



PX-xxG5Me-72

| Model |
|--------------|
| PX-16G5Me-72 |
| PX-24G5Me-72 |
| PX-32G5Me-72 |

mSATA (JEDEC MO-300)

SATA 6.0 Gb/s Solid State Drive

Product Specification

(for Advantech)

Manual Rev.: Rev1.1

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LITE-ON IT CORPORATION



Document History

| Revision | Date | Changes |
|----------|------------|---|
| Rev 0.1 | 2012/11/09 | Draft |
| Rev 1.0 | 2012/12/07 | First Release |
| Rev 1.1 | 2013/02/03 | Update support ATA commands |
| | 2013/02/21 | Add 16G capacity and modify power consumption table |
| | 2013/03/07 | Modify Device Sleep Signal description |
| | 2013/04/23 | Remove NOP COMMAND from SUPPORT COMMAND LIST |
| | 2013/08/12 | Update Identify Table |

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1 Introduction

1.1 Overview :

The **PX-xxG5Me MLC** series mSATA 6 Gb/s Solid State Drive (mSATA SSD) delivers leading performance in an industry standard JEDEC MO-300 form factor while simultaneously improving system responsiveness for mobile applications over standard rotating drive media or hard disk drives. By combining leading NAND flash memory technology with our innovative high performance firmware, LITEON IT delivers a SSD for native Serial Advanced Technology Attachment (SATA) hard disk drive drop-in replacement with enhanced performance, reliability, ruggedness and power savings. Since there are no rotating platters, moving heads, fragile actuators, or unnecessary delays due to spin-up time or positional seek time that can slow down the storage subsystem, significant I/O and throughput performance improvement is achieved as compared to rotating media or hard disk drives. This document describes the specifications of the **PX-xxG5Me MLC** series mSATA SSD in **JEDEC MO-300** form factors.

The **PX-xxG5Me mSATA** SSD primarily targets mSATA based laptop PCs, highly rugged mobile client devices, as well as thin and light mini/sub-notebooks. Key attributes include high performance, low power, increased system responsiveness, high reliability, and enhanced ruggedness as compared to standard mobile mSATA hard drives. The **PX-xxG5Me mSATA** SSD is available in JEDEC MO-300 form factor that are electrically, mechanically, and software compatible with existing **JEDEC MO-300** Serial ATA slots. Our flexible design allows interchangeability with existing mobile hard drives based on the mSATA interface standard.

1.2 Product Specification

1.2.0 Key Component and FW Version

1.2.0.1 Flash: Toshiba TC58TEG6DDJTA00

1.2.0.2 Controller: Marvel Monet Lite 9188

1.2.0.3 FW Version: FW Version: V1.01 – 16/24GB, V1.00-32GB

1.2.1. Form Factor: JEDEC MO-300 mSATA SSD form factor

1.2.2. Capacity: available now

- 16GB (PX-16G5Me)
- 24GB (PX-24G5Me)
- 32GB (PX-32G5Me)

Table 1 User Addressable Sectors

| Unformatted capacity | Total user addressable sectors in LBA mode |
|----------------------|--|
| 16GB | 31,277,232 |
| 24GB | 46,905,264 |
| 32GB | 62,533,296 |

Notes: 1. 1GB=1,000,000,000 bytes and not all of the memory can be used for storage.

2. 1 Sector = 512 bytes

1.2.3. Flash: Multi-Level Cell (MLC) component with Toggle-Mode,

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1.2.4. Band Performance

Table 2 Maximum Sustained Read and Write Bandwidth

| Capacity | Access Type | MB/s |
|----------|---|-------------------------------|
| 16 GB | Sequential Read | Up to 210 MB/s (SATA 6Gb/s) |
| | Sequential Write | Up to 30 MB/s (SATA 6Gb/s) |
| | ATTO up to Read 220 MB/s, Write 30 MB/s | |
| 24 GB | Sequential Read | Up to 290 MB/s (SATA 6Gb/s) |
| | Sequential Write | Up to 50 MB/s (SATA 6Gb/s) |
| | ATTO up to Read 300 MB/s, Write 50 MB/s | |
| 32 GB | Sequential Read | Up to 390 (SATA 6Gb/s) |
| | Sequential Write | Up to 70 (SATA 6Gb/s) |
| | ATTO up to Read 430 MB/s, Write 70 MB/s | |

- Notes:**
- 1). Performance measured using CrystalDiskMark. ATTO
 - 2). 1 MB/sec = 1,048,576 bytes/sec is used in measuring sequential performance.
If 1 MB/sec = 1,000,000 bytes/sec is used, performance values become 4.85% higher.
 - 3). Test platform: ASUS P8Z68-V Pro Gen3 (Windows 7 x64)
 - 4). Test by secondary drive(data drive)

