

> XG5 SERIES CLIENT SSD

XG5 series SSDs feature Toshiba's latest 64-layer, 3D TLC (3-bit-per-cell) flash memory BiCS FLASH™. This new line of NVMe™ based client SSDs deliver high performance up to 3000 MB/s of sequential read and 2100 MB/s of sequential write with a maximum interface bandwidth of 32 GT/s. XG5 series SSDs also feature an SLC cache to accelerate burst type workloads, as well as improved power consumption comparing to prior generation XG3, making these SSDs an efficient option for high performance mobile computing.

XG5 Series SSDs are available in 256GB, 512GB and 1024GB capacities in compact single-sided M.2 2280 form factors.

Self-encrypting drive (SED) models supporting TCG Opal Version 2.01 are also offered, making the new series highly suited to address data security needs for commercial PCs or other business applications.

SSD



> KEY FEATURES

- Toshiba 64-Layer BiCS FLASH™
- PCIe® Gen3*4L NVMe™
- Capacities up to 1024GB
- M.2 2280 Single-sided
- TCG OPAL 2.01 Optional for SED

> APPLICATIONS

- Thin performance Notebook
- Enthusiast Desktop/Laptop
- Mainstream PC Computing
- Server/Storage Boot

* Availability of the SED model line-up may vary by region.

> SPECIFICATIONS

| Standard Models | | M.2 2280-S2 (Single-sided) | | |
|--------------------------------------|------------------|--|------------------------------|------------------------------|
| Model Number | | KXG50ZNV256G KXG5AZNV256G | KXG50ZNV512G KXG5AZNV512G | KXG50ZNV1T02 KXG5AZNV1T02 |
| Memory | | TOSHIBA BiCS FLASH™ | | |
| Interface | | PCI Express® Base Specification Revision 3.1 (PCIe®) | | |
| Maximum Speed | | 32 GT/s (PCIe® Gen3x4 Lane) | | |
| Command | | NVM Express™ Revision 1.2.1 (NVMe™) | | |
| Connector Type | | M.2 M | | |
| Formatted Capacity ¹⁾ | | 256 GB | 512 GB | 1,024 GB |
| Performance ²⁾ (Up to) | Sequential Read | 2,700 MB/s {2,580 MiB/s} | 3,000 MB/s {2,900 MiB/s} | |
| | Sequential Write | 1,050 MB/s {1,000 MiB/s} | | 2,100 MB/s {2,000 MiB/s} |
| Supply Voltage | | 3.3 V ±5 % | | |
| Power Consumption | Active | 4.0 W typ. | 4.3 W typ. | 4.5 W typ. |
| | L1.2 mode | 3 mW typ. | | |
| Size | | 80.0 mm x 22.0 mm x 2.23 mm | | |
| Weight | | 7.0 g typ. | 7.3 g typ. | |

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| Standard Models | | M.2 2280-S2 (Single-sided) |
|---------------------------|---------------|--|
| Temperature | Operating | 0 to 95 °C (Controller Temperature) 0 to 85 °C (Other Components Temperature) |
| | Non-operating | -40 to 85 °C |
| Reliability ³⁾ | | Mean Time to Failure (MTTF): 1,500,000 hours Product Life: Approximately 5 years |
| More Features | | <ul style="list-style-type: none"> · Device Self-test is supported. · Host Controlled Thermal Management (HCTM) is supported. · Strong & highly-efficient ECC named QSBC™ is supported. · TCG Pyrite Version 1.00 is supported. · Storage Interface Interactions Specification(SIIS) Version 1.06 is supported. |
| Compliance | | UL, cUL, TÜV, KC, FCC, BSMI, CE, RCM, IC, VCCI |

Note: 1) Definition of capacity: Toshiba defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2³⁰ = 1,073,741,824 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

2) 1 MiB (mebibyte) = 2²⁰ bytes = 1,048,576 bytes, and 1 MB (megabyte) = 1,000,000 bytes.

3) MTTF (Mean Time to Failure) is not a guarantee or estimate of product life; it is a statistical value related to mean failure rates for a large number of products which may not accurately reflect actual operation. Actual operating life of the product may be different from the MTTF.

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* NVMe™ and NVM Express™ are trademarks of NVM Express, Inc.

