

FORESEE SATAIII M.2 2280 SSD S40R Datasheet

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2019.09

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Revision History

| Revision Number | Description | Revision Date |
|------------------------|---------------------|----------------------|
| A4 | Update performance. | 2019.10 |
| A3 | Add 64GB capacity. | 2019.09 |
| A2 | Update endurance. | 2019.07 |
| A1 | Update PN. | 2018.04 |
| A0 | Initial release. | 2017.12 |

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1. General Description

The FORESEE SSD (Solid State Drive) fully consists of semiconductor devices using NAND Flash Memory which provide high reliability and high performance for a storage media. The SSD doesn't have any moving parts such as platter (disk) and head media, which provides a better solution in a notebook PC, Tablet PC and industrial PC for a storage device providing higher performance, reduced latencies, and a low power consumption in a small form factor. SSD has the same host interface with Hard Disk Drives and has a same physical dimension.

●Capacity

- 64/128/256GB is available

●Form Factor

- M.2 2280

●Host interface

- Serial ATA interface of 6.0Gbps
- Complies with ATA/ATAPI-8
- Supports NCQ
- Supports TRIM

●Performance

- 64GB
- Read: Up to 540MB/s
- Write: Up to 285MB/s
- 128GB
- Read: Up to 550MB/s
- Write: Up to 450MB/s
- 256GB
- Read: Up to 550MB/s
- Write: Up to 470MB/s

●Power Consumption

- Active write: 1089mW (256GB)
- Active read: 1056mW (256GB)

●Temperature

- Operating : 0°C to 70°C

●Shock

- Shock : 1500G, duration 0.5ms, Half Sine Wave
- Vibration : 7~800Hz, 3.08Grms, 30min/axis(X,Y,Z)
- * Applicable only for cased product