1.2.5. Read and Write IOPS (IOMETER)

Table 3 Random Read/Write Input/Output Operations per Second

| Capacity | Access Type | IOPS |
|----------|---|---------------------|
| 16GB | 4K Read (IOPS) | 23,000 (SATA 6Gb/s) |
| | 4K Write (IOPS) | 8,000 (SATA 6Gb/s) |
| | CDM QD32 IOPS up to Read 25,000, Write 10,000 | |
| 24GB | 4K Read (IOPS) | 32,000 (SATA 6Gb/s) |
| | 4K Write (IOPS) | 14,000 (SATA 6Gb/s) |
| | CDM QD32 IOPS up to Read 34,000, Write 15,000 | |
| 32GB | 4K Read (IOPS) | 41,000 (SATA 6Gb/s) |
| | 4K Write (IOPS) | 19,000 (SATA 6Gb/s) |
| | CDM QD32 IOPS up to Read 43,000, Write 21,000 | |

- Notes:**
1. Performance measured using IOMETER with queue depth set to 32, Crystal Disk Mark QD32.
 2. Write cache enabled
 3. Test computer: ASUS P8Z68-V Pro Gen3 (SATA 6 Gb/s – Win7 x64)
 4. Test by secondary drive(data drive)

1.2.6. Ready Time

Table 4 Latency Specifications

| Type | Average Latency |
|--------------------|-----------------|
| Power on to Ready | 1s |
| Resume from DEVSLP | 100ms |

- Notes:**
1. Write cache enabled
 2. Device measured form power-on to ready to receive first Media command.

1.2.7. Compatibility

- SATA Revision 3.0 compliant
Compatible with SATA 1.5Gb/s, 3.0Gb/s & 6.0Gb/s interface rates
- ATA/ATAPI- 8 compliant
- SSD enhanced SMART ATA feature set
- Native Command Queuing (NCQ) command set
- TRIM supported

1.2.8. Certifications

Table 5 Device Certifications

| Certification | Description |
|----------------|--|
| CE compliant | Indicates conformity with the essential health and safety requirements set out in European Directives Low voltage Directive and EMC Directive |
| UL certified | Underwriters Laboratories, Inc. Component Recognition UL60950-1 |
| BSMI | Compliance to the Taiwan EMC standard "Limits and methods of Radio Disturbance Characteristics of Information Technology Equipment, CNS 13438 Class B" |
| Microsoft WHQL | Microsoft Windows Hardware Quality Labs |
| RoHS compliant | Restriction of Hazardous Substance Directive |

1.2.9. mSATA Interface Power Management

- 3.3V SATA
- SATA interface power management

1.2.10. Power Consumption

Table 6 Operating Voltage

| Capacity | Description | Min | Max | Unit |
|----------|-------------------------------------|-------|-------|------|
| 16GB | Operating voltage for 3.3V (+/- 5%) | 3.135 | 3.465 | V |
| 24GB | Operating voltage for 3.3V (+/- 5%) | 3.135 | 3.465 | V |
| 32GB | Operating voltage for 3.3V (+/- 5%) | 3.135 | 3.465 | V |

Table 7 Power Consumption (MobileMark)

| Capacity | Mode | Max | Unit |
|----------|-------------|-----|------|
| 16GB | DIPM Enable | 0.2 | W |
| 24GB | DIPM Enable | 0.2 | W |
| 32GB | DIPM Enable | 0.2 | W |

Table 8 DEVSLP Mode Power Consumption

| Capacity | Mode | Max | Unit |
|----------|--------|-----|------|
| 16GB | DEVSLP | 1 | mW |
| 24GB | DEVSLP | 1 | mW |
| 32GB | DEVSLP | 1 | mW |

1.2.11. Temperature

Table 9 Temperature Relative Specifications

| Environment | Mode | Min | Max | Unit |
|---------------------|---------------|-----|-----|------|
| Ambient Temperature | Operating | 0 | 70 | °C |
| | Non-operating | -40 | 85 | °C |
| Humidity | Operation | 5 | 95 | % |
| | Non-operation | 5 | 95 | % |

Note: Measured without condensation

1.2.12. Reliability

Table 10 Reliability specifications

| Parameter | Value |
|----------------------------------|-------------------|
| Mean Time between Failure (MTBF) | > 1,500,000 hours |
| Power on/off cycles | 50000 cycles |

Notes:

1. MTBF is calculated based on a Part Stress Analysis. It assumes nominal voltage. With all other parameters within specified range.
2. Power on/off cycles is defined as power being removed from the drive, and the restored. Most host systems remove power from the drive when entering suspend and hibernate as well as on a system shutdown.