* Product image may represent a design model.

* Read and write speed may vary depending on the host device, read and write conditions, and file size.

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/ > ORDERING INFORMATION

| | | | | | | | |
|----------|-----------|----------|----------|----------|----------|----------|-------------|
| <u>K</u> | <u>XX</u> | <u>X</u> | <u>X</u> | <u>X</u> | <u>X</u> | <u>X</u> | <u>XXXX</u> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

- | | | |
|----|------------------------|--|
| 1. | Product Name | K: SSD product |
| 2. | Product Category | XG: XG Series |
| 3. | Development Generation | 5: Generation 5 |
| 4. | Option Code 1 | 0: Non-SED A: SED |
| 5. | Option Code 2 | Z: No-option |
| 6. | Connector Type | N: M.2 M (PCI Express® I/F) |
| 7. | Form Factor | V: M.2 2280 Single Sided/M.2 M type |
| 8. | Capacity | 128G / 256G / 512G /1T02 128G is 128 GB, 256G is 256 GB, 512G is 512 GB and 1T02 is 1024 GB (1 GB = 1,000,000,000 bytes) |

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> PRODUCT LINE UP

| Model Number | Formatted Capacity | Form Factor/Connect Type | Function Note |
|--------------|--------------------|-------------------------------------|-------------------|
| KXG50ZNV256G | 256 GB | M.2 2280-S2 ¹⁾ -M module | Non- SED |
| KXG50ZNV512G | 512 GB | | |
| KXG50ZNV1T02 | 1,024 GB | | |
| KXG5AZNV256G | 256 GB | | SED ²⁾ |
| KXG5AZNV512G | 512 GB | | |
| KXG5AZNV1T02 | 1,024 GB | | |

Note: 1) Single Sided

2) Availability of the SED model line-up may vary by region.

> CAPACITY

| Capacity | Total Number of User Addressable Sectors in LBA Mode | |
|----------|--|--------------------|
| | 512 bytes sector | 4,096 bytes sector |
| 256 GB | 500,118,192 | 62,514,774 |
| 512 GB | 1,000,215,216 | 125,026,902 |
| 1,024 GB | 2,000,409,264 | 250,051,158 |

Note: 1 GB (Gigabyte) = 1,000,000,000 bytes

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> PERFORMANCE

| Standard Models | KXG50ZNV256G KXG5AZNV256G | KXG50ZNV512G KXG5AZNV512G | KXG50ZNV1T02 KXG5AZNV1T02 |
|--|---|------------------------------|------------------------------|
| Interface Speed | 32 GT/s (Gen3x4 Lane), 20 GT/s (Gen2x4 Lane), 16 GT/s (Gen3x2 Lane), 10 GT/s (Gen2x2 Lane) | | |
| @32GT/s | | | |
| Sequential Read ¹⁾ (Up to) | 2,700 MB/s {2,580 MiB/s} | 3,000 MB/s {2,900 MiB/s} | 3,000 MB/s {2,900 MiB/s} |
| Sequential Write ²⁾³⁾ (Up to) | 1,050 MB/s {1,000 MiB/s} | 1,050 MB/s {1,000 MiB/s} | 2,100 MB/s {2,000 MiB/s} |
| Time from Power-on to process the Admin Commands ⁴⁾ | 100 ms typ. | | |
| Time from Power-on to process the I/O Commnads ⁴⁾ | 100 ms typ. | | |

Note: 1) Under the condition of measurement with 128 KiB unit sequential access (1 KiB = 1024 bytes) and queue depth is 64.
 2) Under the condition of measurement with 128 KiB unit sequential access with 4KiB (1 KiB = 1024 bytes) align and queue depth is 64.
 3) SLC cache is effective.
 4) After unexpected power down, it may increase up to 10 s.

