read up to 560 MB/s
- Sequential Write up to 420 MB/s

### Power Requirements:

|                        |         |
|------------------------|---------|
| Input Voltage:         | 3.3V±5% |
| Max Operating Wattage: | 2.9W    |
| Idle Wattage:          | 0.8W    |

### Reliability:

| Capacity | TBW  | DWPD |
|----------|------|------|
| 128GB    | 289  | 2.36 |
| 256GB    | 578  | 2.36 |
| 512GB    | 1154 | 2.36 |
| 1TB      | 2308 | 2.36 |
| 2TB      | 4615 | 2.41 |

|                |          |
|----------------|----------|
| Data Retention | 10 Years |
| Warranty       | 3 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)

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## REVISION HISTORY

| Revision | Description                                             | Date        |
|----------|---------------------------------------------------------|-------------|
| V1.0     | First Released                                          | Feb., 2019  |
| V1.1     | Correct user capacity<br>Add TRIM/Die RAID description. | April, 2019 |
| V1.2     | Update 2TB Information                                  | April, 2020 |
| V1.3     | Add 96 Layer 3D TLC Specification                       | July, 2020  |
| V1.4     | Add Wide Temperature Specification                      | Dec, 2020   |
| V1.5     | Update performance and TBW value                        | Jan, 2021   |
| V1.6     | Update single-sided PCB                                 | Jun, 2021   |
| V2.0     | Modify to new format & add 112 Layers 3D TLC            | Apr., 2022  |
| V2.1     | Update 128GB LBA                                        | Sep., 2022  |

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# 1. Product Overview

## 1.1 Introduction of Innodisk M.2 (S80) 3TG6-P

Innodisk M.2 (S80) 3TG6-P is characterized by L<sup>3</sup> architecture with the latest SATA III (6.0GHz) Marvell NAND controller. Innodisk's exclusive L<sup>3</sup> architecture is L<sup>2</sup> architecture multiplied LDPC (Low Density Parity Check). L<sup>2</sup> (Long Life) architecture is a 4K mapping algorithm that reduces WAF and features a real-time wear leveling algorithm to provide high performance and prolong lifespan with exceptional reliability. Innodisk M.2 (S80) 3TG6-P is designed for industrial field, and supports several standard features, including TRIM, NCQ, and S.M.A.R.T. In addition, Innodisk's exclusive industrial-oriented firmware provides a flexible customization service, making it perfect for a variety of industrial applications.

**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) 3TG6-P is available in follow capacities within 3D TLC flash ICs.

[M.2 \(S80\) 3TG6-P 128GB](#)

[M.2 \(S80\) 3TG6-P 256GB](#)

[M.2 \(S80\) 3TG6-P 512GB](#)

[M.2 \(S80\) 3TG6-P 1TB](#)

[M.2 \(S80\) 3TG6-P 2TB](#)



**Figure 1: Innodisk M.2 (S80) 3TG6-P (type 2280)**

## 1.3 SATA Interface

Innodisk M.2 (S80) 3TG6-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) 3TG6-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) 3TG6-P device parameters are shown in Table 1.

**Table 1: Device parameters**

| Capacity | Cylinders | Heads | Sectors | LBA        | User Capacity(MB) |
|----------|-----------|-------|---------|------------|-------------------|
| 128GB    | 16383     | 16    | 63      | 214906608  | 114473            |
| 256GB    | 16383     | 16    | 63      | 468862128  | 228936            |
| 512GB    | 16383     | 16    | 63      | 937703088  | 457862            |
| 1TB      | 16383     | 16    | 63      | 1875385008 | 915715            |
| 2TB      | 16383     | 16    | 63      | 3750748848 | 1788000           |

### 2.2 Performance

Burst Transfer Rate: 6.0Gbps

**Table 2: Performance - 96 Layers 3D TLC**

|                             | Capacity                     | Unit | 128GB  | 256GB  | 512GB  | 1TB    | 2TB    |
|-----------------------------|------------------------------|------|--------|--------|--------|--------|--------|
| <b>96 Layers<br/>3D TLC</b> | Sequential*<br>Read (max.)   | MB/s | 380    | 550    | 560    | 510    | 510    |
|                             | Sequential*<br>Write (max.)  |      | 65     | 120    | 250    | 420    | 400    |
|                             | 4KB Random**<br>Read (QD32)  | IOPS | 25,000 | 48,000 | 67,000 | 67,000 | 68,000 |
|                             | 4KB Random**<br>Write (QD32) |      | 16,000 | 31,000 | 52,000 | 56,000 | 56,000 |
|                             |                              |      |        |        |        |        |        |