1.2.13. Shock and Vibration

Table 11 Shock and Vibration

| Item | Mode | Timing/Frequency | Max |
|------------------------|---------------|---------------------|----------|
| Shock ¹ | operating | At 1 msec half-sine | 1500G |
| | operating | At 2 msec half-sine | 1000G |
| | Non-operating | At 1 msec half-sine | 1500G |
| | Non-operating | At 2 msec half-sine | 1000G |
| Vibration ² | Operation | 7~800 Hz | 2.17Grms |
| | Non-operation | 7~800 Hz | 3.08Grms |

Notes:

1. Shock specifications assume that the SSD is mounted securely with the input vibration applied to the drive mounting screws. Stimulus may be applied in the X, Y or Z axis.
2. Vibration specifications assume that the SSD is mounted securely with the input vibration applied to the drive mounting screws. Stimulus may be applied in the X, Y or Z axis. The measured specification is in root mean squared form.

1.2.14. Electromagnetic Immunity

Electromagnetic Immunity tests assume the SSD is properly installed in the representative host system. The drive operates properly without errors degradation in performance when subjected to radio frequency (RF) environments defined in the following table.

Table 12 Radio Frequency Specifications

| Test | Description | Performance criteria | Reference standard |
|-----------------------------------|--|----------------------|--|
| Electrostatic discharge | Contact ±4KV Air: ±8KV | A | IEC 61000-4-2:2008 |
| Electrostatic discharge | Contact ±6KV Air: ±12KV | B | IEC 61000-4-2:2008 |
| Electrostatic discharge | Contact ±8KV Air: ±15KV | C | IEC 61000-4-2:2008 |
| Radiated RF immunity | 80~1000MHz, 3V/m, 80% AM with 1 KHz sine 900 MHz, 3 V/m, 50% pulse modulation at 200Hz | A | IEC 61000-4-3:2008 |
| Electrical fast transient | ±1KV on AC mains ±0.5KV on external I/O | B | IEC 61000-4-4:2004 +Corr.1:2006 +Corr.2:2007 |
| Surge immunity | ±1KV differential ±2KV common, AC mains | B | IEC 61000-4-5:2005 |
| Conducted RF immunity | 150KHz~80 MHz, 3 Vrms, 80% AM with 1KHz sine | A | IEC 61000-4-6:2008 |
| Power frequency magnetic field | 50Hz, 1A/m (r.m.s.) | A | IEC 61000-4-6:2008 |

Notes:

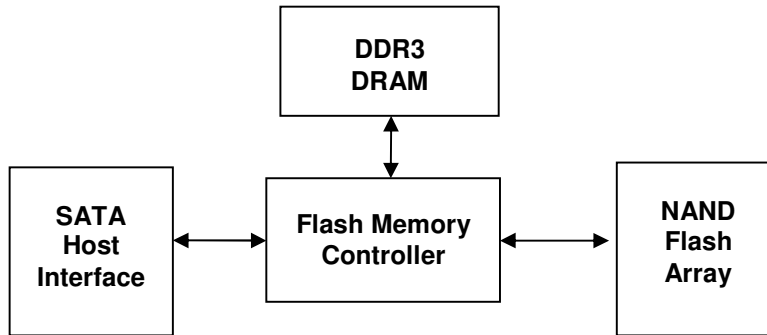
1. Performance criterion A = The device shall continue to operate as intended, i.e., normal unit operation with no degradation of performance.
2. Performance criterion B = The device shall continue to operate as intended after completion of test, however, during the test, some degradation of performance is allowed as long as there is no data loss operator intervention to restore device function.
3. Performance criterion C = Temporary loss of function is allowed. Operator intervention is acceptable to restore device function.
4. Contact electrostatic discharge is applied to drive enclosure.

1.2.15. Weight: 9 g Max.

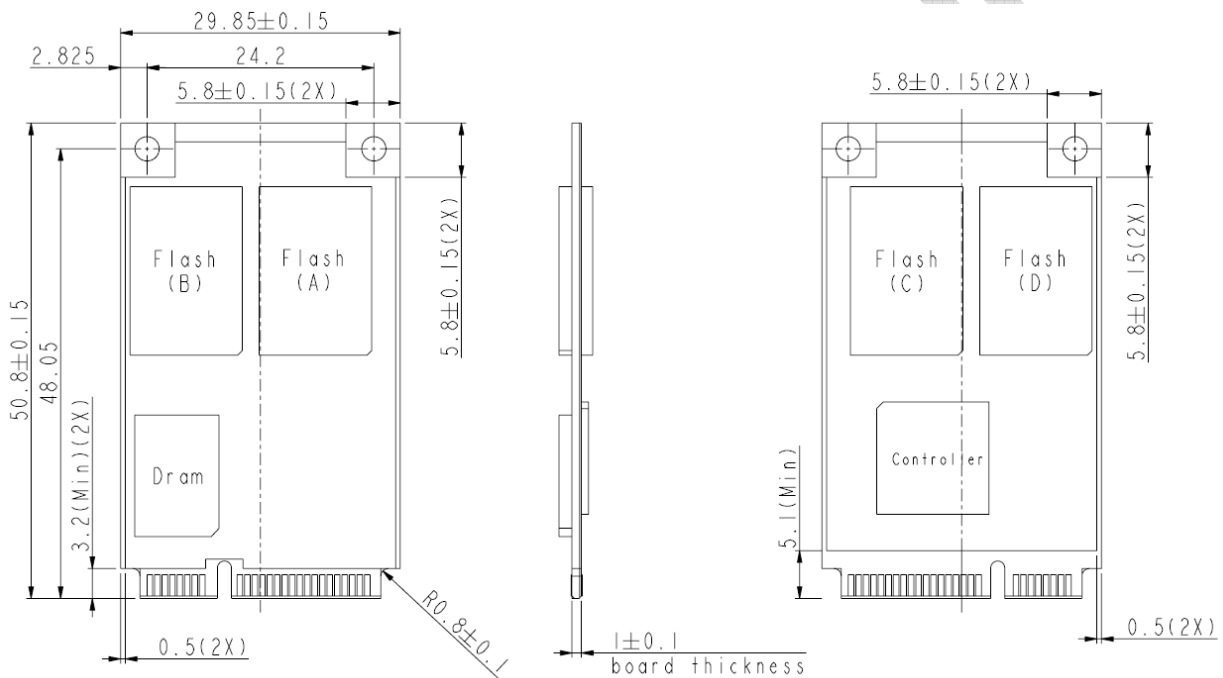
1.2.16. Dimension:

50.8 mm x 29.8mm x 3.6 mm (L x W x H)

1.3 Functional Block Diagram



1.4 Mechanical Drawing:



Dimension: 50.8 mm x 29.8mm x 3.6 mm (L x W x H)

1.5 Architecture

The **PX-xxG5Me MLC series mSATA 6Gb/s Solid State Drive (SSD)** utilizes a cost effective system-on-chip (SoC) design to provide a full 6Gb/s bandwidth with the host while managing multiple flash memory devices on multiple channels internally.

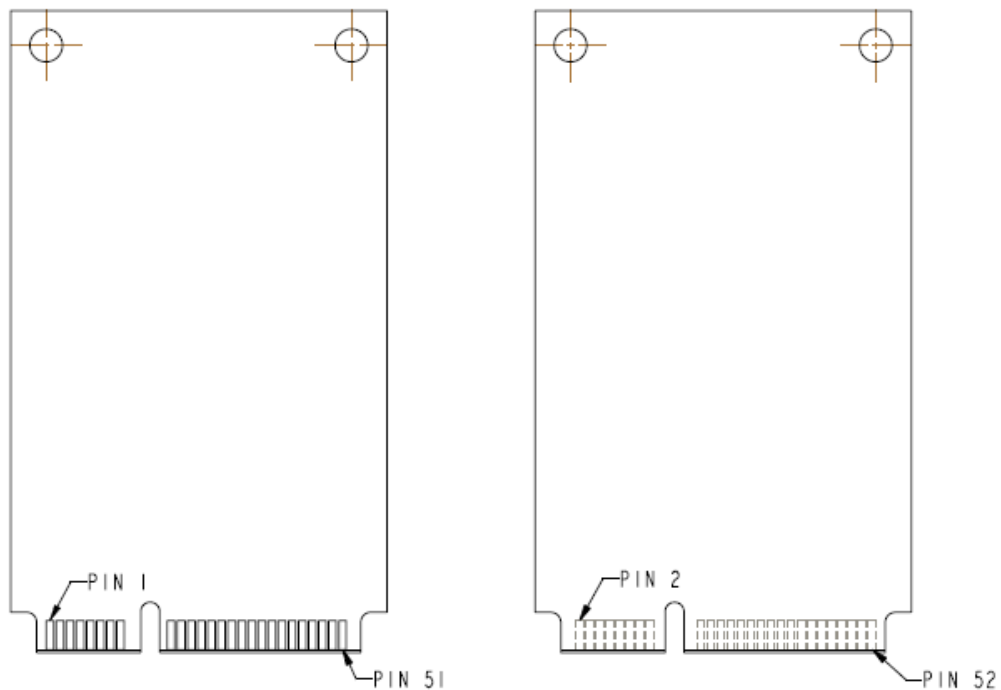
1.6 DEVSLP power mode

LiteON SSD support DEVSLP power mode. After power up, and enabled by a SET FEATURES command from the host, device will enter DEVSLP mode from any state after receive HW DEVSLP signal pin trigger. And return to Reset state after HW DEVSLP signal pin negated.

2 Pin Locations and Signal Descriptions

2.1 Pin Locations

The data and power connector pin locations of the **PX-xxG5Me series mSATA 6 Gb/s SSD** are as shown below.