> SUPPLY VOLTAGE

| Standard Models | M.2 2280 Module |
|----------------------------|------------------------------|
| Allowable voltage | 3.3 V ±5 % |
| Allowable noise/ripple | 100 mV p-p or less, 0-10 MHz |
| Allowable supply rise time | 2 –100 ms |

Note: The drive has over current protection circuit. (Rated current: 3.15A)

> POWER CONSUMPTION

| Operation (Ta 1)=25°C | M.2 2280 Module | | |
|-----------------------------|------------------------------|------------------------------|------------------------------|
| | KXG50ZNV256G KXG5AZNV256G | KXG50ZNV512G KXG5AZNV512G | KXG50ZNV1T02 KXG5AZNV1T02 |
| Read ²⁾ | 4.0 W typ. | 4.3 W typ. | 4.5 W typ. |
| Write ²⁾ | 2.6 W typ. | 2.6 W typ. | 3.4 W typ. |
| Power State 3 ³⁾ | 50.0 mW typ. | 50.0 mW typ. | 50.0 mW typ. |
| Power State 4 ³⁾ | 5.0 mW typ. | 5.0 mW typ. | 5.0 mW typ. |
| Power State 5 ³⁾ | 3.0 mW typ. | 3.0 mW typ. | 3.0 mW typ. |

Note: 1) Ambient Temperature
 2) The values are specified at the condition causing maximum power consumption and Power State 0.
 3) PCIe Link state is L1.2. Power consumption during the Admin command processing is excluded.

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ENVIRONMENTAL CONDITIONS

> TEMPERATURE

| Condition | Range | Gradient |
|------------------------------|--|------------------------|
| Operating ¹⁾ | 0°C (Tc) – 95°C (Tc) (Controller Temperature) 0°C (Tc) – 95°C (Tc) (Other Components Temperature) | 30 °C (Ta) / h maximum |
| Non-operating | -40 °C – 85 °C | 30 °C / h maximum |
| Under Shipment ²⁾ | -40 °C – 85 °C | 30 °C / h maximum |

Note: 1) Ta: Ambient Temperature, Tc: Components Temperature

2) Packaged in Toshiba's original shipping package

> HUMIDITY

| Condition | Range |
|------------------------------|---|
| Operating | 8 % – 90 % R.H. (No condensation) |
| Non-operating | 8 % – 95 % R.H. (No condensation) |
| Under Shipment ¹⁾ | 5 % – 95 % R.H. |
| Max. wet bulb | 32.5 °C (Operating) 40.0 °C (Non-operating / Shipping) |

Note: 1) Packaged in Toshiba's original shipping package

> SHOCK

| Condition | Range |
|---------------|---|
| Operating | 14.709 km/s ² {1,500 G}, 0.5 ms half sine wave |
| Non-operating | |

> VIBRATION

| Condition | Range |
|---------------|---|
| Operating | 196 m/s ² {20 G} Peak, 10 - 2,000 Hz (20 minutes per axis) x 3 axis |
| Non-operating | |

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COMPLIANCE

> SAFETY / EMI STANDARDS

| Title | Description | Region |
|---|--------------------------|------------------------|
| UL (Underwriters Laboratories) | UL 60950-1 | USA ¹⁾ |
| cUL (Underwriters Laboratories of Canada) | CSA-C22.2 No.60950-1-07 | Canada |
| TÜV (Technischer Überwachungs Verein) | EN 60950-1 | EURO |
| KC | KN32, KN35 | Korea |
| FCC | FCC part 15 Subpart B | USA |
| BSMI (Bureau of Standards, Metrology and Inspection) | CNS13438 (CISPR Pub. 22) | Taiwan |
| CE | EN 55032, EN 55024 | EURO |
| RCM | AS/NZS CISPR 32 | Australia, New Zealand |
| ISED | ICES-003 | Canada |
| VCCI | VCCI-CISPR32 | Japan |

Note: 1) UL certification is basically on a voluntary basis.