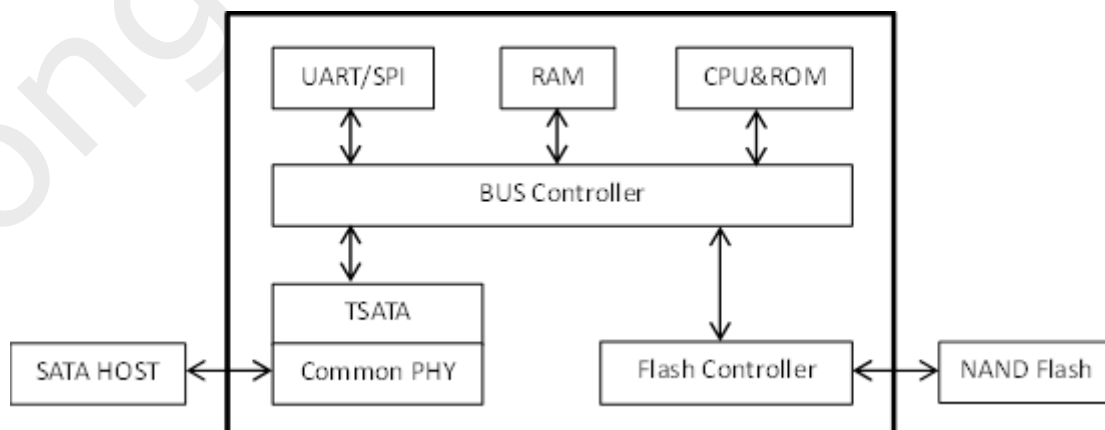
●MTBF

- 1,500,000 Hours

●Weight

- 64/128/256GB
- Max 9g

●SSD Functional Block Diagram

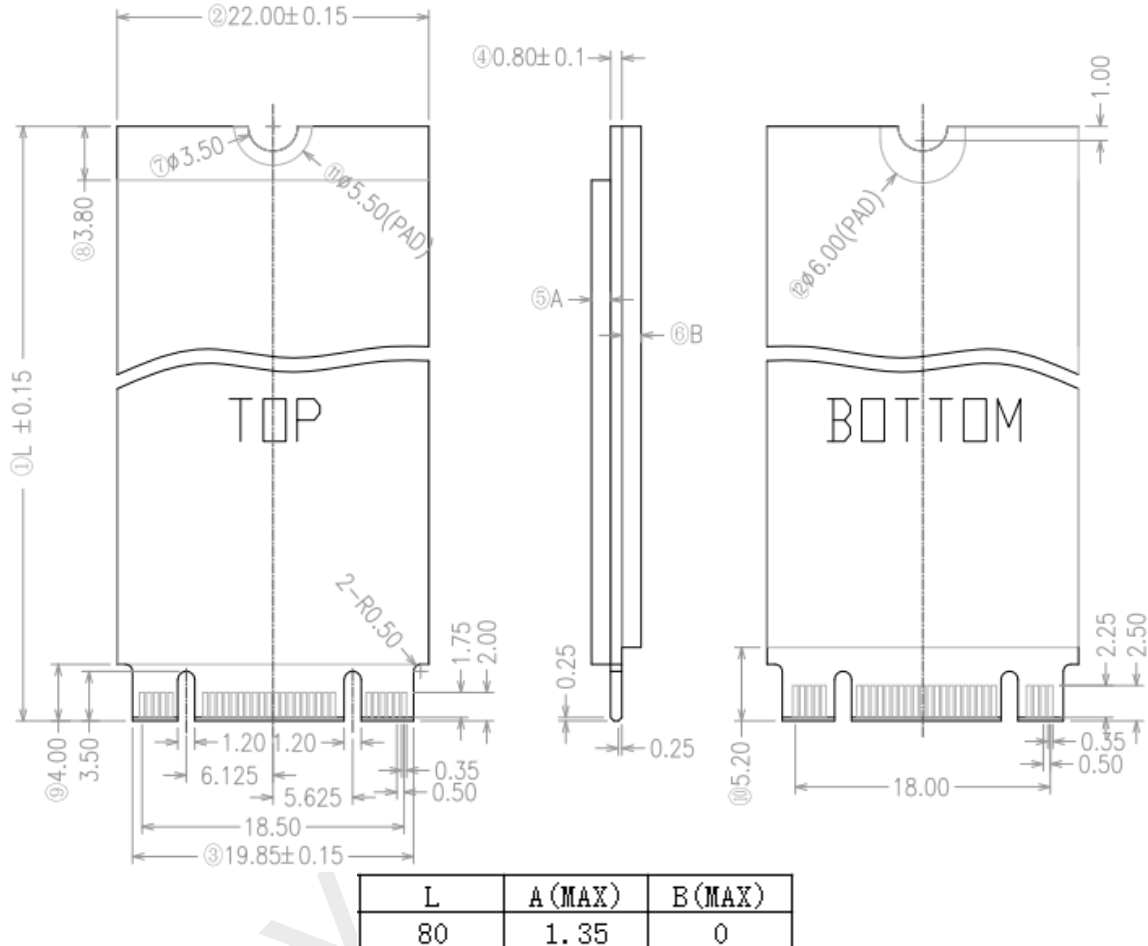


[Figure 1-1] SSD Functional Block Diagram

2. Mechanical Specification

2.1 M.2 2280 SSD physical dimensions and Weight

| Capacity(GB) | Height (mm) | Width (mm) | Length (mm) | Weight (gram) |
|--------------|-------------|------------|-------------|---------------|
| 64/128/256 | MAX 2.25 | 22.00±0.15 | 80.00±0.15 | MAX 9g |



[Figure 2-1] M.2 2280 Physical dimension

3. Product Specifications

3.1 System Interface and Configuration

Burst read/write rate is 600 MB/sec (6.0 Gb/sec).

3.2 System Performance

| SATA 6Gb/s host interface | | | | |
|-------------------------------|------|-------|-------|-------|
| Parameter | Unit | 64GB | 128GB | 256GB |
| Sequential Read (Max) | MB/S | 540 | 550 | 550 |
| Sequential Write (Max) | MB/S | 285 | 450 | 470 |
| Random Read (4K) QD=32 (Max) | IOPS | 28000 | 38400 | 38400 |
| Random Write (4K) QD=32 (Max) | IOPS | 51000 | 51200 | 51200 |

* Actual performance may vary depending on use conditions and environment

* Note

1. Performance measured using CrystalDiskMark 5.1.0 x64
2. Write cache enabled
3. 1MB/sec = 1,048,576 bytes/sec was used in sequential performance
 - System: Intel Z170 Chipset, Intel Core i5-6600K@3.5GHz, 4GB DDR4
 - OS: Windows 7 x64

3.3 Drive Capacity

| Nominal Capacity | 64GB | 128GB | 256GB |
|--------------------------|-----------|-----------|-----------|
| Unformatted Capacity | 59.63GB | 119.24GB | 238.47GB |
| User-Addressable Sectors | 125045424 | 250069680 | 500118192 |
| Bytes per Sector | 512 Bytes | | |

NOTE:

1 Megabyte (MB) = 1 Million bytes; 1 Gigabyte (GB) = 1 Billion bytes

*Actual usable capacity may be less (due to formatting, partitioning, operating system, applications or otherwise)

3.4 Supply Voltage

| Item | Requirements |
|------------------------|-------------------|
| Allowable voltage | 3.3V ± 5% |
| Allowable noise/ripple | 100mV p-p or less |

3.5 System Power Consumption

| Input Voltage 3.3V±5% | | | |
|-----------------------|--------|---------|---------|
| Parameter | 64GB | 128GB | 256GB |
| Sequential Read | 850 mW | 1023 mW | 1056 mW |
| Sequential Write | 800 mW | 1056 mW | 1089 mW |
| Random Read | 600 mW | 627 mW | 990 mW |
| Random Write | 610 mW | 627 mW | 627 mW |
| Idle | 320 mW | 330 mW | 330 mW |
| Devslp | 3.3 mW | 7.6 mW | 7.6 mW |

CPU : Intel Core i5-6600K
 DRAM : 4GB DDR4
 Chipset : Intel Z170
 OS : Windows 7 x64
 Test Tool : IO Meter 2006

3.6 System Reliability

| | |
|-------------|-----------------|
| MTBF | 1,500,000 Hours |
|-------------|-----------------|

MTBF is Mean Time Between Failure. As same word, annual failure ratio is 0.4%.

3.7 Endurance

| TBW | | |
|------|-------|-------|
| 64GB | 128GB | 256GB |
| 96TB | 192TB | 384TB |

Notes:

1-TBW (Terabytes Written) is a measurement of SSDs’ expected lifespan, which represents the amount of data written to the device. To calculate the TBW of a SSD, the following equation is applied:

$$TBW = [(NAND\ Endurance) \times (SSD\ Capacity)] / WAF$$

NAND Endurance: NAND endurance refers to the P/E (Program/Erase) cycle of a NAND flash.

SSD Capacity: The SSD capacity is the specific capacity in total of a SSD.