Note: \* Sequential performance is based on CrystalDiskMark 6.0.2 with file size 1000MB

\*\* Random performance is based on IO meter with Queue Depth 32

**Table 3: Performance- 112 Layers 3D TLC**

|                              | Capacity                    | Unit | 128GB  | 256GB<br>(4CH) | 256GB<br>(2CH) | 512GB  | 1TB    | 2TB    |
|------------------------------|-----------------------------|------|--------|----------------|----------------|--------|--------|--------|
| <b>112 Layers<br/>3D TLC</b> | Sequential*<br>Read (Q32T1) | MB/s | 400    | 510            | 370            | 510    | 510    | 510    |
|                              | Sequential<br>Write (Q32T1) |      | 90     | 170            | 70             | 150    | 300    | 450    |
|                              | 4KB Random<br>Read (QD32)   | IOPS | 27,000 | 49,000         | 24,000         | 44,000 | 69,000 | 76,000 |
|                              | 4KB Random<br>Write (QD32)  |      | 23,000 | 44,000         | 20,000         | 39,000 | 57,000 | 57,000 |
|                              |                             |      |        |                |                |        |        |        |

Note: \* Performance results are tested in Room Temperature with Out-of-Box devices and may vary depending on overall system setup.

Note: \*\* Performance results are based on CrystalDiskMark 6.0.2 with typical tolerance for range from 1% to 10%.

Note: \*\*\* Performance results are based on AIDA 64 with block size 1MB of Linear Write Test Item

## 2.3 Electrical Specifications

### 2.3.1 Power Requirement

**Table 4: Innodisk M.2 (S80) 3TG6-P Power Requirement**

| Item          | Symbol          | Rating        | Unit |
|---------------|-----------------|---------------|------|
| Input voltage | V <sub>IN</sub> | +3.3 DC +- 5% | V    |

### 2.3.2 Power Consumption

**Table 5: Typical Power Consumption**

| Mode          | Power Consumption (W) |
|---------------|-----------------------|
| Read          | 2.3                   |
| Write         | 3.1                   |
| Idle          | 1.0                   |
| Power-on Peak | 0.2                   |

\* Target: 2TB M.2 (S80) 3TG6-P

Note: Current results may vary depending on system components and power circuit design

Please refer to the test report for other capacities

## 2.4 Environmental Specifications

### 2.4.1 Temperature Ranges

**Table 6: Temperature range for M.2 (S80) 3TG6-P**

| Temperature | Range                            |
|-------------|----------------------------------|
| Operating   | 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 7: Shock/Vibration Testing for M.2 (S80) 3TG6-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) 3TG6-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 8: M.2 (S80) 3TG6-P MTBF**

| Product                   | Condition                 | MTBF (Hours) |
|---------------------------|---------------------------|--------------|
| Innodisk M.2 (S80) 3TG6-P | Telcordia SR-332 GB, 25°C | >3,000,000   |

### 2.5 CE and FCC Compatibility

M.2 (S80) 3TG6-P conforms to CE and FCC requirements.

### 2.6 RoHS Compliance

M.2 (S80) 3TG6-P is fully compliant with RoHS directive.

### 2.7 Reliability

**Table 9: M.2 (S80) 3TG6-P TBW**

| Parameter       | Value            |
|-----------------|------------------|
| Flash endurance | 3,000 P/E cycles |

