

Amtron Technology, Inc.

Industrial Grade M.2 SATA SSD

AS Series

Product Datasheet

V1.5

Table of Contents

1.	Introduction.....	4
1.1.	Description.....	4
1.2.	Product Features.....	4
1.3.	Product Overview	5
1.4.	Product Dimension	6
1.5.	Block Diagram	8
2.	Product Specifications.....	9
2.1.	Specifications	9
2.2.	MTBF	13
2.3.	Certification	13
2.4.	Compliance	13
3.	Environmental Specifications	14
3.1.	Environmental Conditions	14
3.1.1.	Temperature and Humidity.....	14
3.1.2.	Shock.....	15
3.1.3.	Vibration	15
3.1.4.	Drop	15
3.1.5.	Bending.....	16
3.1.6.	Electrostatic Discharge (ESD).....	16
4.	Electrical Specifications	17
4.1.	Supply Voltage	17
4.2.	Power Consumption	17
5.	Interface	19
5.1.	Pin Assignment and Descriptions	19
6.	Supported Commands.....	22
6.1.	ATA Command List	22
6.2.	Identify Device Data.....	25
6.3.	Write Protect Function (Optional).....	28
6.4.	Quick Erase Function (Optional).....	28
7.	Power Loss Protection (PLP)	29
7.1.	General Description	29

7.2. Data Protection 29

8. ACRONYMS..... 31

9. Part Number Decoder 32

1. INTRODUCTION



1.1. Description

Amtron industrial grade AS series M.2 2280 form factor SATA SSD is designed with SATA I/II/III interface and is fully compliant with the standard Next Generation Form Factor (NGFF). It can reach up to 520 MB/s read and 430 MB/s write high performance. These industrial M.2 SATA SSDs are offered in standard temperature grade (0°C to +70°C) and wide temperature grade (-40°C to +85°C). The memory capacities are available from 4GB to 512GB.

1.2. Product Features

- M.2 2280 form factor
- SATA Version 3.1
- RoHS compliant [Lead free]
- SLC and MLC NAND Flash
- Capacity
 - SLC: 4GB up to 64GB
 - pSLC: 32GB up to 256GB
 - MLC: 8GB up to 512GB
- Read: 520 MB/s max. , Write: 430 MB/s max
- Endure severe thermal and dynamic environments
- Very low power consumption
- Features (Optional)
 - Write protection (WP)
 - Quick erase jumper (QEJ)
 - Power Loss Protection (PLP)
 - Conformal coating (CC)
- MTBF *
 - SLC: >3,000,000 hours
 - pSLC: >2,500,000 hours
 - MLC: >2,000,000 hours
- Support SMART and TRIM Command
- Controlled Bill of Materials (BOM)