WAF: Write Amplification Factor (WAF) is a numerical value representing the ratio between the amount of data that a SSD controller needs to write and the amount of data that the host’s flash controller writes. A better WAF, which is near 1, guarantees better endurance and lower frequency of data written to flash memory.

2-The above TBW values are calculated based on WAF=1.

3-TBW may differ according to flash configuration and platform.

4-The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

3.8 Environmental Specifications

| Features | Operating | Non-Operating |
|-------------|---------------------------------------|---------------|
| Temperature | 0°C to 70°C | -40°C to 85°C |
| Humidity | 5% to 95%, non-condensing | |
| Vibration | 7~800Hz, 3.08Grms, 30min/axis(X,Y,Z) | |
| Shock | 1500G, duration 0.5ms, Half Sine Wave | |

Notes:

1-Temperature is measured by SMART Temperature .Proper airflow recommended.

2-Humidity is measured in non-condensing.

3-Test condition for shock: 0.5ms duration with half sine wave.

4-Test condition for vibration: 10Hz to 2,000Hz, 15mins/axis on 3axis.

4. Electrical Interface Specification

4.1 M.2 2280 Pin Assignments

| Pin # | Type | Description | Pin # | Type | Description |
|-------|------------|---|-------|------------|--|
| 1 | GND | Ground | 2 | 3.3V | Supply pin, 3.3V +/- 5% @ 0.5 Amps |
| 3 | GND | Ground | 4 | 3.3V | Supply pin, 3.3V +/- 5% @ 0.5 Amps |
| 5 | GND | Ground | 6 | no connect | |
| 7 | no connect | | 8 | no connect | |
| 9 | no connect | | 10 | DAS/DSS | Device Activity / Disable Staggered Spin-up |
| 11 | no connect | | 12 | no connect | |
| 13 | no connect | | 14 | no connect | |
| 15 | no connect | | 16 | no connect | |
| 17 | no connect | | 18 | no connect | |
| 19 | no connect | | 20 | no connect | |
| 21 | no connect | | 22 | no connect | |
| 23 | no connect | | 24 | no connect | |
| 25 | no connect | | 26 | no connect | |
| 27 | GND | Ground | 28 | no connect | |
| 29 | no connect | | 30 | no connect | |
| 31 | no connect | | 32 | no connect | |
| 33 | GND | Ground | 34 | no connect | |
| 35 | no connect | | 36 | no connect | |
| 37 | no connect | | 38 | DEVSLP | 0 / 1.8V DEVSLP(device sleep mode) enable. |
| 39 | GND | Ground | 40 | no connect | |
| 41 | SATA-B+ | Host receiver differential signal pair | 42 | no connect | |

| | | | | | |
|----|------------|---|----|------------|---------------------------------------|
| 43 | SATA-B- | Host receiver differential signal pair | 44 | no connect | |
| 45 | GND | | 46 | no connect | |
| 47 | SATA-A- | Host transmitter differential signal pair | 48 | no connect | |
| 49 | SATA-A+ | Host transmitter differential signal pair | 50 | no connect | |
| 51 | GND | Ground | 52 | no connect | |
| 53 | no connect | | 54 | no connect | |
| 55 | no connect | | 56 | no connect | |
| 57 | GND | Ground | 58 | no connect | |
| 59 | no connect | | 60 | no connect | |
| 61 | no connect | | 62 | no connect | |
| 63 | no connect | | 64 | no connect | |
| 65 | no connect | | 66 | no connect | |
| 67 | no connect | | 68 | no connect | |
| 69 | GND | Ground | 70 | 3.3V | Supply pin, 3.3V +/- 5% @ 0.5 Amps |
| 71 | GND | Ground | 72 | 3.3V | Supply pin, 3.3V +/- 5% @ 0.5 Amps |
| 73 | GND | Ground | 74 | 3.3V | Supply pin, 3.3V +/- 5% @ 0.5 Amps |
| 75 | GND | Ground | | | |

Table 4-1: M.2 2280 Connector Pin Assignment

5. Command Descriptions

5.1 Supported ATA Commands

| Command | Code | Protocol |
|--|------------|---------------------------|
| General Feature Set | | |
| Execute Device Diagnostic | 90h | Execute device diagnostic |
| Flush Cache | E7h | Non-data |
| Identify Device | ECh | PIO data-in |
| Initialize Drive Parameters | 91h | Non-data |
| Read DMA | C8h | DMA |
| Read Multiple | C4h | PIO data-in |
| Read Sector(s) | 20h | PIO data-in |
| Read Verify Sector(s) | 40h or 41h | Non-data |
| Set Feature | EFh | Non-data |
| Set Multiple Mode | C6h | Non-data |
| Write DMA | CAh | DMA |
| Write Multiple | C5h | PIO data-out |
| Write Sector(s) | 30h | PIO data-out |
| NOP | 00h | Non-data |
| Read Buffer | E4h | PIO data-in |
| Write Buffer | E8h | PIO data-out |
| Power Management Feature Set | | |
| Check Power Mode | E5h or 98h | Non-data |
| Idle | E3h or 97h | Non-data |
| Idle Immediate | E1h or 95h | Non-data |
| Sleep | E6h or 99h | Non-data |
| Standby | E2h or 96h | Non-data |
| Standby Immediate | E0h or 94h | Non-data |
| SMART Feature Set | | |
| SMART Read Data | B0h | PIO data-in |
| SMART Read Threshold | B0h | PIO data-in |
| Host Protected Area Feature Set | | |
| Read Native Max Address | F8h | Non-data |
| 48-bit Address Feature Set | | |
| Flush Cache Ext | EAh | Non-data |
| Read Sector(s) Ext | 24h | PIO data-in |
| Read DMA Ext | 25h | DMA |
| Read Multiple Ext | 29h | PIO data-in |
| Read Native Max Address Ext | 27h | Non-data |
| Read Verify Sector(s) Ext | 42h | Non-data |
| Write DMA Ext | 35h | DMA |
| Write Multiple Ext | 39h | PIO data-out |
| Write Sector(s) Ext | 34h | PIO data-out |
| NCQ Feature Set | | |