> RELIABILITY

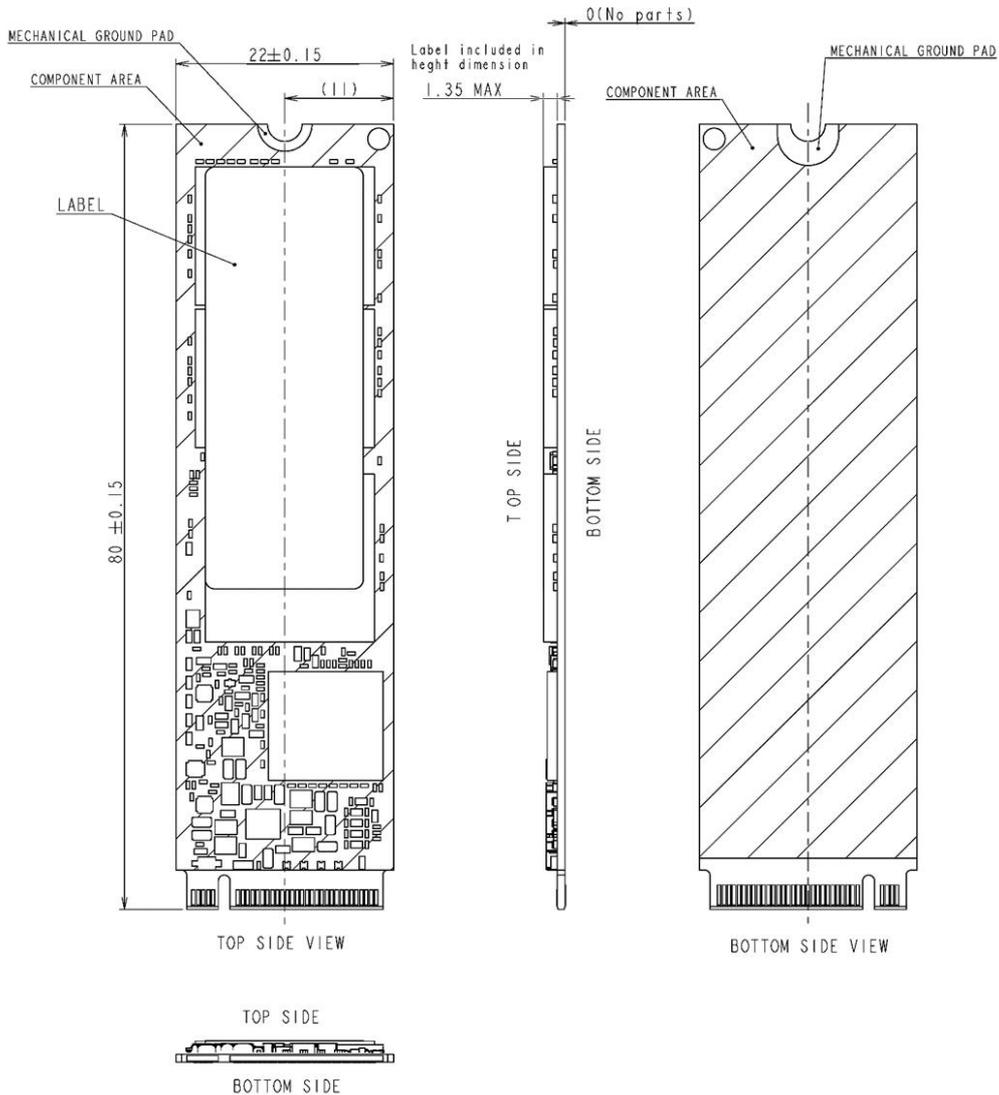
| Parameter | Value |
|----------------------|-----------------------|
| Mean Time to Failure | 1,500,000 hours |
| Product Life | Approximately 5 years |

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MECHANICAL SPECIFICATIONS

> **M.2 2280 MODULE**

| Model Number | Weight | Width | Height | Length |
|------------------------------|------------|----------|---------|----------|
| KXG50ZNV256G KXG5AZNV256G | 7.0 g typ. | 22.00 mm | 2.23 mm | 80.00 mm |
| KXG50ZNV512G KXG5AZNV512G | 7.3 g typ. | | | |
| KXG50ZNV1T02 KXG5AZNV1T02 | 7.3 g typ. | | | |