***Note:** A lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document

1.3. Product Overview

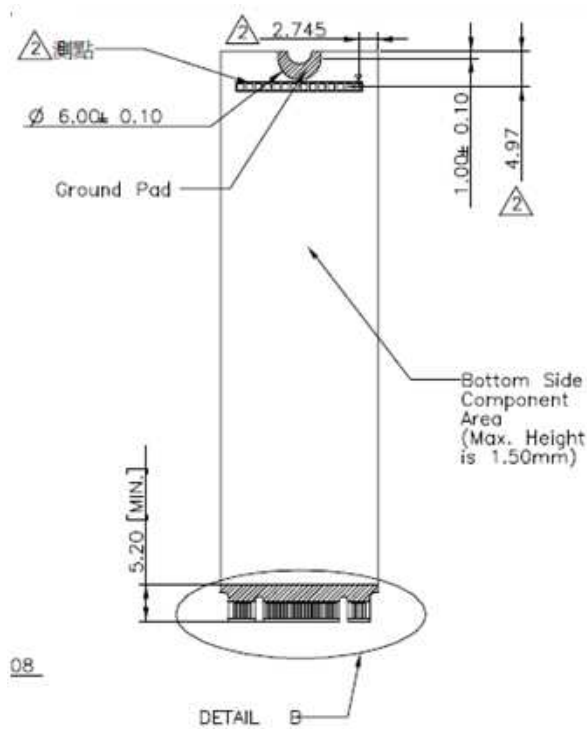
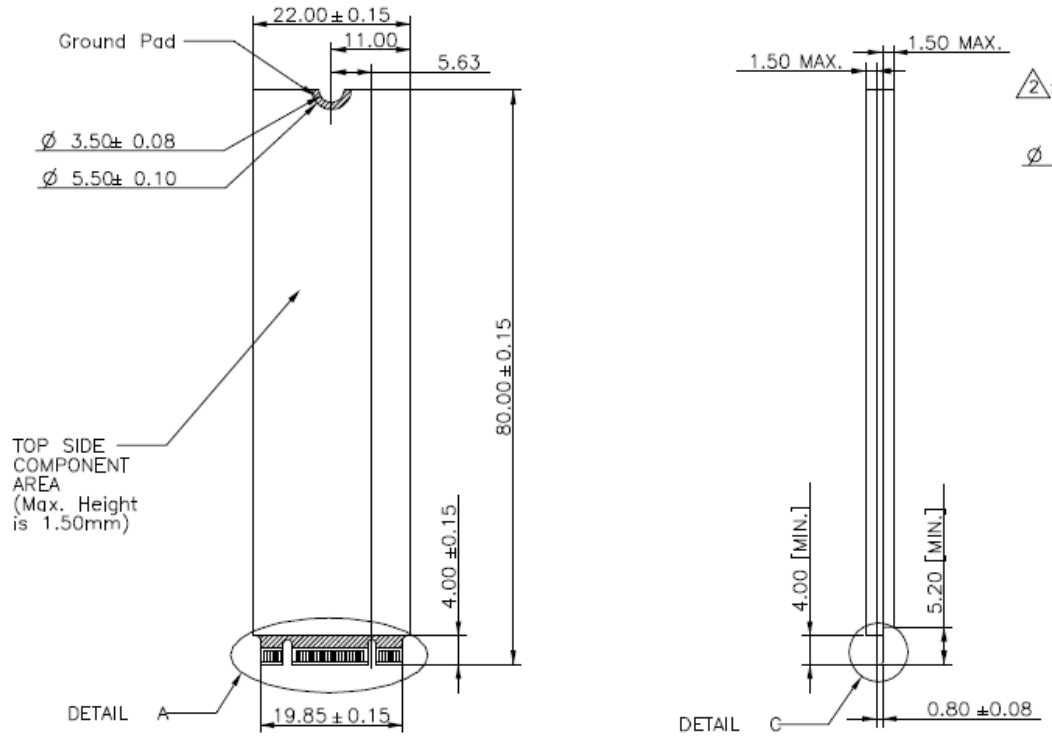
- **SATA Interface**
 - SATA 3.1
- **Form Factor**
 - M.2 2280
- **Capacity**
 - SLC: 4GB to 64GB
 - pSLC: 32GB to 256GB
 - MLC: 8GB to 512GB
- **Flash Interface**
 - Flash Type: SLC and MLC
- **Performance**
 - Read: 520 MB/s max.
 - Write: 430 MB/s max.
- **TBW (Terabyte Written)**
 - SLC: 1873 TBW for 64GB
 - pSLC: 705 TBW for 512GB
 - MLC: 3024 TBW for 256GB
- **Reliability / MTBF ¹**
 - SLC: > 3,000,000 hours
 - pSLC: > 2,500,000 hours
 - MLC: > 2,000,000 hours
- **Power Consumption ²**
 - Active mode: < 3,870mW
 - Idle mode: < 510mW
- **Advanced Flash Management**
 - Static and Dynamic Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Low Power Management**
 - DIPM/HIPM Mode
- **Temperature Range**
 - Operation (standard): 0°C to 70°C
 - Operation (wide): -40°C to 85°C
 - Storage: -40°C to 85°C
- **Features (Optional) ³**
 - Write protection (WP)
 - Quick erase jumper (QEJ)
 - Power Loss Protection (PLP)
 - Conformal coating (CC)
- **Security (Optional) ³**
 - AES 256 encryption
 - SHA 256
 - TCG OPAL 2.0 compliant
- **Compliant**
 - RoHS
 - CE
 - FCC

