

# 2.5" SATA SSD

Version 1.2  
Jun. 23, 2022

**ISSS31C**

128GB, 256GB, 512GB, 1TB, 2TB

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## **Revision History**

| <b>Revision</b> | <b>Date</b>   | <b>Description</b>     | <b>Editor</b> |
|-----------------|---------------|------------------------|---------------|
| 1.0             | Mar. 01, 2022 | Initial release        | Austin Lee    |
| 1.1             | Mar. 25, 2022 | Update TBW information | Austin Lee    |
| 1.2             | Jun. 23, 2022 | Update TBW information | Austin Lee    |

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## Key Features

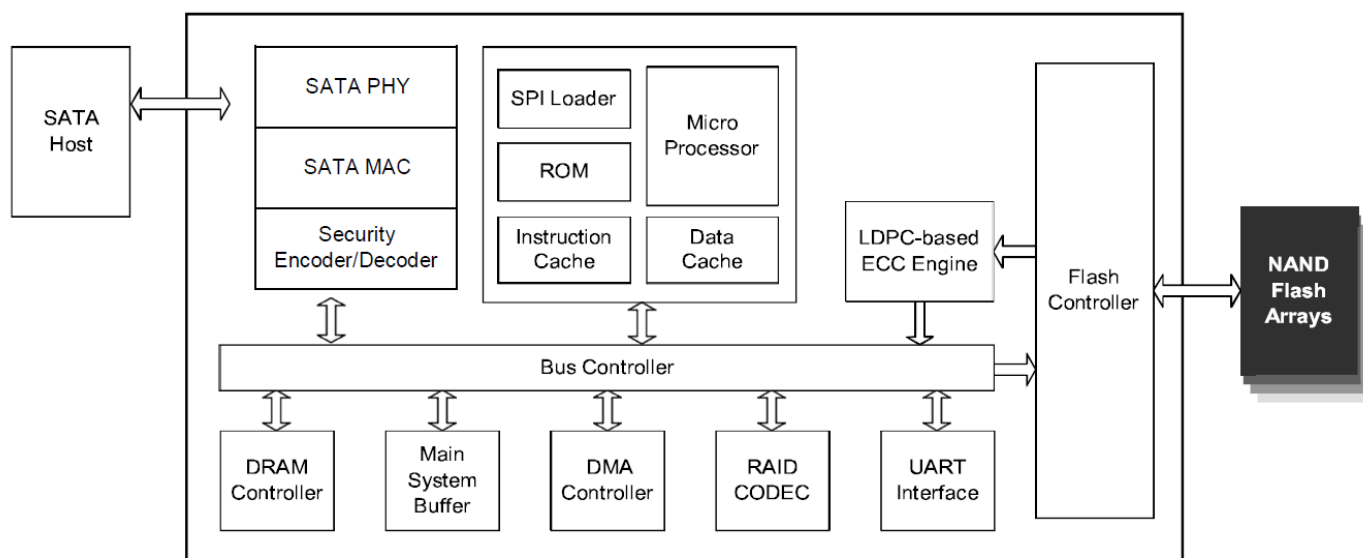
- **Capacity:**
  - 128GB, 256GB, 512GB, 1TB, 2TB
- **NAND Flash:** 3D TLC 112L
- **DRAM Buffer:** DDR3
- **Form Factor:** 2.5 inch SATA
- **Host Interface:**
  - Serial ATA 6Gb/s interface
  - Compliant with ATA-8 Standard
  - Compliant with SATA Revision 3.1
- **Flash Management:**
  - LDPC ECC engine
  - RAID engine
  - Global wear-leveling
  - Bad block management
  - Garbage collection
  - TRIM command
  - SLC cache technology
  - NCQ command
- **Data Integrity:**
  - Thermal throttling
  - S.M.A.R.T. monitor
- **Performance:**
  - Sequential Read: Up to 560 MB/s
  - Sequential Write: Up to 500 MB/s
  - Random 4K Read: Up to 85K IOPS
  - Random 4K Write: Up to 75K IOPS
- **Power Consumption:**
  - Device Sleep: 5mW
  - Slumber: 0.05W
  - Idle: 0.5W
  - Sequential Read/Write: 2.3W/2.2W
  - Random Read/Write: 2.0W/1.9W
- **Temperature:**
  - Standard: 0°C ~ 70°C
  - Non-operation: -55°C ~ 95°C
- **Reliability:**
  - Shock: 1500G/0.5ms
  - Vibration 20G Peak, 20~2000Hz
  - MTBF: 3,000,000 hours
- **Endurance:**
  - TBW: Up to 4320TB

## 1.0 General Description

ISSS31C industrial-grade 2.5" solid state drives implement 3D NAND Flash for superb transfer rates up to 560/500MB per second. They also feature low power consumption, high reliability, and compatibility across diverse storage applications that require security, convenience, performance, and capacity. ISSS31C solid state drives are purpose-made for industrial computing, embedded applications, and general automation, and take full advantage of proprietary A+ Testing Methodology. This guarantees drives meet the exacting requirements of industrial and enterprise applications. When it comes to SSD quality, A+ Testing Methodology delivers superior functionality and reliability. ISSS31C SSDs undergo the strictest quality controls to provide industrial systems with the best choice for reliability and rugged performance.

### 1.1 Functional Block

Figure 1-1 Functional Block



## 2.0 Mechanical Specifications

All product specifications not covered in this document (electrical performance, appearance, etc.) are in accordance with defined norms and standards.