| | | |
|---------------------|-----|------------|
| Read FPDMA Queued | 60h | DMA Queued |
| Write FPDMA Queued | 61h | DMA Queued |
| Others | | |
| Data Set Management | 06h | DMA |
| Seek | 70h | Non-data |

5.2 SMART Attributes

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

SMART Data Vendor-specific Attributes

| Attribute ID (hex) | Attribute Name |
|---------------------------|--|
| 05 | Number of New Bad Block |
| 09 | Power On Hours |
| 0C | Power Cycle Count |
| A1 | Reserved |
| A4 | Total Erase Count |
| A5 | Max Erase Count |
| A6 | Min Erase Count |
| A7 | Average Erase Count |
| C0 | Power off Retract Count |
| C2 | Controlled temperature |
| C3 | Reserved |
| B0 | Reserved |
| B1 | Reserved |
| B2 | Reserved |
| C7 | SATA CRC Error Count |
| F1 | Total LBAs Written (each write unit = 1GB) |
| F2 | Total LBAs Read (each read unit = 1GB) |
| F3 | Reserved |
| F4 | Reserved |
| FA | Reserved |
| FB | Reserved |
| FC | Reserved |
| FD | Reserved |
| FE | Reserved |

6. Identify Device Data

The Identify Device command enables the host to receive parameter information from the SSD. This command has the same protocol as the Read Sector(s) command. The parameter words in the buffer have the arrangement and meanings defined in the following table.

ID Table Information

| Word | Default Value | Description |
|---------|---------------|---|
| 0 | 045Ah | General configuration 15 0=ATA device 14:8 Retired 7:6 Obsolete 5:3 Retired 2 Response incomplete 1 Retired 0 Reserved |
| 1 | 3FFFh | Obsolete |
| 2 | C837h | Specific configuration |
| 3 | 0010h | Obsolete |
| 4 - 5 | 00000000h | Retired |
| 6 | 003Fh | Obsolete |
| 7 - 8 | 00000000h | Reserved for the CompactFlash Association |
| 9 | 0000h | Retired |
| 10 - 19 | X..Xh | Serial number in ASCII (Right justified) |
| 20 - 21 | 00000000h | Retired |
| 22 | 0000h | Obsolete |
| 23 - 26 | X..Xh | Firmware revision in ASCII |
| 27 - 46 | X..Xh | Model number in ASCII (Left justified) Big Endian Byte Order in Word |
| 47 | 8001h | 15:8 80h 7:0 01h=Maximum number of logical sectors that shall be DRQ data block on READ/WRITE MULTIPLE commands |
| 48 | 4000h | Trusted Computing feature set options 15 Shall be cleared to zero 14 Shall be set to one 13:1 Reserved for the Trusted Computing Group 0 1=Trusted Computing feature set is supported |

| | | |
|---------|-----------|---|
| 49 | 2F00h | <p>Capabilities</p> <p>15:14 Reserved for the IDENTIFY PACKET DEVICE command.</p> <p>13 1 = Standby timer values as specified in this standard are supported</p> <p>0 = Standby timer values shall be managed by the device</p> <p>12 Reserved for the IDENTIFY PACKET DEVICE command.</p> <p>11 1 = IORDY supported</p> <p>0 = IORDY may be supported</p> <p>10 1 = IORDY may be disabled</p> <p>9 Shall be set to one to indicate that LBA is supported.</p> <p>8 1 = DMA supported</p> <p>7:2 Reserved</p> <p>1:0 Current Long Physical Sector Alignment setting</p> |
| 50 | 4000h | <p>Capabilities</p> <p>15 Shall be cleared to zero</p> <p>14 Shall be set to one</p> <p>13:2 Reserved</p> <p>1 Obsolete</p> <p>0 Shall be set to one to indicate a vendor specific Standby timer value minimum</p> |
| 51 - 52 | 00000000h | Obsolete |
| 53 | 0007h | <p>15:8 Free-fall Control Sensitivity</p> <p>00h = Vendor's recommended setting</p> <p>01h-FFh = Sensitivity level. A larger number is a more sensitive setting.</p> <p>7:3 Reserved</p> <p>2 1 = the fields reported in word 88 are valid</p> <p>0 = the fields reported in word 88 are not valid</p> <p>1 1 = the fields reported in words (70:64) are valid</p> <p>0 = the fields reported in words (70:64) are not valid</p> <p>X 0 Obsolete</p> |
| 54 - 58 | X..Xh | Obsolete |
| 59 | 0000h | <p>15 1 = The BLOCK ERASE EXT command is supported</p> <p>14 1 = The OVERWRITE EXT command is supported</p> <p>13 1 = The CRYPTO SCRAMBLE EXT command is supported</p> <p>12 1 = The Sanitize feature set is supported</p> <p>11:9 Reserved</p> <p>8 1 = Multiple logical sector setting is valid</p> <p>7:0 Current setting for number of logical sectors that shall be transferred per DRQ data block on READ/WRITE Multiple commands</p> |
| 60 - 61 | X..Xh | Total number of user addressable logical sectors for 28-bit commands (DWord) |
| 62 | 0000h | Obsolete |