|                                                                                                                                                                                                                                                                                                                                                     |                                                                              |                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------|
| Error Correct Code                                                                                                                                                                                                                                                                                                                                  | Support (LDPC)                                                               |                        |
| Data Retention                                                                                                                                                                                                                                                                                                                                      | Under 40 °C:<br>10 Years at Initial NAND status ;<br>1 Year at NAND Life End |                        |
| UBER                                                                                                                                                                                                                                                                                                                                                | 10 <sup>-16</sup>                                                            |                        |
| <b>TBW* (Total Bytes Written)</b> Unit: TB                                                                                                                                                                                                                                                                                                          |                                                                              |                        |
| <b>Capacity</b>                                                                                                                                                                                                                                                                                                                                     | <b>Sequential workload</b>                                                   | <b>Client workload</b> |
| 128GB                                                                                                                                                                                                                                                                                                                                               | 341                                                                          | 289                    |
| 256GB                                                                                                                                                                                                                                                                                                                                               | 682                                                                          | 578                    |
| 512GB                                                                                                                                                                                                                                                                                                                                               | 1364                                                                         | 1154                   |
| 1TB                                                                                                                                                                                                                                                                                                                                                 | 2663                                                                         | 2308                   |
| 2TB                                                                                                                                                                                                                                                                                                                                                 | 5327                                                                         | 4615                   |
| <p>* Note:</p> <p>1. Sequential: Mainly sequential write are estimated by PassMark Burnin Test v8.1 pro</p> <p>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.)</p> <p>3. Based on out-of-box performance.</p> |                                                                              |                        |

## 2.8 Transfer Mode

M.2 (S80) 3TG6-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) 3TG6-P uses a standard SATA pin-out. See Table 9 for M.2 (S80) 3TG6-P pin assignment.

**Table 10: Innodisk M.2 (S80) 3TG6-P Pin Assignment**

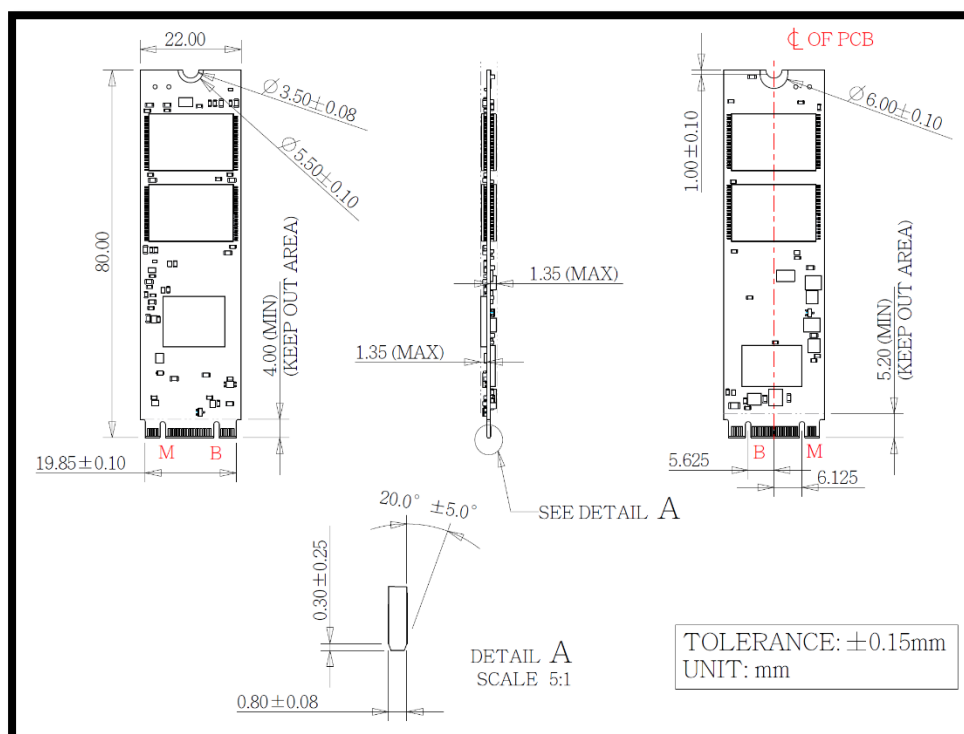
| Signal Name | Pin # | Pin # | Signal Name |
|-------------|-------|-------|-------------|
|             |       | 75    | GND         |
| 3.3V        | 74    | 73    | GND         |
| 3.3V        | 72    | 71    | GND         |
| 3.3V        | 70    | 69    | GND         |
| NC          | 68    | 67    | 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   |