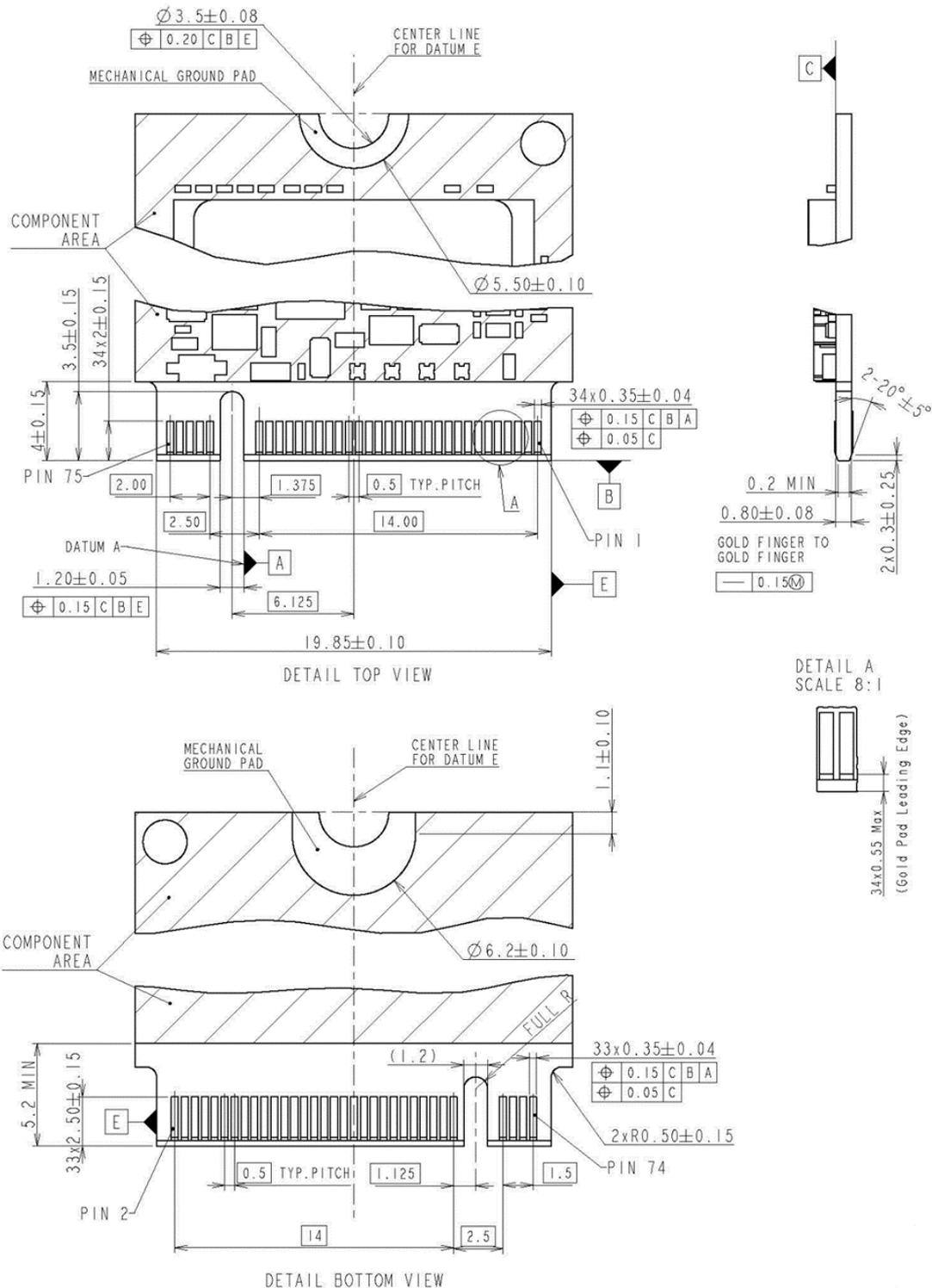
Unit:mm

Figure 1: Dimension of KXG5xZNVxxxx (M.2 2280-S2 Module)

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INTERFACE CONNECTOR

> M.2 2280 MODULE INTERFACE CONNECTOR



Unit:mm

Figure 2: Interface Dimensions of KXG5xZNVxxxx (M.2 2280 Module)

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> PIN ASSIGNMENT ON M.2 2280 MODULE CONNECTOR