| | | |
|---------|-------|---|
| 63 | 0007h | <p>15:11 Reserved</p> <p>10 1 = Multiword DMA mode 2 is selected 0 = Multiword DMA mode 2 is not selected</p> <p>9 1 = Multiword DMA mode 1 is selected 0 = Multiword DMA mode 1 is not selected</p> <p>8 1 = Multiword DMA mode 0 is selected 0 = Multiword DMA mode 0 is not selected</p> <p>7:3 Reserved</p> <p>2 1 = Multiword DMA mode 2 and below are supported 1 1 = Multiword DMA mode 1 and below are supported 0 1 = Multiword DMA mode 0 is supported</p> |
| 64 | 0003h | <p>15:8 Reserved</p> <p>7:0 PIO modes supported</p> |
| 65 | 0078h | <p>Minimum Multiword DMA transfer cycle time per word</p> <p>15:0 Cycle time in nanoseconds</p> |
| 66 | 0078h | <p>Manufacturer's recommended Multiword DMA transfer cycle time</p> <p>15:0 Cycle time in nanoseconds</p> |
| 67 | 0078h | <p>Minimum PIO transfer cycle time without flow control</p> <p>15:0 Cycle time in nanoseconds</p> |
| 68 | 0078h | <p>Minimum PIO transfer cycle time with IORDY flow control</p> <p>15:0 Cycle time in nanoseconds</p> |
| 69 | 4C20h | <p>Additional Supported</p> <p>15 1 = CFast Specification Support</p> <p>14 1 = Deterministic read after Trim is supported</p> <p>13 1 = Long Physical Sector Alignment Error Reporting Control is supported</p> <p>12 1 = DEVICE CONFIGURATION IDENTIFY DMA and DEVICE CONFIGURATIONSET DMA are supported</p> <p>11 1 = READ BUFFER DMA is supported</p> <p>10 1 = WRITE BUFFER DMA is supported</p> <p>9 1 = SET MAX SET PASSWORD DMA and SET MAX UNLOCK DMA are supported</p> <p>8 1 = DOWNLOAD MICROCODE DMA is supported</p> <p>7 Reserved for IEEE-1667</p> <p>6 0 = Optional ATA device 28-bit commands supported</p> <p>5 1 = Read zero after Trim is supported</p> <p>4:0 Reserved</p> |
| 70 | 0000h | Reserved |
| 71 - 74 | X..Xh | Reserved for the IDENTIFY PACKET DEVICE command |
| 75 | 001Fh | <p>Queue depth</p> <p>15:5 Reserved</p> <p>4:0 Maximum queue depth - 1</p> |

| | | |
|----|-------|---|
| 76 | E10Eh | <p>Serial ATA Capabilities</p> <p>15:13 Reserved for Serial ATA</p> <p>12 1 = Supports NCQ priority information</p> <p>11 1 = Supports Unload while NCQ commands are outstanding</p> <p>10 1 = Supports Phy Event Counters</p> <p>9 1 = Supports receipt of host initiated power management requests</p> <p>8 1 = Supports the NCQ feature set</p> <p>7:3 Reserved for Serial ATA</p> <p>2 1 = Supports SATA Gen2 Signaling Speed (3.0Gb/s)</p> <p>1 1 = Supports SATA Gen1 Signaling Speed (1.5Gb/s)</p> <p>0 Shall be cleared to zero</p> |
| 77 | 00C6h | Reserved for Serial ATA |
| 78 | 0104h | <p>Serial ATA features supported</p> <p>15:7 Reserved for Serial ATA</p> <p>6 1 = Device supports Software Settings Preservation</p> <p>5 Reserved for Serial ATA</p> <p>4 1 = Device supports in-order data delivery</p> <p>3 1 = Device supports initiating power management</p> <p>2 1 = Device supports DMA Setup auto-activation</p> <p>1 1 = Device supports non-zero buffer offsets</p> <p>0 Shall be cleared to zero</p> |
| 79 | 00C4h | <p>Serial ATA features enabled</p> <p>15:7 Reserved for Serial ATA</p> <p>6 1 = Software Settings Preservation enabled</p> <p>5 Reserved for Serial ATA</p> <p>4 1 = In-order data delivery enabled</p> <p>3 1 = Device initiated power management enabled</p> <p>2 1 = DMA Setup auto-activation enabled</p> <p>1 1 = Non-zero buffer offsets enabled</p> <p>0 Shall be cleared to zero</p> |
| 80 | 07F8h | <p>Major version number</p> <p>15:9 Reserved</p> <p>8 1 = supports ATA8-ACS</p> <p>7 1 = supports ATA/ATAPI-7</p> <p>6 1 = supports ATA/ATAPI-6</p> <p>5 1 = supports ATA/ATAPI-5</p> <p>4 1 = supports ATA/ATAPI-4</p> <p>3 Obsolete</p> <p>2 Obsolete</p> <p>1 Obsolete</p> <p>0 Reserved</p> |
| 81 | 011Bh | Minor version number |