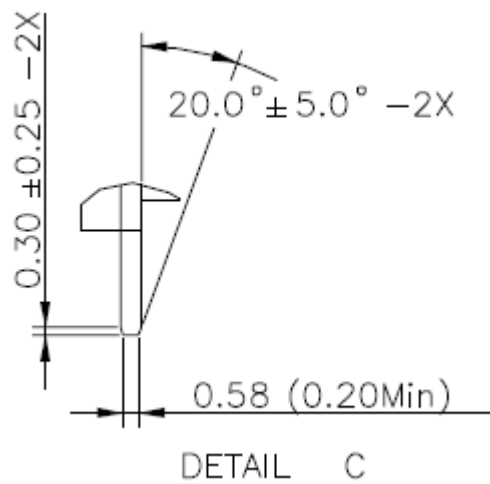
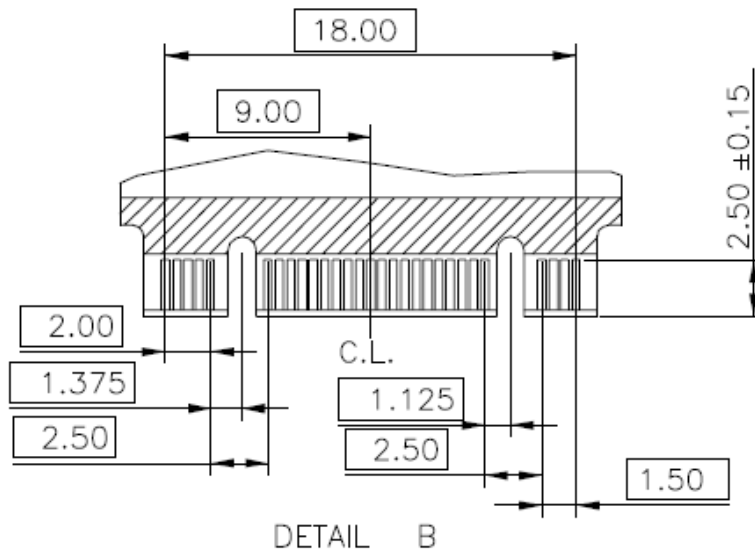
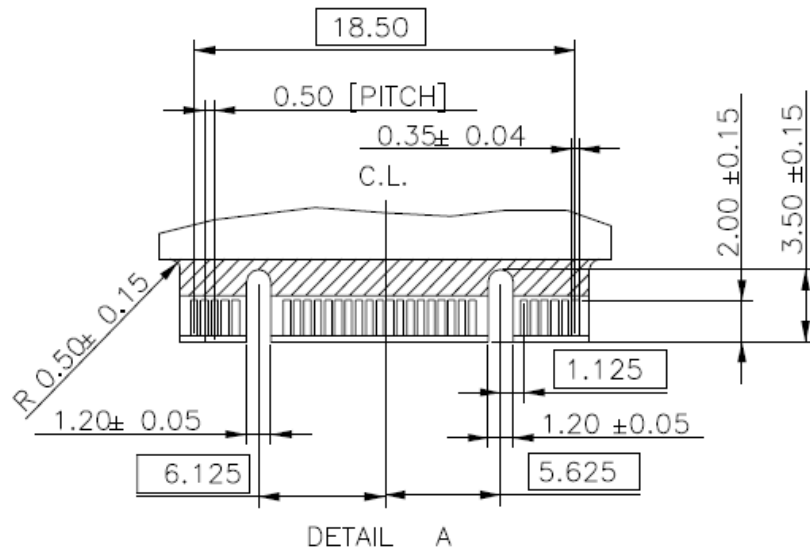
Note:

1. **MTBF** (mean time between failures) is a measure of how reliable a hardware product is. Its value represents the average time between a failure repair and the next failure. The unit of MTBF is typically in hours. The higher the MTBF value, the higher the reliability of the product. Please note that a lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document.
2. See Section 4.2 “Power Consumption” for details.
3. Optional features. See Section 8 “Part Number Decoder”.