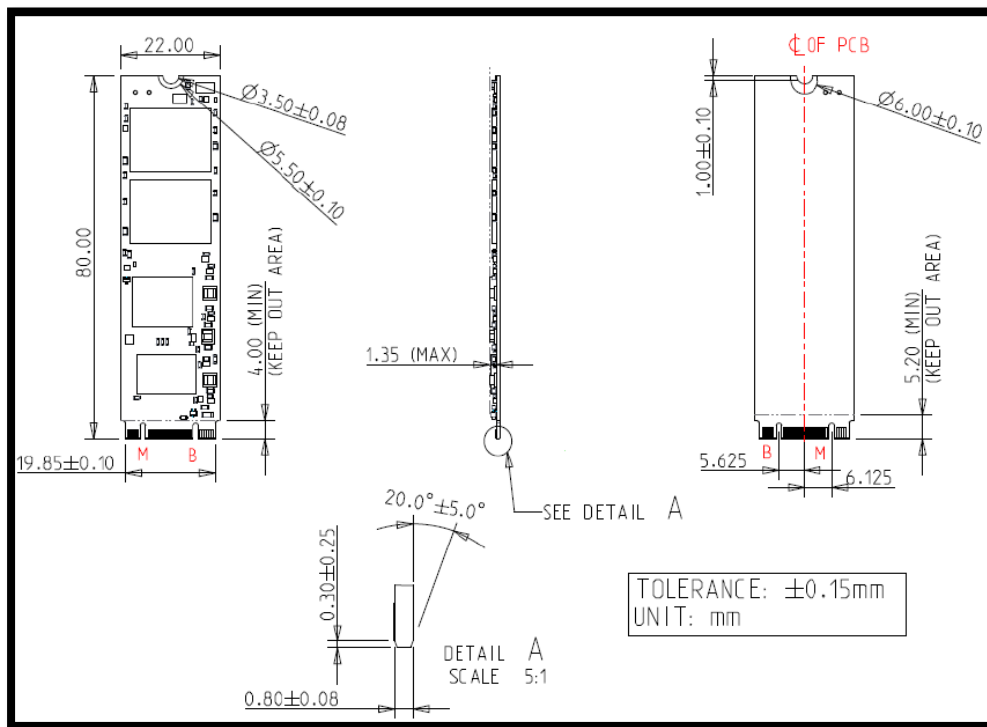
| LED Color | Function |
|-----------|----------|
| Green     | Power    |
|           | Access   |