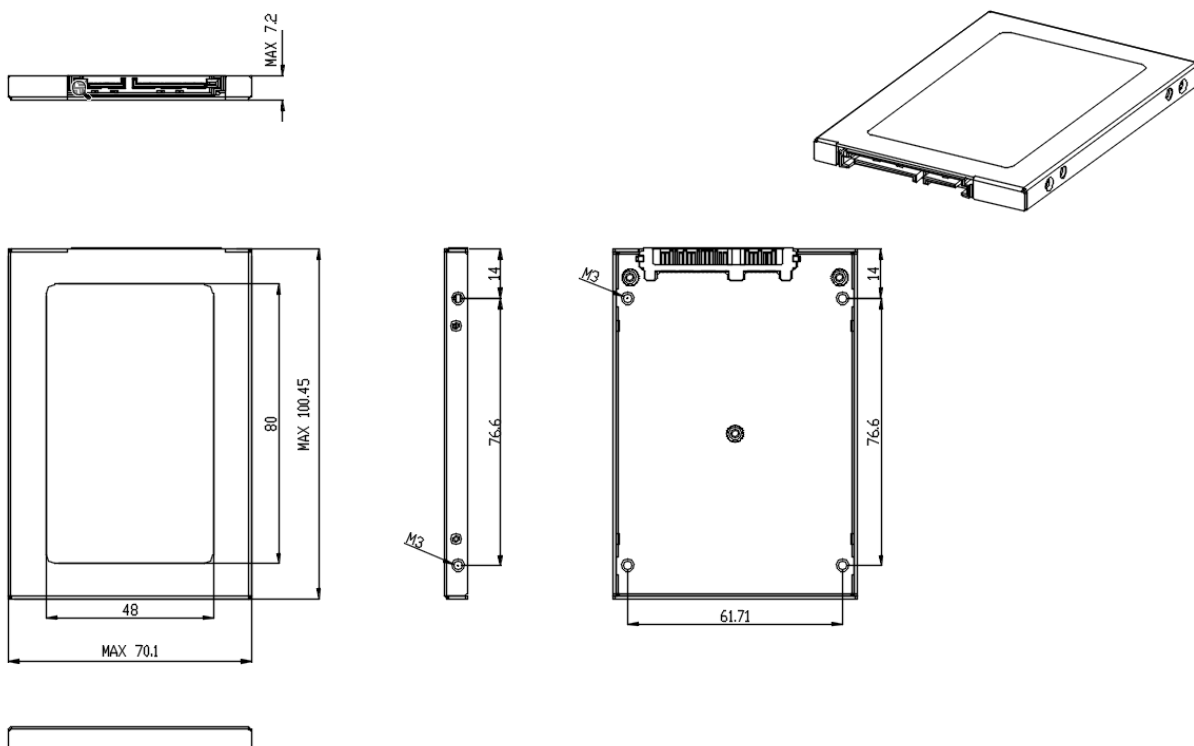
### 2.1 Physical Dimensions and Weights

Table 2-1 Dimensions and Weights

| Capacity(GB) | Length(mm)       | Width(mm)        | Height(mm)    | Weight(gram) |
|--------------|------------------|------------------|---------------|--------------|
| 128          | 100.25 $\pm$ 0.2 | 69.85 $\pm$ 0.25 | 7.0 $\pm$ 0.2 | 43 $\pm$ 5   |
| 256          | 100.25 $\pm$ 0.2 | 69.85 $\pm$ 0.25 | 7.0 $\pm$ 0.2 | 43 $\pm$ 5   |
| 512          | 100.25 $\pm$ 0.2 | 69.85 $\pm$ 0.25 | 7.0 $\pm$ 0.2 | 43 $\pm$ 5   |
| 1024         | 100.25 $\pm$ 0.2 | 69.85 $\pm$ 0.25 | 7.0 $\pm$ 0.2 | 43 $\pm$ 5   |
| 2048         | 100.25 $\pm$ 0.2 | 69.85 $\pm$ 0.25 | 7.0 $\pm$ 0.2 | 43 $\pm$ 5   |

### 2.2 Product Dimensions

Figure 2-1 Product Dimensions



## 3.0 Product Specifications

### 3.1 Interface and Configurations

- Compliant with Serial ATA International Organization: Serial ATA revision 3.1
- Compliant with SSD Alliance compliance program
- Support ATA-8 Command Set
- Support 1-port 1.5/3.0/6.0 Gbps SATA I/II/III interface

### 3.2 Capacity

Table 3-1 User Addressable Sectors

| Model                                     | ISSS31C     |             |               |               |               |
|---|-------------|-------------|---------------|---------------|---------------|
| Unformatted Capacity                      | 128GB       | 256GB       | 512GB         | 1TB           | 2TB           |
| Total User Addressable Sectors (LBA Mode) | 250,069,680 | 500,118,192 | 1,000,215,216 | 2,000,409,264 | 4,000,797,360 |

Total useable capacity may be less (due to formatting, flash management, and other functions).  
1GB=1,000,000,000 bytes; 1sector = 512bytes.

### 3.3 Performance

#### 3.3.1 ATTO Performance

Table 3-2 Read/Write Performance (ATTO)

|                  | 128GB | 256GB | 512GB | 1TB | 2TB | Unit |
|------------------|-------|-------|-------|-----|-----|------|
| Sequential Read  | 450   | 540   | 540   | 540 | 540 | MB/s |
| Sequential Write | 380   | 460   | 480   | 490 | 490 | MB/s |

-Seq. Read & Write speed test by ATTO

-The system conditions and test environment may affect test result

#### 3.3.2 CDM Performance

Table 3-3 Read/Write Performance (CDM)

|                      | 128GB | 256GB | 512GB | 1TB | 2TB | Unit |
|----------------------|-------|-------|-------|-----|-----|------|
| Sequential Q32 Read  | 460   | 560   | 560   | 560 | 560 | MB/s |
| Sequential Q32 Write | 390   | 470   | 490   | 500 | 500 | MB/s |

-Seq. Read & Write speed test by Crystal Disk Mark 5.1.2

### 3.3.3 IOPS Performance

Table 3-4 Read/Write IOPS Performance

|                        | 128GB | 256GB | 512GB | 1TB | 2TB | Unit |
|------------------------|-------|-------|-------|-----|-----|------|
| <b>4K Random Read</b>  | 35K   | 65K   | 85K   | 85K | 85K | IOPS |
| <b>4K Random Write</b> | 55K   | 60K   | 75K   | 75K | 75K | IOPS |

-Seq. Read & Write speed test by IOMeter 2010 with "00" pattern (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)

-IOPS Test Utility: IOMeter 2010 (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)

-Different system conditions and test environments may affect test results

### 3.3.4 AS-SSD Performance

Table 3-5 Read/Write Performance (AS-SSD)

|                         | 128GB | 256GB | 512GB | 1TB | 2TB | Unit |
|-------------------------|-------|-------|-------|-----|-----|------|
| <b>Sequential Read</b>  | 410   | 490   | 490   | 490 | 490 | MB/s |
| <b>Sequential Write</b> | 300   | 390   | 440   | 440 | 440 | MB/s |
| <b>4K-64 Thrd Read</b>  | 100   | 200   | 350   | 350 | 350 | MB/s |
| <b>4K-64 Thrd Write</b> | 80    | 170   | 310   | 310 | 310 | MB/s |