2.2 Signal Descriptions

Table 13 Connector Pin Definitions

| Name | Type | Description |
|------|----------|-----------------------|
| P1 | Reserved | No Connect |
| P2 | +3.3V | 3.3V Power |
| P3 | Reserved | No Connect |
| P4 | GND | Return Current Path |
| P5 | Reserved | No Connect |
| P6 | +1.5V | 1.5V Power (No use) |
| P7 | Reserved | No Connect |
| P8 | Reserved | No Connect |

| Name | Type | Description |
|------|--------------------|---|
| P9 | GND | Return Current Path |
| P10 | Reserved | No Connect |
| P11 | Reserved | No Connect |
| P12 | Reserved | No Connect |
| P13 | Reserved | No Connect |
| P14 | Reserved | No Connect |
| P15 | GND | Return Current Path |
| P16 | Reserved | No Connect |
| P17 | Reserved | No Connect |
| P18 | GND | Return Current Path |
| P19 | Reserved | No Connect |
| P20 | Reserved | No Connect |
| P21 | GND | Return Current Path |
| P22 | Reserved | No Connect |
| P23 | +B | Host Receiver Differential Signal Pair B |
| P24 | +3.3V | 3.3V Power |
| P25 | -B | Host Receiver Differential Signal Pair B |
| P26 | GND | Return Current Path |
| P27 | GND | Return Current Path |
| P28 | +1.5V | 1.5V Power (No use) |
| P29 | GND | Return Current Path |
| P30 | Two Wire Interface | No Connect |
| P31 | -A | Host Transmitter Differential Signal Pair A |
| P32 | Two Wire Interface | No Connect |
| P33 | +A | Host Transmitter Differential Signal Pair A |
| P34 | GND | Return Current Path |
| P35 | GND | Return Current Path |
| P36 | Reserved | No Connect |
| P37 | GND | Return Current Path |
| P38 | Reserved | No Connect |
| P39 | +3.3V | 3.3V Power |
| P40 | GND | Return Current Path |
| P41 | +3.3V | 3.3V Power |
| P42 | Reserved | No Connect |

| Name | Type | Description |
|------|---------------------|---|
| P43 | Device Type | No Connect |
| P44 | Device Sleep Signal | <p>If system didn't support DEVSLP, set DEVSLP Sleep Signal pin power high and keep (from power on), device will ignore.</p> <p>If system support DEVSLP, set DEVSLP Sleep Signal pin power low (from power on) device, device will support DEVSLP function.</p> <p>Device Sleep Signal H: SSD enter sleep model.</p> <p>Device Sleep Signal L: SSD exit sleep model.</p> |
| P45 | Vendor | Vendor Specific / Manufacturing Pin/No connect on the host side |
| P46 | Reserved | No Connect |
| P47 | Vendor | Vendor Specific / Manufacturing Pin/No connect on the host side |
| P48 | +1.5V | 1.5V Power (No use) |
| P49 | DAS | Device Activity Signal |
| P50 | GND | Return Current Path |
| P51 | Presence Detection | This pin connect 0 ohm resistor to GND to indicate the presence of an mSATA device |
| P52 | +3.3V | 3.3V Power |

3 ATA Command Sets

3.1 ATA Command

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports all the mandatory ATA commands defined in the ATA/ATAPI-8 specification.

3.1.1 ATA General Feature Command Set

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the ATA General feature Command set (non-packet), which consists of

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE
- READ DMA
- READ DMA WITHOUT RETRIES
- READ SECTOR(S)
- READ SECTORS(S) WITHOUT RETRIES
- READ VERIFY SECTORS(S)
- READ VERIFY SECTORS(S) WITHOUT RETRIES
- SEEK
- SET FEATURES
- WRITE DMA
- WRITE DMA WITHOUT RETRIES
- WRITE SECTOR(S)
- WRITE SECTOR(S) WITHOUT RETRY
- READ MULTIPLE
- SET MULTIPLE MODE
- WRITE MULTIPLE
- INITIALIZE DEVICE PARAMETERS
- DATA SET MANAGEMENT

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports all the following optional commands

- READ BUFFER
- WRITE BUFFER
- DOWNLOAD MICROCODE

3.1.2 Identify Device Data

The following table details the sector data returned after issuing an IDENTIFY DEVICE command.

Table 14 Returned Sector Data

| Word | F=Fixed V=Variable X=Both | Default Value | Description |
|-------|---------------------------------|----------------------|---|
| 0 | F | 0040h | General configuration bit-significant information |
| 1 | F | 3FFFh | Obsolete-Number of logical cylinders (16,383) |
| 2 | F | C837h | Specific configuration |
| 3 | F | 0010h | Obsolete-Number of logical heads (16) |
| 4-5 | F | 0000h | Retired |
| 6 | F | 003Fh | Obsolete-Number of logical sectors per logical track (63) |
| 7-8 | F | 0000h | Reserved for assignment by the Compact Flash Association |
| 9 | F | 0000h | Retired |
| 10-19 | V | Var. | Serial number (20 ASCII characters) |
| 20-22 | F | 0000h | Retired / Obsolete |
| 23-26 | V | Var. | Firmware revision (8 ASCII characters) |
| 27-46 | V | Var. | Model number |
| 47 | F | 8010h | 7:0 – Maximum number of sectors transferred per interrupt on multiple commands |
| 48 | F | 4000h | Trusted Computing feature set options, bit14 should be 1 |
| 49 | F | 2F00h | Capabilities |
| 50 | F | 4000h | Capabilities |
| 51-52 | F | 0000h | Obsolete |
| 53 | F | 0007h | Words 88 and 70:64 valid |
| 54 | V | Var. | Obsolete - Number of logical cylinders (16,383) |
| 55 | V | Var. | Obsolete - Number of logical heads (16) |
| 56 | V | Var. | Obsolete - Number of logical sectors per logical track (63) |
| 57-58 | V | Var. | Capacity(Cylinders*heads*sectors) |
| 59 | V | 01xxh | Number of sectors transferred per interrupt on multiple commands(Bit7:0 are variable) |
| 60-61 | V | 31,277,232 (16GB) | Total number of user addressable logical sectors for 28-bit commands (DWord) |
| | | 46,905,264 (24GB) | |
| | | 62,533,296 (32GB) | |