**Table 11: Innodisk M.2 (S80) 3TG6-P LED indicator**

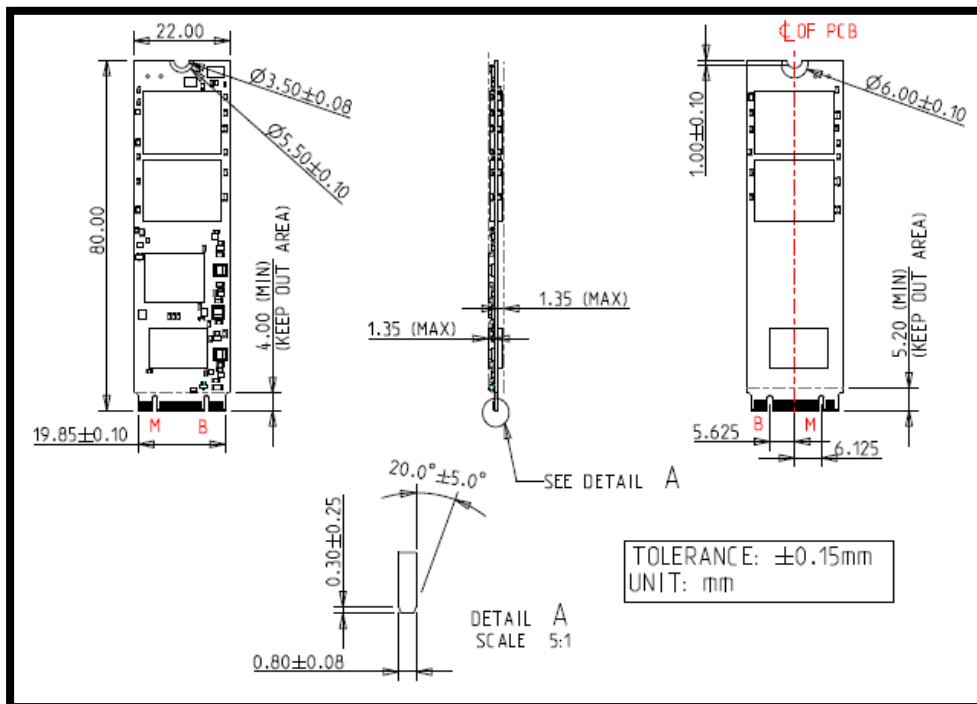
## 2.10 Mechanical Dimensions



**Figure 2: Innodisk M.2 (S80) 3TG6-P diagram (TSOP)**



**Figure 3: Innodisk M.2 (S80) 3TG6-P diagram (single-sided)**



**Figure 4: Innodisk M.2 (S80) 3TG6-P diagram (2TB only)**

## 2.11 Assembly Weight

An Innodisk M.2 (S80) 3TG6-P within flash ICs, 512GB's weight is 10 grams approximately.

## 2.12 Seek Time

Innodisk M.2 (S80) 3TG6-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.

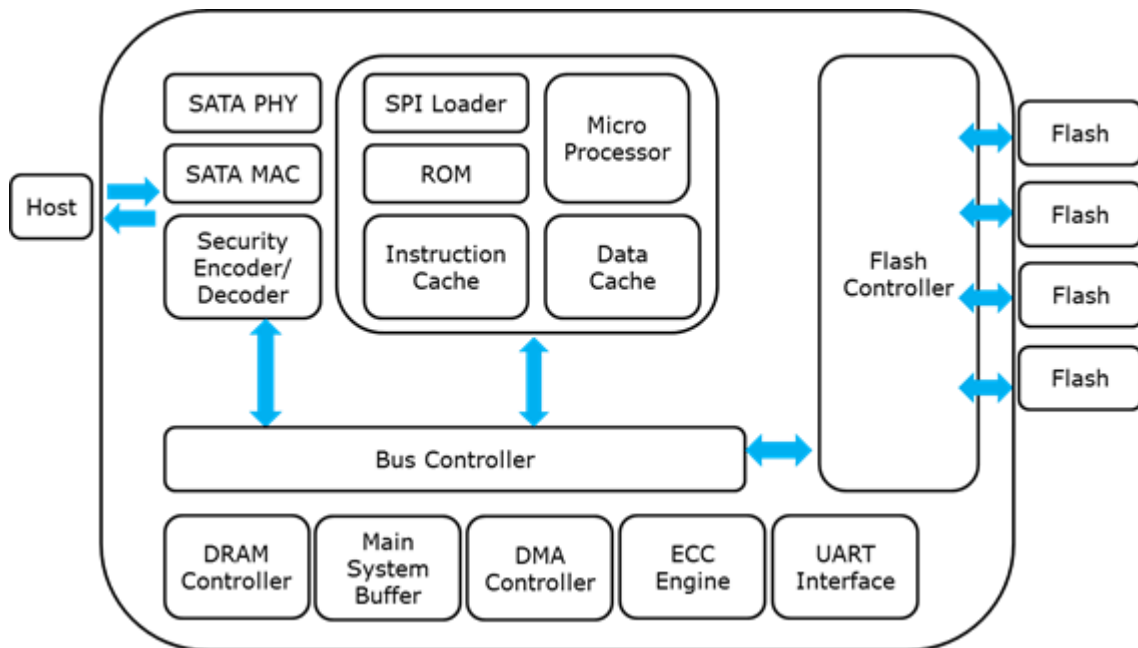
### **2.14 NAND Flash Memory**

Innodisk M.2 (S80) 3TG6-P uses 3D Triple Level Cell (TLC) 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) 3TG6-P from the system level, including the major hardware blocks.



**Figure 5: Innodisk M.2 (S80) 3TG6-P Block Diagram**

Innodisk M.2 (S80) 3TG6-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 M.2 (S80) 3TG6-P 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 M.2 (S80) 3TG6-P 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 M.2 (S80) 3TG6-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 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 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**