-Seq. Read & Write speed test by AS-SSD with Random pattern

## 3.4 Electrical Specifications

### 3.4.1 Operating Voltage

Table 3-6 Operating Voltage

| Operating Voltage               |               |
|---------------------------------|---------------|
| <b>Input Power</b>              | DC 5.0V ± 10% |
| <b>Maximum Allowable Ripple</b> | 100mV p-p     |

### 3.4.2 Power Consumption

Table 3-7 Power Consumption (Typical)

|                         | 128GB | 256GB | 512GB | 1TB  | 2TB  | Unit |
|-------------------------|-------|-------|-------|------|------|------|
| <b>Device Sleep</b>     | 5     | 5     | 5     | 5    | 5    | mW   |
| <b>Slumber</b>          | 0.04  | 0.05  | 0.06  | 0.07 | 0.07 | W    |
| <b>Idle</b>             | 0.5   | 0.6   | 0.6   | 0.6  | 0.6  | W    |
| <b>Sequential Read</b>  | 1.5   | 2.0   | 2.2   | 2.3  | 2.3  | W    |
| <b>Sequential Write</b> | 1.5   | 1.8   | 2.0   | 2.2  | 2.2  | W    |
| <b>Random Read</b>      | 1.4   | 1.9   | 1.9   | 2.0  | 2.0  | W    |
| <b>Random Write</b>     | 1.4   | 1.8   | 1.8   | 1.9  | 1.9  | W    |

- The typical value means to measure the power consumption by using IO Meter with 128KB Sequential and 4K Random read/write transfers within 15 minutes.

- The measurement may vary among different host systems and settings.



### 3.5 Environmental Conditions

Table 3-8 Temperature and Humidity

| Feature              | Operating                 | Non-Operating |
|----------------------|---------------------------|---------------|
| Standard Temperature | 0°C to 70°C               | -55°C to 95°C |
| Humidity             | 5%~95% RH, non-condensing |               |

### 3.6 Reliability

Table 3-9 Shock and Vibration

| Parameter | Conditions                                    | Reference Standards |
|-----------|---|---------------------|
| Shock     | 1500G, 3 axes, duration 0.5ms, Half Sine Wave | JESD22-B110         |
| Vibration | 20G , 3 axes , Peak, 20~2000Hz                | JESD22-B103         |

Table 3-10 MTBF

| Parameter | Conditions   | Hours     |
|-----------|--------------|-----------|
| MTBF      | MIL-HDBK-217 | 3,000,000 |

### 3.7 Endurance

SSD endurance can be predicted based on the operating workload. The table below shows the drive lifetime for each SSD capacity based JESD219 client workload.

Table 3-11 Terabytes Written

| Capacity | 128GB | 256GB | 512GB | 1TB  | 2TB  | Unit |
|----------|-------|-------|-------|------|------|------|
| TBW      | 270   | 540   | 1080  | 2160 | 4320 | TB   |

## 4.0 Support Command Sets

### 4.1 Identify Device Command

IDENTIFY DEVICE (ECh). These commands read out 512Bytes of drive parameter information. Parameter Information consists of the arrangement and value as shown in the following table. This command enables the host to receive the Identify Drive Information from the device.

Table 4-1 Identify Device Table

| Word  | Value | F/V/X | Description  |
|-------|-------|-------|--|
| 0     | 0040h | F     | General configuration bit-significant information:   |
|       | 0     |       | 15 0 = ATA device  |
|       | 0     |       | 14-8 Retired   |
|       | 1     |       | 7:6 Obsolete   |
|       | 0     |       | 5-3 Retired  |
|       | 0     |       | 2 Response incomplete  |
|       | 0     |       | 1 Retired  |
|       | 0     |       | 0 Reserved   |
| 1     | 3FFFh | X     | Obsolete   |
| 2     | C837h | V     | Specific configuration   |
| 3     | 0010h | X     | Obsolete   |
| 4-5   | XXXXh | X     | Retired  |
| 6     | 003Fh | X     | Obsolete   |
| 7-8   | XXXXh | V     | Reserved for the Compact Flash Association   |
| 9     | 0000h | X     | Retired  |
| 10-19 | XXXXh | F     | Serial number  |
| 20-21 | XXXXh | X     | Retired  |
| 22    | 0000h | X     | Obsolete   |
| 23-26 | XXXXh | F     | Firmware revision (8 ASCII characters)   |
| 27-46 | XXXXh | F     | Model number (40 ASCII characters)   |
| 47    | 8010h | F     | Capabilities   |
|       | 80    |       | 15-8 80h   |
|       | 10    |       | 07-00 00h = Reserved   |
|       |       |       | 01h-FFh = Maximum number of logical sectors that shall be transferred per DRQ data block on READ/WRITE MULTIPLE commands |
| 48    | 4000h | F     | Trusted Computing feature set options  |
|       | 0     |       | 15 Shall be cleared to zero  |
|       | 1     |       | 14 Shall be set to one   |
|       | 0000  |       | 13:1 Reserved for the Trusted Computing Group  |
|       | 0     |       | 0 1=Trusted Computing feature set is supported   |
| 49    | 2F00h | F     | Capabilities   |