1.4. Product Dimension

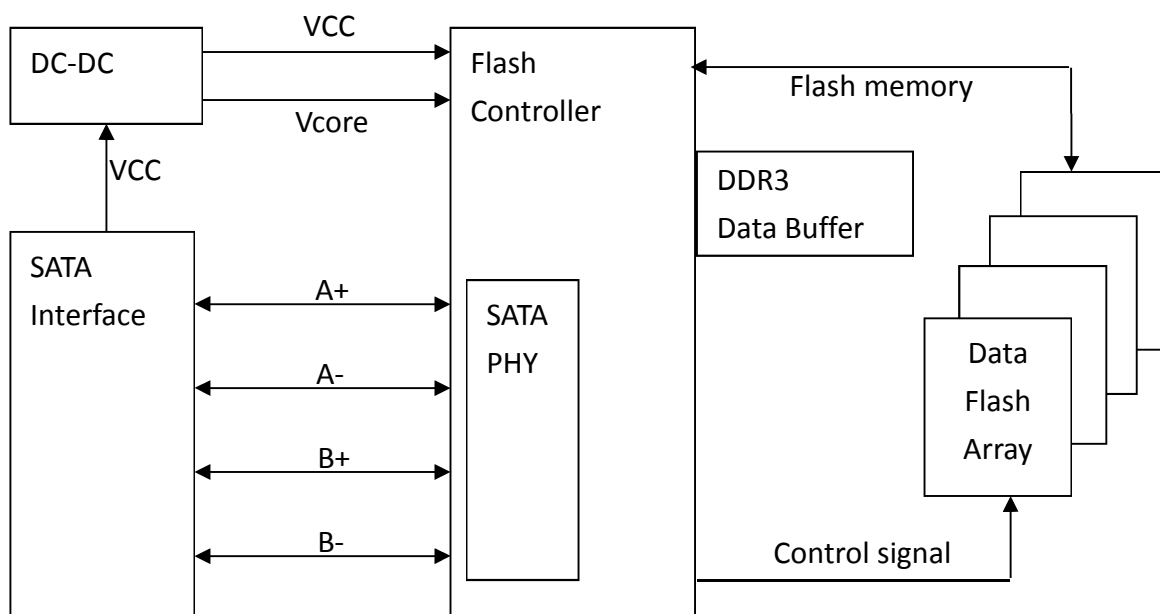
80mm (L) x 22mm (W) x 4mm (H)





Unit : mm

1.5. Block Diagram



M.2 2280 SATA SSD Block Diagram

2. PRODUCT SPECIFICATIONS



2.1. Specifications

- **Capacity**
 - SLC: From 4GB up to 64GB (support 48-bit addressing mode)
 - MLC: From 8GB up to 512GB (support 48-bit addressing mode)
 - pSLC: From 32GB up to 256GB (support 48-bit addressing mode)
- **Electrical/Physical Interface**
 - SATA Interface
 - ◆ Compliant with SATA Revision 3.1
 - ◆ Industrial Standard ATA/ATAPI-8 and ACS-2 command compliant
 - ◆ Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
 - ◆ Native Command Queuing up to 32 commands
 - ◆ Support SATA Device Sleep mode (Optional)
 - ◆ Supports 28-bit and 48-bit LBA (Logical Block Addressing) mode commands
- **Supported NAND Flash**
 - Supports 1x/1y/2x/2y/3xnm SLC and MLC
 - Supports ONFI 3.0, Toggle 2.0
 - Supports 8KB and 16KB page size
 - Supports 1-plane, 2-plane, and 4-plane operation
- **ECC Scheme**
 - Up to 66 bits / 1K Byte
- **Support SMART and TRIM commands**
- **Support Power Loss Protection (Optional)**
 - Protect data loss, even the last data, during write process when power sudden off.
 - Add-on Polymer Tantalum Capacitors hold-up several milliseconds for sending DRAM data to NAND Flash.
- **Support Hardware Quick Erase Function (Optional)**
- **Support Hardware Write Protect Function (Optional)**