| Word | F=Fixed V=Variable X=Both | Default Value | Description |
|-------|---------------------------------|---------------|---|
| 62 | F | 0000h | Obsolete |
| 63 | V | 0007h | Multi-word DMA modes supported/selected |
| 64 | F | 0003h | PIO modes supported |
| 65 | F | 0078h | Minimum multiword DMA transfer cycle time per word |
| 66 | F | 0078h | Manufacture's recommended multiword DMA transfer cycle time |
| 67 | F | 0078h | Minimum PIO transfer cycle time without flow control |
| 68 | F | 0078h | Minimum PIO transfer cycle time with IORDY flow control |
| 69-70 | F | 0000h | Reserved(for future command overlap and queuing) |
| 71-74 | F | 0000h | Reserved for the IDENTIFY packet DEVICE command |
| 75 | F | 001Fh | 4:0 Maximum Queue depth-1=31 |
| 76 | V | 070Eh | Serial ATA capabilities |
| 77 | V | Var. | Reserved for Serial ATA |
| 78 | V | 014Ch | Serial ATA features supported |
| 79 | V | Var. | Serial ATA features enabled |
| 80 | F | 01FEh | Major Version Number |
| 81 | F | 0021h | Minor Version Number |
| 82 | F | 346Bh | Commands and feature sets supported |
| 83 | F | 7D01h | Commands and feature sets supported |
| 84 | F | 4123h | Commands and feature sets supported |
| 85 | V | 3469h | Commands and feature sets supported or enabled |
| 86 | V | BC01h | Commands and feature sets supported or enabled |
| 87 | F | 4123h | Commands and feature sets supported or enabled |
| 88 | V | 407Fh | Ultra DMA modes |
| 89 | F | 0003h | Time required for security erase unit completion |
| 90 | F | 0003h | Time required for enhanced security erase completion |
| 91 | F | 0000h | Current advanced power management value |
| 92 | V | Var. | Master Password Identifier |
| 93 | V | 0000h | Hardware reset result. The contents of bits (12:0) of this word shall change only during the execution of a hardware reset. |
| 94 | F | 0000h | Current AAM value |
| 95 | F | 0000h | Stream Minimum Request Size |
| 96 | F | 0000h | Streaming Transfer Time - DMA |
| 97 | F | 0000h | Streaming Access Latency - DMA and PIO |

| Word | F=Fixed V=Variable X=Both | Default Value | Description |
|---------|---------------------------------|----------------------------|---|
| 98-99 | F | 0000h | Streaming Performance Granularity |
| 100-103 | V | 31,277,232 (16GB) | Maximum user LBA for 48-bit Address feature set |
| | | 46,905,264 (24GB) | |
| | | 62,533,296 (32GB) | |
| 104 | F | 0000h | Streaming Transfer Time - PIO |
| 105 | F | 0008h | Maximum number of 512-byte blocks per DATA SET MANAGEMENT command |
| 106 | F | 4000h | Physical sector size/logical sector size |
| 107 | F | 0000h | Inter-seek delay for ISO-7779 acoustic testing in microseconds |
| 108-111 | V | 0000h 0000h 0000h 0000h | World wide name |
| 112-115 | F | 0000h | Reserved for word wide name extension to 128 bits |
| 116 | F | 0000h | Reserved for TLC |
| 117-118 | F | 0000h | Words per logical sector |
| 119 | F | 4010h | Commands and feature sets supported |
| 120 | F | 4010h | Commands and feature sets supported or enabled |
| 121-126 | F | 0000h | Reserved for expanded supported and enabled settings |
| 127 | F | 0000h | Removable Media Status Notification feature set support |
| 128 | V | 002xh | Security status (Bit4:1 are variable) |
| 129-159 | F | 0000h | Vendor specific |
| 160 | F | 0000h | Compact Flash Association (CFA) power mode 1 |
| 161-167 | F | 0000h | Reserved for the CompactFlash Association |
| 168 | F | 0000h | |
| 169 | F | 0001h | DATA SET MANAGEMENT command is supported |
| 170-173 | V | Var. | Additional Product Identifier (ATA String) |
| 174-175 | F | 0000h | Reserved |
| 176-205 | F | 0000h | Current media serial number (ATA string) |
| 206 | F | 003Dh | SCT Command Transport |
| 207-208 | F | 0000h | Reserved |
| 209 | F | 4000h | Alignment of logical blocks within a physical block |
| 210-211 | F | 0000h | Write-Read-Verify Sector Count Mode 3 (DWord) |
| 212-213 | F | 0000h | Write-Read-Verify Sector Count Mode 2 (DWord) |
| 214 | F | 0000h | NV Cache Capabilities |