|       |       |   |   |
|-------|-------|---|---|
|       | 0     |   | 15:14 Reserved for the IDENTIFY PACKET DEVICE command                   |
|       | 1     |   | 13 1 = Standby timer values as specified in this standard are supported |
|       |       |   | 0 = Standby timer values shall be managed by the device                 |
|       | 0     |   | 12 Reserved for the IDENTIFY PACKET DEVICE command                      |
|       | 1     |   | 11 1 = IORDY supported  |
|       |       |   | 0 = IORDY may be supported  |
|       | 1     |   | 10 1 = IORDY may be disabled  |
|       | 1     |   | 9 1 = LBA is supported  |
|       | 1     |   | 8 1 = DMA supported   |
|       | 00    |   | 7:2 Reserved  |
|       | 0     |   | 1:0 Current Long Physical Sector Alignment setting                      |
| 50    | 4001h | F | Capabilities  |
|       | 0     | F | 15 Shall be cleared to zero   |
|       | 1     | F | 14 Shall be set to one  |
|       | 000   | X | 13:02 Reserved  |
|       | 0     | X | 1 Obsolete  |
|       | 1     | F | 0 Vendor specific Standby timer value minimum                           |
| 51-52 | XXXXh | X | Obsolete  |
| 53    | 0006h |   | Field Validity  |
|       | 00    | F | 15:8 Free-fall Control Sensitivity                                      |
|       |       |   | 00h = Vendor's recommended setting                                      |
|       |       |   | 01h-FFh = Sensitivity level   |
|       | 00    | X | 7:3 Reserved  |
|       | 1     | F | 2 1 = Word 88 are valid   |
|       | 1     | F | 1 1 = Word 70:64 are valid  |
|       | 0     | F | 0 Obsolete  |
| 54-58 | XXXXh | X | Obsolete  |
| 59    | BD10h |   | Capabilities  |
|       | 1     | F | 15 1 = BLOCK ERASE EXT command is supported                             |
|       | 0     | F | 14 1 = OVERWRITE EXT command is supported                               |
|       | 1     | F | 13 1 = CRYPTO SCRAMBLE EXT command is supported                         |
|       | 1     | F | 12 1 = Sanitize feature set is supported                                |
|       | 6     | F | 11:9 Reserved   |
|       | 1     | V | 8 1 = Multiple logical sector setting is valid                          |
|       | 10    | V | 7:0 Current setting for number of logical sectors                       |
| 60-61 | XXXXh | F | Total number of user addressable logical sectors                        |
| 62    | 0000h | X | Obsolete  |
| 63    | 0007h |   | Multiword DMA transfer  |

|       |       |   |       |   |
|-------|-------|---|-------|---|
|       | 00    | F | 15:11 | Reserved  |
|       | 0     | V | 10    | 1 = Multiword DMA mode 2 is selected                                    |
|       | 0     | V | 9     | 1 = Multiword DMA mode 1 is selected                                    |
|       | 0     | V | 8     | 1 = Multiword DMA mode 0 is selected                                    |
|       | 00    | X | 7:3   | Reserved  |
|       | 1     | F | 2     | 1 = Multiword DMA mode 2 and below are supported                        |
|       | 1     | F | 1     | 1 = Multiword DMA mode 1 and below are supported                        |
|       | 1     | F | 0     | 1 = Multiword DMA mode 0 is supported                                   |
| 64    | 0003h |   |       | PIO transfer mode   |
|       | 0000  | F | 15:2  | Reserved  |
|       | 3     | F | 1:0   | PIO modes supported   |
| 65    | 0078h |   |       | Minimum Multiword DMA transfer cycle time per word                      |
|       |       | F | 15:0  | Cycle time in nanoseconds   |
| 66    | 0078h |   |       | Manufacturer's recommended Multiword DMA transfer cycle time            |
|       |       | F | 15:0  | Cycle time in nanoseconds   |
| 67    | 0078h |   |       | Minimum PIO transfer cycle time without flow control                    |
|       |       | F | 15:0  | Cycle time in nanoseconds   |
| 68    | 0078h |   |       | Minimum PIO transfer cycle time with IORDY flow control                 |
|       |       | F | 15:0  | Cycle time in nanoseconds   |
| 69    | 0D18h | X |       | Additional Supported  |
|       | 0     |   | 15    | 1 = CFAST Specification Support   |
|       | 0     |   | 14    | 1 = Deterministic data in trimmed LBA range(s) is supported             |
|       | 0     |   | 13    | 1 = Long Physical Sector Alignment Error Reporting Control is supported |
|       | 0     |   | 12    | Obsolete  |
|       | 1     |   | 11    | 1 = READ BUFFER DMA is supported  |
|       | 1     |   | 10    | 1 = WRITE BUFFER DMA is supported                                       |
|       | 0     |   | 9     | 1 = SET MAX SET PASSWORD DMA and SET MAX UNLOCK DMA are supported       |
|       | 1     |   | 8     | 1 = DOWNLOAD MICROCODE DMA is supported                                 |
|       | 0     |   | 7     | Reserved for IEEE 1667  |
|       | 0     |   | 6     | 0 = Optional ATA device 28-bit commands supported                       |
|       | 0     |   | 5     | 1 = Trimmed LBA range(s) returning zeroed data is supported             |
|       | 1     |   | 4     | 1 = Device Encrypts All User Data                                       |
|       | 1     |   | 3     | 1 = Extended Number of User Addressable Sectors is supported            |
|       | 0     |   | 2     | 1 = All write cache is non-volatile                                     |
|       | 0     |   | 1:0   | Reserved  |
| 70    | 0000h | F |       | Reserved  |
| 71-74 | XXXXh | F |       | Reserved for the IDENTIFY PACKET DEVICE command                         |