| | | |
|-----------|--------------|---|
| <p>82</p> | <p>7069h</p> | <p>Commands and feature sets supported</p> <p>15 Obsolete</p> <p>14 1 = The NOP command is supported</p> <p>13 1 = The READ BUFFER command is supported</p> <p>12 1 = The WRITE BUFFER command is supported</p> <p>11 Obsolete</p> <p>10 1 = The HPA feature set is supported</p> <p>9 Shall be cleared to zero to indicate that the DEVICE RESET command is not supported</p> <p>8 1 = The SERVICE interrupt is supported</p> <p>7 1 = The release interrupt is supported</p> <p>6 1 = Read look-ahead is supported</p> <p>5 1 = The volatile write cache is supported</p> <p>4 Shall be cleared to zero to indicate that the PACKET feature set is not supported</p> <p>3 Shall be set to one to indicate that the mandatory Power Management feature set is supported</p> <p>2 Obsolete</p> <p>1 1 = The Security feature set is supported</p> <p>0 1 = The SMART feature set is supported</p> |
| <p>83</p> | <p>7409h</p> | <p>Commands and feature sets supported</p> <p>15 Shall be cleared to zero</p> <p>14 Shall be set to one</p> <p>13 1 = The FLUSH CACHE EXT command is supported</p> <p>12 Shall be set to one to indicate that the mandatory FLUSH CACHE command is supported</p> <p>11 1 = The DCO feature set is supported</p> <p>10 1 = The 48-bit Address feature set is supported</p> <p>9 1 = The AAM feature set is supported</p> <p>8 1 = The SET MAX security extension is supported</p> <p>7 Reserved for the Address Offset Reserved Area Boot Method</p> <p>6 1 = SET FEATURES subcommand is required to spin-up after power-up</p> <p>5 1 = The PUIS feature set is supported</p> <p>4 Obsolete</p> <p>3 1 = The APM feature set is supported</p> <p>2 1 = The CFA feature set is supported</p> <p>X 1 Obsolete</p> <p>0 1 = The DOWNLOAD MICROCODE command is supported</p> |

| | | |
|-----------|--------------|--|
| <p>84</p> | <p>4160h</p> | <p>Commands and feature sets supported</p> <p>15 Shall be cleared to zero</p> <p>14 Shall be set to one</p> <p>13 1 = The IDLE IMMEDIATE command with UNLOAD feature is supported</p> <p>12 Reserved for TLC</p> <p>11 Reserved for TLC</p> <p>10:9 Obsolete</p> <p>8 1 = The 64-bit World wide name is supported</p> <p>7 Obsolete</p> <p>6 1 = The WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported</p> <p>5 1 = The GPL feature set is supported</p> <p>4 1 = The Streaming feature set is supported</p> <p>3 1 = The Media Card Pass Through Command feature set is supported</p> <p>2 1 = Media serial number is supported</p> <p>1 1 = The SMART self-test is supported</p> <p>0 1 = SMART error logging is supported</p> |
| <p>85</p> | <p>0769h</p> | <p>Commands and feature sets supported or enabled</p> <p>15 Obsolete</p> <p>14 1 = The NOP command is supported</p> <p>13 1 = The READ BUFFER command is supported</p> <p>12 1 = The WRITE BUFFER command is supported</p> <p>11 Obsolete</p> <p>10 1 = HPA feature set is supported</p> <p>9 Shall be cleared to zero to indicate that the DEVICE RESET command is not supported</p> <p>8 1 = The SERVICE interrupt is enabled</p> <p>7 1 = The release interrupt is enabled</p> <p>6 1 = Read look-ahead is enabled</p> <p>5 1 = The volatile write cache is enabled</p> <p>4 Shall be cleared to zero to indicate that the PACKET feature set is not supported</p> <p>3 Shall be set to one to indicate that the mandatory Power Management feature set is supported</p> <p>2 Obsolete</p> <p>1 1 = The Security feature set is enabled</p> <p>0 1 = The SMART feature set is enabled</p> |

| | | |
|------------------------|--|--|
| <p>86</p> <p>B409h</p> | | <p>Commands and feature sets supported or enabled</p> <p>15 1 = Words 119..120 are valid</p> <p>14 Reserved</p> <p>13 1 = FLUSH CACHE EXT command supported</p> <p>12 1 = FLUSH CACHE command supported</p> <p>11 1 = The DCO feature set is supported</p> <p>10 1 = The 48-bit Address features set is supported</p> <p>9 1 = The AAM feature set is enabled</p> <p>8 1 = the SET MAX security extension is enabled by SET MAX SET PASSWORD</p> <p>7 Reserved for Address Offset Reserved Area Boot Method</p> <p>6 1 = SET FEATURES subcommand is required to spin-up after power-up</p> <p>5 1 = The PUIS feature set is enabled</p> <p>4 Obsolete</p> <p>3 1 = The APM feature set is enabled</p> <p>2 1 = The CFA feature set is supported</p> <p>1 Obsolete</p> <p>0 1 = The DOWNLOAD MICROCODE command is supported</p> |
| <p>87</p> <p>4160h</p> | | <p>Commands and feature sets supported or enabled</p> <p>15 Shall be cleared to zero</p> <p>14 Shall be set to one</p> <p>13 1 = The IDLE IMMEDIATE command with UNLOAD FEATURE is supported</p> <p>12 Reserved for TLC</p> <p>11 Reserved for TLC</p> <p>10:9 Obsolete</p> <p>8 1 = The 64-bit World wide name is supported</p> <p>7 Obsolete</p> <p>6 1 = The WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported</p> <p>5 1 = The GPL feature set is supported</p> <p>4 Obsolete</p> <p>3 1 = The Media Card Pass Through Command feature set is supported</p> <p>2 1 = Media serial number is valid</p> <p>1 1 = SMART self-test supported</p> <p>0 1 = SMART error logging is supported</p> |
| <p>88</p> <p>407Fh</p> | | <p>Ultra DMA modes</p> <p>15 Reserved</p> <p>14 1 = Ultra DMA mode 6 is selected 0 = Ultra DMA mode 6 is not selected</p> <p>13 1 = Ultra DMA mode 5 is selected 0 = Ultra DMA mode 5 is not selected</p> <p>12 1 = Ultra DMA mode 4 is selected 0 = Ultra DMA mode 4 is not selected</p> |