| Word | F=Fixed V=Variable X=Both | Default Value | Description |
|---------|---------------------------------|---------------|--|
| 215-216 | F | 0000h | NV Cache Size in Logical Blocks (DWord) |
| 217 | F | 0001h | Nominal media rotation rate |
| 218 | F | 0000h | Reserved |
| 219 | F | 0000h | NV Cache Options |
| 220 | F | 0000h | 7:0 Write-Read-Verify feature set current mode |
| 221 | F | 0000h | Reserved |
| 222 | F | 1075F | Transport major version number |
| 223 | F | 0000h | Transport minor version number |
| 224-229 | F | 0000h | Reserved |
| 230-233 | F | 0000h | Extended Number of User Addressable Sectors (QWord) |
| 234 | F | 0000h | Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 235 | F | 0000h | Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 236-254 | F | 0000h | Reserved |
| 255 | V | Var. | Integrity word |

Notes:

1. F=Fixed. 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.
2. V=Variable. The state of at least one bit in a word is variable and may change depending on the state of the device or the commands executed by the device.
3. X=F or V. The content of the word may be fixed or variable.

3.2 Power Management Command Set

The **PX-xxG5Me MLC series mSATA 6Gb/s SSD** supports the power management command set, which consists of

- CHECK POWER MODE
- IDLE
- IDLE IMMEDIATE
- SLEEP
- STANDBY
- STANDBY IMMEDIATE

3.3 Security Mode Feature Set

The **PX-xxG5Me MLC series mSATA** 6 Gb/s SSD supports the Security Mode command set, which consist of

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD

3.4 SMART Command Set

The **PX-xxG5Me MLC series mSATA** SSD supports the SMART command set, which consist of

- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART ENABLE/DISABLE AUTOSAVE
- SMART RETURN STATUS

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the following optional commands.

- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ DATA
- SMART READ LOG
- SMART WRITE LOG

The table below lists the SMART commands.

Table 15 SMART commands

| Subcommand | Code | LBA Low value |
|--|------|---------------|
| SMART ATTRIBUTE VALUES (READ DATA) | D0h | |
| READ ATTRIBUTE THRESHOLDS | D1h | |
| ENABLE/DISABLE ATTRIBUTE AUTOSAVE | D2h | |
| SAVE ATTRIBUTE VALUES | D3h | |
| EXECUTE OFF-LINE IMMEDIATE | D4h | |
| EXECUTE SMART OFF-LINE ROUTINE | | 00h |
| EXECUTE SMART SHORT SELF-TEST ROUTINE (OFFLINE) | | 01h |
| EXECUTE SMART EXTENDED SELF-TEST ROUTINE (OFFLINE) | | 02h |
| ABORT OFF-LINE ROUTINE | | 7Fh |

| | | |
|--|-----|-----|
| EXECUTE SMART SHORT SELF-TEST ROUTINE (CAPTIVE) | | 81h |
| EXECUTE SMART EXTENDED SELF-TEST ROUTINE (CAPTIVE) | | 82h |
| READ LOG SECTOR | D5h | |
| WRITE LOG SECTOR | D6h | |
| ENABLE SMART OPERATIONS | D8h | |
| DISABLE SMART OPERATIONS | D9h | |
| RETURN SMART STATUS | DAh | |
| Enable/Disable Automatic OFFLINE | DBh | |

3.5 Host Protected Area Command Set

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the Host Protected Area command set which consists of

- READ NATIVE MAX ADDRESS
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- SET MAX ADDRESS EXT

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the following optional commands.

- SET MAX SET PASSWORD
- SET MAX LOCK
- SET MAX FREEZE LOCK
- SET MAX UNLOCK

3.6 48-Bit Address Command Set

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the Host Protected Area command set, which consists of

- FLUSH CACHE EXT
- READ DMA EXT
- READ NATIVE MAX ADDRESS EXT
- READ SECTOR(S) EXT
- READ VERIFY SECTOR(S) EXT
- READ MULTIPLE EXT
- SET MAX ADDRESS EXT
- WRITE DMA EXT
- WRITE MULTIPLE EXT
- WRITE MULTIPLE FUA EXT

- WRITE SECTOR(S) EXT

3.7 Device Configuration Overlay Command Set

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the Device configuration Overlay command set, which consists of

- DEVICE CONFIGURATION FREEZE LOCK
- DEVICE CONFIGURATION IDENTITY
- DEVICE CONFIGURATION RESTORE
- DEVICE CONFIGURATION SET

3.8 General Purpose log Command Set

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the general purpose log command set, which consists of

- READ LOG EXT
- WRITE LOG EXT

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4 SATA Command Sets

4.1 SATA Command

The SATA 3.0 Specification is a super set of the ATA/ATAPI-8 specification with regard to supported commands. The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the following features which are unique to the SATA 3.0 Specification.