|    |       |   |  |
|----|-------|---|--|
| 75 | 001Fh |   | Queue depth  |
|    | 000   | F | 15:5 Reserved  |
|    | 1F    | F | 4:0 Maximum queue depth - 1  |
| 76 | 850Eh | X | Serial ATA Capabilities  |
|    | 1     |   | 15 1 = Supports READ LOG DMA EXT as equivalent to READ LOG EXT           |
|    | 0     |   | 14 1 = Supports Device Automatic Partial to Slumber transitions          |
|    | 0     |   | 13 1 = Supports Host Automatic Partial to Slumber transitions            |
|    | 0     |   | 12 1 = Supports NCQ priority information                                 |
|    | 0     |   | 11 1 = Supports Unload while NCQ commands are outstanding                |
|    | 1     |   | 10 1 = Supports the SATA Phy Event Counters log                          |
|    | 0     |   | 9 1 = Supports receipt of host initiated power management requests(HIPM) |
|    | 1     |   | 8 1 = Supports the NCQ feature set                                       |
|    | 0     |   | 7:4 Reserved for Serial ATA  |
|    | 1     |   | 3 1 = Supports SATA Gen3 Signaling Speed (6.0Gb/s)                       |
|    | 1     |   | 2 1 = Supports SATA Gen2 Signaling Speed (3.0Gb/s)                       |
|    | 1     |   | 1 1 = Supports SATA Gen1 Signaling Speed (1.5Gb/s)                       |
|    | 0     |   | 0 Shall be cleared to zero   |
| 77 | 0006h | X | Serial ATA Additional Capabilities                                       |
|    | 000   |   | 15:7 Reserved for Serial ATA   |
|    | 0     |   | 6 1 = Supports RECEIVE FPDMA QUEUED and SEND FPDMA QUEUED commands       |
|    | 0     |   | 5 1 = Supports NCQ Queue Management Command                              |
|    | 0     |   | 4 1 = Supports NCQ Streaming   |
|    | 3     |   | 3:1 Serial ATA signal speed (01:Gen1, 02:Gen2, 03:Gen3)                  |
|    | 0     |   | 0 Shall be cleared to zero   |
| 78 | 014Ch | X | Serial ATA features supported  |
|    | 0     | X | 15:9 Reserved for Serial ATA   |
|    | 1     | X | 8 1 = Device Sleep supported   |
|    | 0     | X | 7 1 = Device supports NCQ Autosense                                      |
|    | 1     | X | 6 1 = Device supports Software Settings Preservation                     |
|    | 0     | X | 5 Reserved for Serial ATA  |
|    | 0     | X | 4 1 = Device supports in-order data delivery                             |
|    | 1     | X | 3 1 = Device supports initiating power management(DIPM)                  |
|    | 1     | X | 2 1 = Device supports DMA Setup auto-activation                          |
|    | 0     | X | 1 1 = Device supports non-zero buffer offsets                            |
|    | 0     | F | 0 Shall be cleared to zero   |
| 79 | 0040h |   | Serial ATA features enabled  |

|    |       |   |   |
|----|-------|---|---|
|    | 00    |   | 15:9 Reserved for Serial ATA  |
|    | 0     |   | 8 1 = Device Sleep enabled  |
|    | 0     |   | 7 1 = Automatic Partial to Slumber transitions enabled                  |
|    | 1     |   | 6 1 = Software Settings Preservation enabled                            |
|    | 0     |   | 5 Reserved for Serial ATA   |
|    | 0     |   | 4 1 = In-order data delivery enabled                                    |
|    | 0     |   | 3 1 = Device initiated power management enabled(DIPM)                   |
|    | 0     |   | 2 1 = DMA Setup auto-activation enabled                                 |
|    | 0     |   | 1 1 = Non-zero buffer offsets enabled                                   |
|    | 0     |   | 0 Shall be cleared to zero  |
| 80 | 07F0h | X | Major version number<br>0000h or FFFFh = device does not report version |
|    | 00    |   | 15:11 Reserved  |
|    | 1     |   | 10 1 = supports ACS-3   |
|    | 1     |   | 9 1 = supports ACS-2  |
|    | 1     |   | 8 1 = supports ATA8-ACS   |
|    | 1     |   | 7 1 = supports ATA/ATAPI-7  |
|    | 1     |   | 6 1 = supports ATA/ATAPI-6  |
|    | 1     |   | 5 1 = supports ATA/ATAPI-5  |
|    | 8     |   | 4:1 Obsolete  |
|    | 0     |   | 0 Reserved  |
| 81 | 006Dh | V | Minor version number  |
| 82 | 706Bh | X | Commands and feature sets supported                                     |
|    | 0     |   | 15 Obsolete   |
|    | 1     |   | 14 1 = NOP command is supported   |
|    | 1     |   | 13 1 = READ BUFFER command is supported                                 |
|    | 1     |   | 12 1 = WRITE BUFFER command is supported                                |
|    | 0     |   | 11:10 Obsolete  |
|    | 0     |   | 9 1 = DEVICE RESET command is supported                                 |
|    | 0     |   | 8:7 Obsolete  |
|    | 1     |   | 6 1 = Read look-ahead is supported                                      |
|    | 1     |   | 5 1 = Volatile write cache is supported                                 |
|    | 0     |   | 4 1 = PACKET feature set is supported                                   |
|    | 1     |   | 3 1 = Power Management feature set is supported                         |
|    | 0     |   | 2 Obsolete  |
|    | 1     |   | 1 1 = Security feature set is supported                                 |
|    | 1     |   | 0 1 = SMART feature set is supported                                    |
| 83 | 7409h | X | Commands and feature sets supported                                     |

|    |       |   |   |
|----|-------|---|---|
|    | 0     |   | 15 Shall be cleared to zero   |
|    | 1     |   | 14 Shall be set to one  |
|    | 1     |   | 13 1 = FLUSH CACHE EXT command is supported                               |
|    | 1     |   | 12 1 = Mandatory FLUSH CACHE command is supported                         |
|    | 0     |   | 11 Obsolete   |
|    | 1     |   | 10 1 = 48-bit Address feature set is supported                            |
|    | 0     |   | 9:8 Obsolete  |
|    | 0     |   | 7 Reserved for the Address Offset Reserved Area Boot Method               |
|    | 0     |   | 6 1 = SET FEATURES subcommand is required to spin-up after power-up       |
|    | 0     |   | 5 1 = PUIS feature set is supported                                       |
|    | 0     |   | 4 Obsolete  |
|    | 1     |   | 3 1 = APM feature set is supported  |
|    | 0     |   | 2 1 = CFA feature set is supported  |
|    | 0     |   | 1 Obsolete  |
|    | 1     |   | 0 1 = DOWNLOAD MICROCODE command is supported                             |
| 84 | 4163h | X | Commands and feature sets supported                                       |
|    | 0     |   | 15 Shall be cleared to zero   |
|    | 1     |   | 14 Shall be set to one  |
|    | 0     |   | 13 IDLE IMMEDIATE command with UNLOAD feature is supported                |
|    | 0     |   | 12 Reserved for TLC   |
|    | 0     |   | 11 Reserved for TLC   |
|    | 0     |   | 10:9 Obsolete   |
|    | 1     |   | 8 1 = 64-bit world wide name is supported                                 |
|    | 0     |   | 7 Obsolete  |
|    | 1     |   | 6 1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported |
|    | 1     |   | 5 1 = GPL feature set is supported  |
|    | 0     |   | 4 1 = Streaming feature set is supported                                  |
|    | 0     |   | 3 Obsolete  |
|    | 0     |   | 2 1 = Media serial number is supported                                    |
|    | 1     |   | 1 1 = SMART self-test is supported  |
|    | 1     |   | 0 1 = SMART error logging is supported                                    |
| 85 | 7069h | X | Commands and feature sets supported or enabled                            |
|    | 0     |   | 15 Obsolete   |
|    | 1     |   | 14 1 = NOP command is supported   |
|    | 1     |   | 13 1 = READ BUFFER command is supported                                   |
|    | 1     |   | 12 1 = WRITE BUFFER command is supported                                  |
|    | 0     |   | 11:10 Obsolete  |