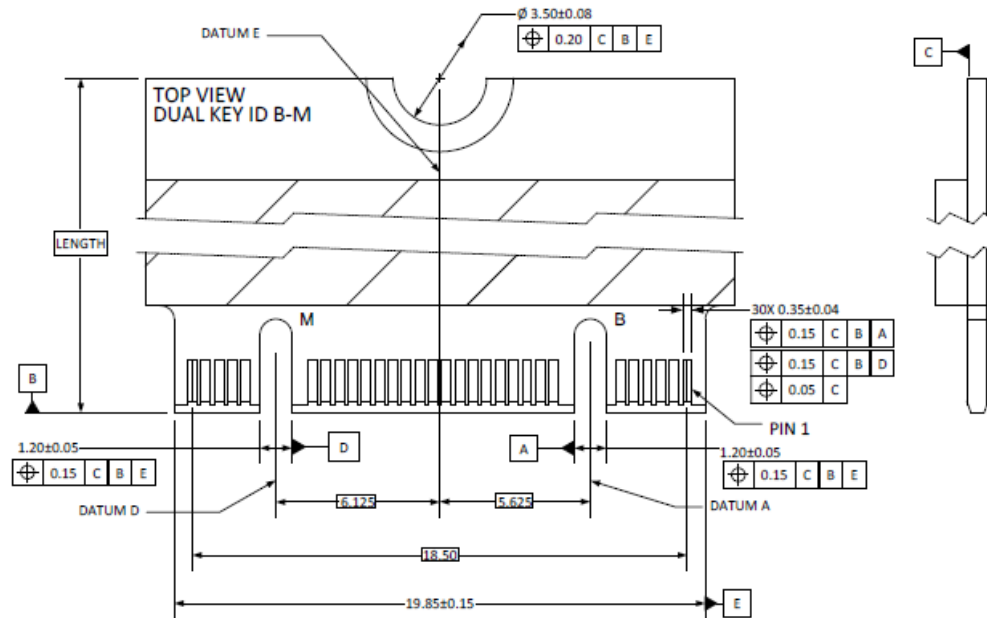
iPower Guard technology is a set of preventive measures that protect the SSD in an unstable power supply environment. This comprehensive package comprises safeguards for startup and shutdown to maintain device performance and ensure data integrity.

### **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 M.2 (S80) 3TG6-P series is default enable the Die RAID function for the industrial application.

## 4. Installation Requirements

### 4.1 M.2 (S80) 3TG6-P Pin Directions



**Figure 6: Signal Segment and Power Segment**

### 4.2 Electrical Connections for M.2 (S80) 3TG6-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 Device Drive

No additional device drives are required. The Innodisk M.2 (S80) 3TG6-P can be configured as a boot device.

## 5. SMART Feature Set

Innodisk 3TG6-P series support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

**Table 12: 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 3TG6-P series SMART data attributes are listed in following table.

**Table 13: SMART attribute**

| Attribute ID (hex) | Value             | Raw Attribute Value |    |    |     |    |     | Rsv | Attribute Name              |
|--------------------|-------------------|---------------------|----|----|-----|----|-----|-----|-----------------------------|
| 05                 | 64 <sub>hex</sub> | LSB                 |    |    | MSB | 00 | 00  | 00  | Later Bad                   |
| 09                 | LSB               | LSB                 |    |    | MSB | 00 | 00  | 00  | Power-On hours Count        |
| 0C                 | LSB               | LSB                 |    |    | MSB | 00 | 00  | 00  | Drive Power Cycle Count     |
| A3                 | LSB               | LSB                 |    |    |     |    | MSB | 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                 | 64 <sub>hex</sub> | LSB                 | 00 | 00 | 00  | 00 | 00  | 00  | Device Life                 |
| AA                 | 64 <sub>hex</sub> | LSB                 |    |    |     |    | MSB | 00  | Spare Block Count           |
| AB                 | LSB               | LSB                 |    |    |     |    | MSB | 00  | Program fail count          |
| AC                 | LSB               | LSB                 |    |    |     |    | MSB | 00  | Erase fail count            |
| B8                 | 00                | LSB                 |    |    | MSB | 00 | 00  | 00  | Error Corrected Count       |
| BB                 | 00                | LSB                 |    |    | MSB | 00 | 00  | 00  | Reported Uncorrected Count  |
| C0                 | LSB               | LSB                 |    |    | MSB | 00 | 00  | 00  | Unexpected Power Loss Count |

|    |                   |       |      |      |      |      |      |       |                                            |
|----|-------------------|-------|------|------|------|------|------|-------|--------------------------------------------|
| C2 | Cur.*             | Cur.* | 00   | MIN  | 00   | MAX  | 03   | Cur.* | Temperature                                |
| E5 | 64 <sub>hex</sub> | ID 0  | ID 1 | ID 2 | ID 3 | ID 4 | ID 5 | 00    | Flash ID                                   |
| EB | 00                |       | MSB  | LSB  | MSB  | LSB  | MSB  | LSB   | Later bad block info<br>(Read/Write/Erase) |
| F1 | 64 <sub>hex</sub> | LSB   |      |      |      |      | MSB  | 00    | Total LBA<br>written(LBA=32MB)             |
| F2 | 64 <sub>hex</sub> | LSB   |      |      |      |      | MSB  | 00    | Total LBA<br>read(LBA=32MB)                |

Notes: The temperature data on iSmart implies built-in or on-board thermal sensor value.