| Pin # | Name | Description |
|-------|----------|-----------------------------------|
| 1 | GND | GND |
| 3 | GND | GND |
| 5 | PETn3 | PCIe Lane 3 Device Transmitter |
| 7 | PETp3 | |
| 9 | GND | GND |
| 11 | PERn3 | PCIe Lane 3 Device Receiver |
| 13 | PERp3 | |
| 15 | GND | GND |
| 17 | PETn2 | PCIe Lane 2 Device Transmitter |
| 19 | PETp2 | |
| 21 | GND | GND |
| 23 | PERn2 | PCIe Lane 2 Device Receiver |
| 25 | PERp2 | |
| 27 | GND | GND |
| 29 | PETn1 | PCIe Lane 1 Device Transmitter |
| 31 | PETp1 | |
| 33 | GND | GND |
| 35 | PERn1 | PCIe Lane 1 Device Receiver |
| 37 | PERp1 | |
| 39 | GND | GND |
| 41 | PETn0 | PCIe Lane 0 Device Transmitter |
| 43 | PETp0 | |
| 45 | GND | GND |
| 47 | PERn0 | PCIe Lane 0 Device Receiver |
| 49 | PERp0 | |
| 51 | GND | GND |
| 53 | REFCLKn | PCIe Reference Clock |
| 55 | REFCLKp | PCIe Reference Clock |
| 57 | GND | GND |
| Notch | | |
| 67 | Reserved | NC |
| 69 | PEDET | NC-PCIe |
| 71 | GND | GND |
| 73 | GND | GND |
| 75 | GND | GND |

| Pin # | Name | Description |
|-------|----------------------|--|
| 2 | +3.3V | 3.3 V Source |
| 4 | +3.3V | 3.3 V Source |
| 6 | Reserved | NC |
| 8 | Reserved | NC |
| 10 | LED1# | Device Activity |
| 12 | +3.3V | 3.3 V Source |
| 14 | +3.3V | 3.3 V Source |
| 16 | +3.3V | 3.3 V Source |
| 18 | +3.3V | 3.3 V Source |
| 20 | Reserved | NC |
| 22 | Reserved | NC |
| 24 | Reserved | NC |
| 26 | Reserved | NC |
| 28 | Reserved | NC |
| 30 | Reserved | NC |
| 32 | Reserved | NC |
| 34 | Reserved | NC |
| 36 | Reserved | NC |
| 38 | Reserved | NC |
| 40 | Reserved | NC |
| 42 | Reserved | NC |
| 44 | Reserved | NC |
| 46 | Reserved | NC |
| 48 | Reserved | NC |
| 50 | PERST# ¹⁾ | PE-Reset |
| 52 | CLKREQ# | Clock Request |
| 54 | PEWAKE# | NC |
| 56 | MFG1 | Manufacturing pin. Must be no- connect on the host board. |
| 58 | MFG2 | |
| Notch | | |
| 68 | SUSCLK | NC |
| 70 | +3.3V | 3.3 V Source |
| 72 | +3.3V | 3.3 V Source |
| 74 | +3.3V | 3.3 V Source |

Note: 1) The drive can't detect PERST# in L1.2.

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> COMMAND TABLE

ADMIN Command set

| Op-Code | Command Name |
|---------|-----------------------------|
| 00h | Delete I/O Submission Queue |
| 01h | Create I/O Submission Queue |
| 02h | Get Log Page |
| 04h | Delete I/O Completion Queue |
| 05h | Create I/O Completion Queue |
| 06h | Identify |
| 08h | Abort |
| 09h | Set Features |
| 0Ah | Get Features |
| 0Ch | Asynchronous Event Request |
| 10h | Firmware Commit |
| 11h | Firmware Image Download |
| 14h | Device Self-Test (DST) |
| 80h | Format NVM |
| 81h | Security Send |
| 82h | Security Receive |

Set Features / Get Features Set

| Op-Code | Feature Name |
|---------|---|
| 01h | Arbitration |
| 02h | Power Management |
| 03h | LBA Range Type |
| 04h | Temperature Threshold |
| 05h | Error Recovery |
| 06h | Volatile Write Cache |
| 07h | Number of Queues |
| 08h | Interrupt Coalescing |
| 09h | Interrupt Vector Configuration |
| 0Ah | Write Atomicity Normal |
| 0Bh | Asynchronous Event Configuration |
| 0Ch | Autonomous Power State Transition |
| 0Eh | Time Stamp |
| 10h | Host Controlled Thermal Management (HCTM) |
| 80h | Software Progress Marker |

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NVM Command Set

| Op-Code | Command Name |
|---------|---------------------|
| 00h | Flush |
| 01h | Write |
| 02h | Read |
| 04h | Write Uncorrectable |
| 05h | Compare |
| 08h | Write Zeroes |
| 09h | Dataset Management |

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