|    |       |   |   |
|----|-------|---|---|
|    | 0     |   | 9 1 = DEVICE RESET command is supported                                   |
|    | 0     |   | 8 1 = SERVICE interrupt is enabled  |
|    | 0     |   | 7 1 = Release interrupt is enabled  |
|    | 1     |   | 6 1 = Read look-ahead is enabled  |
|    | 1     |   | 5 1 = Volatile write cache is enabled                                     |
|    | 0     |   | 4 1 = PACKET feature set is supported                                     |
|    | 1     |   | 3 1 = Mandatory Power Management feature set is supported                 |
|    | 0     |   | 2 Obsolete  |
|    | 0     |   | 1 1 = Security feature set is enabled                                     |
|    | 1     |   | 0 1 = SMART feature set is enabled  |
| 86 | B409h | X | Commands and feature sets supported or enabled                            |
|    | 1     |   | 15 1 = Words 119-120 are valid  |
|    | 0     |   | 14 Reserved   |
|    | 1     |   | 13 1 = FLUSH CACHE EXT command supported                                  |
|    | 1     |   | 12 1 = FLUSH CACHE command supported                                      |
|    | 0     |   | 11 Obsolete   |
|    | 1     |   | 10 1 = 48-bit Address features set is supported                           |
|    | 0     |   | 9:8 Obsolete  |
|    | 0     |   | 7 1 = Reserved for Address Offset Reserved Area Boot Method               |
|    | 0     |   | 6 1 = SET FEATURES subcommand is required to spin-up after power-up       |
|    | 0     |   | 5 1 = PUIS feature set is enabled   |
|    | 0     |   | 4 Obsolete  |
|    | 1     |   | 3 1 = APM feature set is enabled  |
|    | 0     |   | 2 1 = CFA feature set is supported  |
|    | 0     |   | 1 Obsolete  |
|    | 1     |   | 0 1 = DOWNLOAD MICROCODE command is supported                             |
| 87 | 4163h | X | Commands and feature sets supported or enabled                            |
|    | 0     |   | 15 Shall be cleared to zero   |
|    | 1     |   | 14 Shall be set to one  |
|    | 0     |   | 13 1 = IDLE IMMEDIATE command with UNLOAD FEATURE is supported            |
|    | 0     |   | 12 Reserved for TLC   |
|    | 0     |   | 11 Reserved for TLC   |
|    | 0     |   | 10:9 Obsolete   |
|    | 1     |   | 8 1 = 64-bit world wide name is supported                                 |
|    | 0     |   | 7 Obsolete  |
|    | 1     |   | 6 1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported |



|    |       |   |  |
|----|-------|---|--|
|    | 1     |   | 5 1 = GPL feature set is supported                   |
|    | 0     |   | 4:3 Obsolete   |
|    | 0     |   | 2 1 = Media serial number is valid                   |
|    | 1     |   | 1 1 = SMART self-test supported                      |
|    | 1     |   | 0 1 = SMART error logging is supported               |
| 88 | 407Fh | X | Ultra DMA modes                                      |
|    | 0     |   | 15 Reserved  |
|    | 1     |   | 14 1 = Ultra DMA mode 6 is selected                  |
|    | 0     |   | 13 1 = Ultra DMA mode 5 is selected                  |
|    | 0     |   | 12 1 = Ultra DMA mode 4 is selected                  |
|    | 0     |   | 11 1 = Ultra DMA mode 3 is selected                  |
|    | 0     |   | 10 1 = Ultra DMA mode 2 is selected                  |
|    | 0     |   | 9 1 = Ultra DMA mode 1 is selected                   |
|    | 0     |   | 8 1 = Ultra DMA mode 0 is selected                   |
|    | 0     |   | 7 Reserved   |
|    | 1     |   | 6 1 = Ultra DMA mode 6 and below are supported       |
|    | 1     | F | 5 1 = Ultra DMA mode 5 and below are supported       |
|    | 1     | F | 4 1 = Ultra DMA mode 4 and below are supported       |
|    | 1     | F | 3 1 = Ultra DMA mode 3 and below are supported       |
|    | 1     | F | 2 1 = Ultra DMA mode 2 and below are supported       |
|    | 1     | F | 1 1 = Ultra DMA mode 1 and below are supported       |
|    | 1     | F | 0 1 = Ultra DMA mode 0 is supported                  |
| 89 | 0001h | F | Time required for security erase unit completion     |
|    | 0     |   | 15 1 = Extended Time is reported in bits 14:0        |
|    |       |   | 0 = Extended Time is reported in bits 7:0            |
|    | 00    |   | 14:8 Extended Time required for Normal Erase mode    |
|    | 01    |   | 7:0 Extended Time required for Normal Erase mode     |
| 90 | 0001h | F | Time required for Enhanced security erase completion |
|    | 0     |   | 15 1 = Extended Time is reported in bits 14:0        |
|    |       |   | 0 = Extended Time is reported in bits 7:0            |
|    | 00    |   | 14:8 Extended Time required for Enhanced Erase mode  |
|    | 01    |   | 7:0 Extended Time required for Enhanced Erase mode   |
| 91 | 00FEh | V | Advanced Power Management Level                      |
|    | 00    |   | 15:8 Reserved  |
|    | FE    |   | 7:0 Current APM level value                          |
| 92 | FFFEh | V | Master Password Identifier                           |
| 93 | 0000h | X | Hardware reset result                                |
|    | 0     |   | 15 Shall be cleared to zero                          |