4.1.1. Software Settings Preservation

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the SET FEATURES parameter to enable/disable the preservation of software settings.

4.1.2. Native Command Queuing

The **PX-xxG5Me MLC series mSATA** 6Gb/s SSD supports the Native Command Queuing (NCQ) command set, which includes.

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

Note: with a maximum queue depth equal to 32

5 References

This document references standards defined by a variety of organizations as listed below.

Table 16 Standards References

| Date | Title | Location |
|--|--|---|
| Dec 2008 | VCCI | http://www.vcci.or.jp/vcci_e/general/join/index.html |
| July 2007 | ROHS | Search for material description datasheet at http://intel.pcnalert.com |
| July 2007 | SFF-8144, 1.8" drive form factor | http://www.sffcommittee.org |
| February 2007 | Serial ATA Revision 2.6 | http://www.sata-io.org |
| May 2006 | SFF-8223, 2.5" Drive w/Serial Attachment Connector | http://www.sffcommittee.org |
| May 2005 | SFF-8201, 2.5" drive form factor | http://www.sffcommittee.org |
| April 2004 | ATA-7 Spec. Volume 1 | http://www.t13.org/ |
| Aug. 2009 | ATA-8 Spec. Rev 2 | http://www.t13.org/ |
| 2008 2008 2004 2005 2008 2008 | International Electro Technical Commission EB61000 4-2 Personnel Electrostatic Discharge Immunity 4-3 Electromagnetic compatibility (EMC) 4-4 Electromagnetic compatibility (EMC) 4-5 Electromagnetic compatibility (EMC) 4-6 Electromagnetic compatibility (EMC) 4-11 (Voltage variations) | http://www.iec.ch |
| 2004 | ENV 50204 (Radiated electromagnetic field from digital radio telephones) | http://www.iec.ch |

6 Terms and Acronyms

This document incorporates many industry- and device-specific words use the following list to define a variety of terms and acronyms.

Table 17 Glossary of Terms and Acronyms

| Term | Definition |
|----------|---|
| ATA | Advanced Technology Attachment |
| ATAPI | Advanced Technology Attachment Packet Interface |
| BER | Bit Error Rate, or percentage of bits that have errors relative to the total number of bits received |
| BIOS | Basic Input/Output System |
| Chipset | A term used to define a collection of integrated components required to make a PC function |
| DIPM | Device Initiated Power Management The ability of the device to request SATA link power state changes |
| DMA | Direct Memory Access |
| DRAM | Dynamic Random Access Memory |
| EXT | Extended |
| FP | First Party |
| GB | Giga-byte defined as 1×10^9 bytes |
| HCI | Host Controller Interface |
| HCT | Hardware Compatibility Test |
| HDD | Hard Disk Drive |
| HIPM | Host Initiated Power Management The ability of the host to request SATA link power state changes |
| Hot Plug | A term used to describe the removal or insertion of a SATA hard drive when the system is powered on |
| IOPS | Input output operations per second |
| LBA | Logical Block Address |
| LPM | Link Power Management: the ability of the SATA link layer to enter one of two lower power consuming states, partial and slumber |
| MB | Mega-bytes defined as 1×10^6 bytes |
| mSATA | Mini-SATA |
| MTBF | Mean time between failure |
| NCQ | Native Command Queuing |

| | |
|-------------|--|
| | The ability of the SATA hard drive to re-order commands in order to maximize the efficiency of gathering data from the platters |
| NOP | No operation |
| NTFS | NT file system |
| OEM | Original Equipment Manufacturer |
| OS | Operation System |
| Port | The point at which a SATA drive physically connected to the SATA controller |
| RAID | Redundant Array of Independent Disks |
| RMS | Root Mean Squared |
| RPM | Revolutions per Minute |
| RTM | Release to Manufacture |
| SATA | Serial ATA |
| SFF | Small Form Factor |
| SMART | Self-Monitoring, Analysis and reporting Technology An open standard for developing hard drive and software systems that automatically monitors a hard drive's health and reports potential problems |
| SSD | Solid State Drive |
| TBD | To Be Determined |
| WHQL | Microsoft* Windows Hardware Quality Labs |
| Write Cache | A memory device within a hard drive, which is allocated for the temporary storage of data before that data is copied to its permanent storage location |
| VCCI | Voluntary Control Council for Interface |