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| | | <p>11 1 = Ultra DMA mode 3 is selected 0 = Ultra DMA mode 3 is not selected</p> <p>10 1 = Ultra DMA mode 2 is selected 0 = Ultra DMA mode 2 is not selected</p> <p>9 1 = Ultra DMA mode 1 is selected 0 = Ultra DMA mode 1 is not selected</p> <p>8 1 = Ultra DMA mode 0 is selected 0 = Ultra DMA mode 0 is not selected</p> <p>7 Reserved</p> <p>6 1 = Ultra DMA mode 6 and below are supported 5 1 = Ultra DMA mode 5 and below are supported 4 1 = Ultra DMA mode 4 and below are supported 3 1 = Ultra DMA mode 3 and below are supported 2 1 = Ultra DMA mode 2 and below are supported 1 1 = Ultra DMA mode 1 and below are supported 0 1 = Ultra DMA mode 0 is supported</p> |
| 89 | 0005h | <p>15:8 Reserved</p> <p>7:0 Time required for Normal Erase mode SECURITY ERASE UNIT command</p> |
| 90 | 0005h | <p>15:8 Reserved</p> <p>7:0 Time required for an Enhanced Erase mode SECURITY ERASE UNIT command</p> |
| 91 | 00FEh | Current APM level value |
| 92 | 0000h | Master Password Identifier |
| 93 | 0000h | <p>Hardware reset result</p> <p>15 Shall be cleared to zero.</p> <p>14 Shall be set to one.</p> <p>13 1 = device detected CBLID- above ViHB 0 = device detected CBLID- below ViLB</p> <p>12:8 Device 1 hardware reset result.</p> <p>Device 0 shall clear these bits to zero. Device 1 shall set these bits as follows:</p> <p>12 Reserved.</p> <p>11 0 = Device 1 did not assert PDIAG- 1 = Device 1 asserted PDIAG-.</p> <p>10:9 These bits indicate how Device 1 determined the device number:</p> <p>00 = Reserved. 01 = a jumper was used. 10 = the CSEL signal was used. 11 = some other method was used or the method is unknown. 8 Shall be set to one.</p> <p>7:0 Device 0 hardware reset result.</p> <p>Device 1 shall clear these bits to zero. Device 0 shall set these bits as follows:</p> <p>7 Reserved.</p> |

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| | | <p>6 0 = Device 0 does not respond when Device 1 is selected. 1 = Device 0 responds when Device 1 is selected. 5 0 = Device 0 did not detect the assertion of DASP-. 1 = Device 0 detected the assertion of DASP-. 4 0 = Device 0 did not detect the assertion of PDIAG-. 3 0 = Device 0 failed diagnostics. 1 = Device 0 passed diagnostics. 2:1 These bits indicate how Device 0 determined the device number: 00 = Reserved. 01 = a jumper was used. 10 = the CSEL signal was used. 11 = some other method was used or the method is unknown. 0 Shall be set to one.</p> |
| 94 | 0000h | <p>Current AAM value 15:8 Vendor's recommended AAM value. 7:0 Current AAM value.</p> |
| 95 | 0000h | Stream Minimum Request Size |
| 96 | 0000h | Streaming Transfer Time - DMA |
| 97 | 0000h | Streaming Access Latency - DMA and PIO |
| 98 - 99 | 00000000h | Streaming Performance Granularity (DWord) |
| 100 - 103 | X..Xh | Total Number of User Addressable Logical Sectors for 48-bit commands (QWord) |
| 104 | 0000h | Streaming Transfer Time - PIO |
| 105 | 0008h | Maximum number of 512-byte blocks of LBA Range Entries per DATA SET MANAGEMENT command |
| 106 | 4000h | <p>Physical sector size / logical sector size 15 Shall be cleared to zero 14 Shall be set to one 13 1 = Device has multiple logical sectors per physical sector. 12 1 = Device Logical Sector longer than 256 Words 11:4 Reserved 3:0 2XP logical sectors per physical sector</p> |
| 107 | 0000h | Inter-seek delay for ISO 7779 standard acoustic testing |
| 108 - 111 | X..Xh | World wide name |
| 112 - 115 | X..Xh | Reserved |
| 116 | 0000h | Reserved for TLC |
| 117 - 118 | 00000000h | Logical sector size (DWord) |
| 119 | 401Ch | <p>Commands and feature sets supported (Continued from words 82..84) 15 Shall be cleared to zero 14 Shall be set to one 13:8 Reserved 7 1 = Extended Power Conditions feature set is supported 6 1 = Extended Status Reporting feature set is supported</p> |