|         |       |   |   |
|---------|-------|---|---|
|         | 0     |   | 14 Shall be set to one  |
|         | 0     |   | 13 1 = device detected the CBLID- above<br>0 = device detected the CBLID- below |
|         | 00    |   | 12:8 Device 1 hardware reset result   |
|         | 00    |   | 7:0 Device 0 hardware reset result  |
| 94      | 0000h | V | Obsolete  |
| 95      | 0000h | V | Stream Minimum Request Size   |
| 96      | 0000h | V | Streaming Transfer Time - DMA   |
| 97      | 0000h | V | Streaming Access Latency - DMA and PIO  |
| 98-99   | XXXXh | V | Streaming Performance Granularity   |
| 100-103 | XXXXh | V | Number of User Addressable Logical Sectors                                      |
| 104     | 0000h | V | Streaming Transfer Time - PIO   |
| 105     | 0008h | V | Maximum number of 512-byte blocks per DATA SET MANAGEMENT command               |
| 106     | 4000h |   | Physical sector size / logical sector size                                      |
|         | 0     |   | 15 Shall be cleared to zero   |
|         | 1     |   | 14 Shall be set to one  |
|         | 0     |   | 13 1 = Device has multiple logical sectors per physical sector                  |
|         | 0     |   | 12 1 = Device Logical Sector longer than 256 Words                              |
|         | 00    |   | 11:4 Reserved   |
|         | 0     |   | 3:0 2^logical sectors per physical sector                                       |
| 107     | 0000h |   | Inter-seek delay for ISO 7779 standard acoustic testing                         |
| 108-111 | XXXXh | V | World wide name   |
| 112-115 | XXXXh | X | Reserved  |
| 116     | 0000h | X | Reserved for TLC  |
| 117-118 | XXXXh | X | Logical sector size   |
| 119     | 411C  |   | Commands and feature sets supported   |
|         | 0     |   | 15 Shall be cleared to zero   |
|         | 1     |   | 14 Shall be set to one  |
|         | 01    |   | 13:8 Reserved   |
|         | 0     |   | 7 1 = Extended Power Conditions feature set is supported                        |
|         | 0     |   | 6 1 = Sense Data Reporting feature set is supported                             |
|         | 0     |   | 5 1 = Free-fall Control feature set is supported                                |
|         | 1     |   | 4 1 = Download Microcode mode 3 is supported                                    |
|         | 1     |   | 3 1 = READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported             |
|         | 1     |   | 2 1 = WRITE UNCORRECTABLE EXT command is supported                              |
|         | 0     |   | 1 1 = Write-Read-Verify feature set is supported                                |
|         | 0     |   | 0 Reserved for DDT  |

|         |       |                          |  |
|---------|-------|--------------------------|--|
| 120     | 401C  |                          | Commands and feature sets supported or enabled                                     |
|         | 0     |                          | 15 Shall be cleared to zero  |
|         | 1     |                          | 14 Shall be set to one   |
|         | 00    |                          | 13:8 Reserved  |
|         | 0     |                          | 7 1 = Extended Power Conditions feature set is enabled                             |
|         | 0     |                          | 6 1 = Sense Data Reporting feature set is enabled                                  |
|         | 0     |                          | 5 1 = Free-fall Control feature set is enabled                                     |
|         | 1     |                          | 4 1 = Download Microcode mode 3 is supported                                       |
|         | 1     |                          | 3 1 = READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported                |
|         | 1     |                          | 2 1 = WRITE UNCORRECTABLE EXT command is supported                                 |
|         | 0     |                          | 1 1 = Write-Read-Verify feature set is enabled                                     |
|         | 0     |                          | 0 Reserved for DDT   |
| 121-126 | XXXXh | X                        | Reserved for expanded supported and enabled settings                               |
| 127     | 0000h | F                        | Obsolete   |
| 128     | 0021h | V                        | Security status  |
|         | 00    |                          | 15-9 Reserved  |
|         | 0     |                          | 8 Master Password Capability: 0 = High, 1 = Maximum                                |
|         | 0     |                          | 7-6 Reserved   |
|         | 1     |                          | 5 1 = Enhanced security erase supported  |
|         | 0     |                          | 4 1 = Security count expired   |
|         | 0     |                          | 3 1 = Security frozen  |
|         | 0     |                          | 2 1 = Security locked  |
|         | 0     |                          | 1 1 = Security enabled   |
| 1       |       | 0 1 = Security supported |  |
| 129-159 | XXXXh | X                        | Vendor specific  |
| 160     | 0000h | X                        | CFA power mode   |
|         | 0     |                          | 15 Word 160 supported  |
|         | 0     |                          | 14 Reserved  |
|         | 0     |                          | 13 CFA power mode 1 is required for one or more commands implemented by the device |
|         | 0     |                          | 12 CFA power mode 1 disabled   |
|         | 000   |                          | 11:0 Maximum current in mA   |
| 161-167 | XXXXh | X                        | Reserved for the CompactFlash Association  |
| 168     | 0003h |                          | Device Nominal Form Factor   |
|         | 000   |                          | 15:4 Reserved  |
|         | 3     |                          | 3:0 Device Nominal Form Factor   |
| 169     | 0001  |                          | DATA SET MANAGEMENT command is supported   |

|         |       |   |  |
|---------|-------|---|--|
|         | 0000  |   | 15:1 Reserved  |
|         | 1     |   | 0 1 = Trim bit in the DATA SET MANAGEMENT command is supported                                       |
| 170-173 | XXXXh | X | Additional Product Identifier  |
| 174-175 | XXXXh | X | Reserved   |
| 176-205 | XXXXh | V | Current media serial number  |
| 206     | 0031h | X | SCT Command Transport  |
|         | 0     |   | 15:12 Vendor Specific  |
|         | 0     |   | 11:8 Reserved  |
|         | 0     |   | 7 Reserved for Serial ATA  |
|         | 0     |   | 6 Reserved   |
|         | 1     |   | 5 1 = SCT Data Tables command is supported   |
|         | 1     |   | 4 1 = SCT Feature Control command is supported   |
|         | 0     |   | 3 1 = SCT Error Recovery Control command is supported  |
|         | 0     |   | 2 1 = SCT Write Same command is supported  |
|         | 0     |   | 1 Obsolete   |
|         | 1     |   | 0 1 = SCT Command Transport is supported   |
| 207-208 | XXXXh | X | Reserved   |
| 209     | 4000h |   | Alignment of logical blocks within a physical block  |
|         | 0     |   | 15 Shall be cleared to zero  |
|         | 1     |   | 14 Shall be set to one   |
|         | 0000  |   | 13:0 Logical sector offset within the first physical sector where the first logical sector is placed |
| 210-211 | XXXXh | V | Write-Read-Verify Sector Count Mode 3  |
| 212-213 | XXXXh | V | Write-Read-Verify Sector Count Mode 2  |
| 214-216 | XXXXh | X | Obsolete   |
| 217     | 0001h | V | Nominal media rotation rate  |
| 220     | 0000h | V | Write-Read-Verify feature  |
|         | 00    |   | 15:8 Reserved  |
|         | 00    |   | 7:0 Write-Read-Verify feature set current mode   |
| 221     | 0000h | X | Reserved   |
| 222     | 11FFh | X | Transport major version number   |
|         | 1     |   | 15:12 Transport Type ( 0:Parallel, 1:Serial, 2-F:Reserved )  |
|         | 07    |   | 11:6 Parallel = Reserved / Serial = Reserved   |
|         | 1     |   | 5 Parallel = Reserved / Serial = SATA Rev 3.0  |
|         | 1     |   | 4 Parallel = Reserved / Serial = SATA Rev 2.6  |
|         | 1     |   | 3 Parallel = Reserved / Serial = SATA Rev 2.5  |
|         | 1     |   | 2 Parallel = Reserved / Serial = SATA II Extensions  |
|         | 1     |   | 1 Parallel = ATA/ATAPI-7 / Serial = SATA 1.0a  |