Notes: More detailed health info has been defined by innodisk and will be shown on iSMART V5.3.21 (or later version).

## 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 | G | M | 2 | 8 | - | 0 | 2 | T | M  | 7                                                        | 1  | G  | C  | A  | Q  | Q  | S  | -  | X  | X  |
| Definition                                           |   |   |   |   |   |   |   |   |   |    |                                                          |    |    |    |    |    |    |    |    |    |    |
| Code 1 <sup>st</sup> (Disk)                          |   |   |   |   |   |   |   |   |   |    | Code 14 <sup>th</sup> (Operation Temperature)            |    |    |    |    |    |    |    |    |    |    |
| D : Disk                                             |   |   |   |   |   |   |   |   |   |    | C: Standard Grade (0°C ~ +70°C)                          |    |    |    |    |    |    |    |    |    |    |
| Code 2 <sup>nd</sup> (Feature set)                   |   |   |   |   |   |   |   |   |   |    | W: Industrial Grade (-40°C ~ +85°C)                      |    |    |    |    |    |    |    |    |    |    |
| G : EverGreen series                                 |   |   |   |   |   |   |   |   |   |    | Code 15 <sup>th</sup> (Internal control)                 |    |    |    |    |    |    |    |    |    |    |
| Code 3 <sup>rd</sup> ~5 <sup>th</sup> (Form factor)  |   |   |   |   |   |   |   |   |   |    | 1~9: TSOP PCB version.                                   |    |    |    |    |    |    |    |    |    |    |
| M28: M.2 Type 2280-D2-B-M                            |   |   |   |   |   |   |   |   |   |    | A~Z: BGA PCB version.                                    |    |    |    |    |    |    |    |    |    |    |
| Code 7 <sup>th</sup> ~9 <sup>th</sup> (Capacity)     |   |   |   |   |   |   |   |   |   |    | Code 16 <sup>th</sup> (Channel of data transfer)         |    |    |    |    |    |    |    |    |    |    |
| A28: 128GB                                           |   |   |   |   |   |   |   |   |   |    | D: Dual Channels                                         |    |    |    |    |    |    |    |    |    |    |
| B56: 256GB                                           |   |   |   |   |   |   |   |   |   |    | Q: Quad Channels                                         |    |    |    |    |    |    |    |    |    |    |
| C12: 512GB                                           |   |   |   |   |   |   |   |   |   |    | Code 17 <sup>th</sup> (Flash Type)                       |    |    |    |    |    |    |    |    |    |    |
| O1T: 1TB                                             |   |   |   |   |   |   |   |   |   |    | L/Q: Innodisk 3D TLC                                     |    |    |    |    |    |    |    |    |    |    |
| O2T: 2TB                                             |   |   |   |   |   |   |   |   |   |    | Code 18 <sup>th</sup> (Single sided)                     |    |    |    |    |    |    |    |    |    |    |
| Code 10 <sup>th</sup> ~12 <sup>th</sup> (Controller) |   |   |   |   |   |   |   |   |   |    | S: single-sided                                          |    |    |    |    |    |    |    |    |    |    |
| M71: 3TG6-P                                          |   |   |   |   |   |   |   |   |   |    | Code 20 <sup>th</sup> ~21 <sup>st</sup> (Customize code) |    |    |    |    |    |    |    |    |    |    |
| Code 13 <sup>th</sup> (Flash mode)                   |   |   |   |   |   |   |   |   |   |    | G: 96 layers 3D TLC                                      |    |    |    |    |    |    |    |    |    |    |
| K: 112 Layers 3D TLC                                 |   |   |   |   |   |   |   |   |   |    | For customized                                           |    |    |    |    |    |    |    |    |    |    |