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| | | <p>5 1 = The Free-fall Control feature set is supported</p> <p>4 1 = The DOWNLOAD MICROCODE command with mode 3 is supported</p> <p>3 1 = The READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported</p> <p>2 1 = The WRITE UNCORRECTABLE EXT command is supported</p> <p>1 1 = The Write-Read-Verify feature set is supported</p> <p>0 Reserved for DDT</p> |
| 120 | 401Ch | <p>Commands and feature sets supported or enabled (Continued from words 85..87)</p> <p>15 Shall be cleared to zero</p> <p>14 Shall be set to one</p> <p>13:8 Reserved</p> <p>7 1 = At least one Extended Power Conditions Idle timer is enabled</p> <p>6 1 = Extended Status Reporting feature set is enabled</p> <p>5 1 = The Free-fall Control feature set is enabled</p> <p>4 1 = The DOWNLOAD MICROCODE command with mode 3 is supported</p> <p>3 1 = The READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported</p> <p>2 1 = The WRITE UNCORRECTABLE EXT command is supported</p> <p>1 1 = The Write-Read-Verify feature set is enabled</p> <p>0 Reserved for DDT</p> |
| 121 - 126 | X..Xh | Reserved for expanded supported and enabled settings |
| 127 | 0000h | Obsolete |
| 128 | 0000h | <p>Security status</p> <p>15:9 Reserved</p> <p>8 Master Password Capability: 0 = High, 1 = Maximum</p> <p>7:6 Reserved</p> <p>5 1 = Enhanced security erase supported</p> <p>4 1 = Security count expired</p> <p>3 1 = Security frozen</p> <p>2 1 = Security locked</p> <p>1 1 = Security enabled</p> <p>0 1 = Security supported</p> |
| 129 - 159 | X..Xh | Vendor specific |
| 160 | 0000h | <p>CFA power mode</p> <p>15 Word 160 supported</p> <p>14 Reserved</p> <p>13 CFA power mode 1 is required for one or more commands implemented by the device</p> <p>12 CFA power mode 1 disabled</p> <p>11:0 Maximum current in ma</p> |
| 161 - 167 | X..Xh | Reserved for the CompactFlash Association |
| 168 | 0000h | <p>15:4 Reserved</p> <p>3:0 Device Nominal Form Factor</p> |

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| 169 | 0001h | DATA SET MANAGEMENT is supported 15:1 Reserved 0 1 = the Trim bit in the DATA SET MANAGEMENT is supported |
| 170 - 173 | X..Xh | Additional Product Identifier (ATA String) |
| 174 - 175 | X..Xh | Reserved |
| 176 - 205 | X..Xh | Current media serial number (ATA string) |
| 206 | 0000h | SCT Command Transport 15:12 Vendor Specific 11:6 Reserved 5 The SCT Data Tables command is supported 4 The SCT Feature Control command is supported 3 The SCT Error Recovery Control command is supported 2 The SCT Write Same command is supported 1 Obsolete 0 The SCT Command Transport is supported |
| 207 - 208 | 00000000h | Reserved for CE-ATA. |
| 209 | 4000h | Alignment of logical blocks within a physical block 15 Shall be cleared to zero 14 Shall be set to one 13:0 Logical sector offset within the first physical sector where the first logical sector is placed |
| 210 - 211 | 00000000h | Write-Read-Verify Sector Count Mode 3 (DWord) |
| 212 - 213 | 00000000h | Write-Read-Verify Sector Count Mode 2 (DWord) |
| 214 | 0000h | NV Cache Capabilities 15:12 NV Cache feature set version 11:8 NV Cache Power Mode feature set version 7:5 Reserved 4 1 = NV Cache feature set enabled 3:2 Reserved 1 1 = NV Cache Power Mode feature set enabled 0 1 = NV Cache Power Mode feature set supported |
| 215 - 216 | 00000000h | NV Cache Size in Logical Blocks (DWord) |
| 217 | 0001h | Nominal media rotation rate |
| 218 | 0000h | Reserved |
| 219 | 0000h | NV Cache Options 15:8 Reserved 7:0 Device Estimated Time to Spin Up in Seconds |
| 220 | 0000h | 15:8 Reserved 7:0 Write-Read-Verify feature set current mode |
| 221 | 0000h | Reserved |

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| 222 | 10FFh | Transport major version number 0000h or FFFFh = device does not report version 15:12 Transport Type 0h = Parallel 1h = Serial 2h-Fh = Reserved Parallel Serial 11:6 Reserved Reserved 5 Reserved SATA Rev 3.0 4 Reserved SATA Rev 2.6 3 Reserved SATA Rev 2.5 2 Reserved SATA II: Extensions 1 ATA/ATAPI-7 SATA 1.0a 0 ATA8-APT ATA8-AST |
| 223 | 0000h | Transport minor version number |
| 224 - 233 | X..Xh | Reserved |
| 234 | 0008h | Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 235 | 0400h | Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 236 - 254 | X..Xh | Reserved |
| 255 | XXXXh | Integrity word 15:8 Checksum 7:0 Checksum Validity Indicator |

Notes:

X = content (byte) is vendor specific and may be fixed or variable.

7. Product Line up

7.1 SATA3 M.2 2280

| Type | Capacity | MODEL | Part Number |
|--------------------|----------|-----------|------------------------------|
| SATA3 M.2 2280 SSD | 64GB | S40RF064G | FSGGMMC-064G FSGGMNC-064G |
| SATA3 M.2 2280 SSD | 128GB | S40RF128G | FSGGMMC-128G FSGGMNC-128G |
| SATA3 M.2 2280 SSD | 256GB | S40RF256G | FSGGMMC-256G FSGGMOC-256G |

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