|         | 1     |   | 0 Parallel = ATA8-APT / Serial = ATA8-AST  |
|---------|-------|---|--|
| 223     | 0000h | X | Transport minor version number   |
| 224-229 | XXXXh | X | Reserved   |
| 230-233 | XXXXh | X | Extended Number of User Addressable Sectors                                      |
| 234     | 0001h | X | Minimum number of 512-byte data blocks per Download Microcode mode 03h operation |
| 235     | 0200h | X | Maximum number of 512-byte data blocks per Download Microcode mode 03h operation |
| 236-254 | XXXXh | X | Reserved   |
| 255     | XXXXh | X | Integrity word   |
|         | XX    |   | 15-8 Checksum  |
|         | XX    |   | 7-0 Checksum Validity Indicator  |

**Notes:**

F/V = Fixed/variable content.

F = the content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

V = the contents of the word is variable and may change depending on the state of the device or the commands executed by the device.

X = the content of the word may be fixed or variable.

## 4.2 S.M.A.R.T. Attribute

The following table defines the vendor specific data in byte 2 to 361 of the 512-byte SMART data.

Table 4-2 S.M.A.R.T. Attribute

| ID (Dec) | ID (Hex) | Attribute Name                     |
|----------|----------|------------------------------------|
| 1        | 01h      | Read Error Rate                    |
| 5        | 05h      | Reallocated Sectors Count          |
| 9        | 09h      | Power-On Hours Count               |
| 12       | 0Ch      | Power Cycle Count                  |
| 160      | A0h      | Uncorrectable Sector Count On Line |
| 161      | A1h      | Number of Pure Spare               |
| 163      | A3h      | Number of Initial Invalid Block    |
| 148      | 94h      | SLC Total Erase Count              |
| 149      | 95h      | SLC Max Erase Count                |
| 150      | 96h      | SLC Min Erase Count                |
| 151      | 97h      | SLC Average Erase Count            |
| 164      | A4h      | TLC Total Erase Count              |
| 165      | A5h      | TLC Max Erase Count                |
| 166      | A6h      | TLC Min Erase Count                |
| 167      | A7h      | TLC Average Erase Count            |
| 159      | 9Fh      | DRAM 1 bit ECC Count               |
| 168      | A8h      | Max Erase Count in Spec            |
| 169      | A9h      | Remain Life Percentage             |
| 177      | B1h      | Wear Leveling Count                |
| 181      | B5h      | Program Fail Count                 |
| 182      | B6h      | Erase Fail Count                   |
| 192      | C0h      | Power off Retract Count            |
| 194      | C2h      | Temperature                        |
| 195      | C3h      | Hardware ECC Recovered             |
| 196      | C4h      | Reallocation Event Count           |
| 199      | C7h      | UltraDMA CRC Error Count           |
| 232      | E8h      | Available Reserved Space           |
| 241      | F1h      | Write Sector Count                 |
| 242      | F2h      | Read Sector Count                  |
| 245      | F5h      | Flash Write count                  |

## 5.0 Pin Assignment and Descriptions

Table 5-1 Pin assignment and descriptions

|         |     |        |  |
|---------|-----|--------|--|
| Signals | S1  | GND    | System Ground                                |
|         | S2  | Rx+    | Differential signals pair receive            |
|         | S3  | Rx-    |  |
|         | S4  | GND    | System Ground                                |
|         | S5  | Tx-    | Differential signals pair transmit           |
|         | S6  | Tx+    |  |
|         | S7  | GND    | System Ground                                |
| Power   | P1  | V33    | NC   |
|         | P2  | V33    | NC   |
|         | P3  | DEVSLP | Device Sleep Signal Pin                      |
|         | P4  | GND    | System Ground                                |
|         | P5  | GND    | System Ground                                |
|         | P6  | GND    | System Ground                                |
|         | P7  | V5/PC  | +5V Power supply, 2 <sup>nd</sup> Pre-charge |
|         | P8  | V5     | +5V Power supply                             |
|         | P9  | V5     | +5V Power supply                             |
|         | P10 | GND    | System Ground                                |
|         | P11 | DAS    | Device Activity Signal                       |
|         | P12 | GND    | System Ground                                |
|         | P13 | V12/PC | NC   |
|         | P14 | V12    | NC   |
|         | P15 | V12    | NC   |

## 6.0 Ordering Information

Table 6-1 Ordering Information

| Model Name       | Capacity | P/E cycles | Type     | Remark     |
|------------------|----------|------------|----------|------------|
| ISSS31C-128GCTB5 | 128GB    | 3K         | 2.5 SATA | 0°C ~ 70°C |
| ISSS31C-256GCTB5 | 256GB    | 3K         | 2.5 SATA |            |
| ISSS31C-512GCTB5 | 512GB    | 3K         | 2.5 SATA |            |
| ISSS31C-001TCTB5 | 1TB      | 3K         | 2.5 SATA |            |
| ISSS31C-002TCTB5 | 2TB      | 3K         | 2.5 SATA |            |

## 7.0 Package Specification

Figure 7-1 Package Specification