- **Capacity Information**

Capacity	Cylinders	Heads	Sectors	Total Sectors	User Data Size
4GB	7,671	16	63	7,732,368	Depended on file management
8GB	15,343	16	63	15,465,744	
16GB	16,383	15	63	30,932,992	
32GB	16,383	15	63	61,865,984	
64GB	16,383	15	63	123,731,968	
128GB	16,383	15	63	247,463,936	
256GB	16,383	15	63	494,927,872	
512GB	16,383	15	63	989,855,744	

- **Performance**

- **SLC**

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
4GB	4GB x 1	24nm, TSOP	38	20
8GB	8GB x 1	24nm, TSOP	40	38
	4GB x 2	24nm, TSOP	76	40
16GB	16GB x 1	24nm, TSOP	42	40
	8GB x 2	24nm, TSOP	85	80
32GB	16GB x 2	24nm, TSOP	85	80
64GB	32GB x 2	24nm, BGA	TBD	TBD

- **MLC:**

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
8GB	8GB x 1	15nm, TSOP	140	25
16GB	8GB x 2	15nm, TSOP	280	50
	16GB x 1	15nm, TSOP	140	23
32GB	16GB x 2	15nm, TSOP	280	45
	32GB x 1	15nm, BGA	280	45
64GB	32GB x 2	15nm, BGA	510	90
	64GB x 1	15nm, BGA	340	90
128GB	64GB x 2	15nm, BGA	520	180
256GB	128GB x 2	15nm, BGA	520	350
512GB	256GB x 2	15nm, BGA	520	430

■ pSLC:

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
32GB	32GB x 2	15nm, BGA	520	200
	64GB x 1	15nm, BGA	350	230
64GB	64GB x 2	15nm, BGA	520	430
128GB	128GB x 2	15nm, BGA	520	430
256GB	256GB x 2	15nm, BGA	520	430

Notes:

1. The performance was estimated based on Toshiba SLC / MLC NAND flash.
2. Performance may differ according to flash configuration and platform.
3. The table above is for reference only.

- **TBW (Terabytes Written)**

- **SLC:**

Capacity	Flash Structure	TBW
4GB	4GB x 1	117
8GB	8GB x 1	234
16GB	8GB x 2	468
32GB	16GB x 2	936
64GB	32GB x 2	1873

- **MLC:**

Capacity	Flash Structure	TBW
8GB	8GB x 1	11
16GB	16GB x 1	22
32GB	32GB x 1	44
64GB	32GB x 2	88
128GB	64GB x 2	176
256GB	128GB x 2	352
512GB	256GB x 2	705

- **pSLC:**

Capacity	Flash Structure	TBW
32GB	32GB x 2	378
64GB	64GB x 2	756
128GB	128GB x 2	1512
256GB	256GB x 2	3024

Notes:

1. Samples were built using Toshiba SLC and MLC NAND flash.
2. TBW may differ according to flash configuration and platform.

2.2. MTBF

MTBF (mean time between failures) is a measure of how reliable a hardware product is. Its value represents the average time between a failure repair and the next failure. The unit of MTBF is typically in hours. The higher the MTBF value, the higher the reliability of the product. The MTBF calculated in this document is based on a software tool, Relx 7.3 . Please note that a lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document.

- SLC: >3,000,000 hours
- pSLC: >2,500,000 hours
- MLC: >2,000,000 hours

2.3. Certification

- RoHS
- CE
- FCC

2.4. Compliance

- SATA III (SATA Rev. 3.1)
- ATA/ATAPI-8 (Including S.M.A.R.T)

3. ENVIRONMENTAL SPECIFICATIONS



3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- Temperature:
 - ◆ Storage: -40°C to 85°C
 - ◆ Operational (Standard grade): 0°C to 70°C
 - ◆ Operational (Wide grade): -40°C to 85°C
- Humidity:
 - ◆ Standard grade: RH 90% under 40°C (operational)
 - ◆ Wide grade: RH 95% under 55°C (operational)

■ High Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	70°C	0% RH	72 hours
Operation (Wide)	85°C	0% RH	72 hours
Storage (Standard)	85°C	0% RH	72 hours
Storage (Wide)	85°C	0% RH	168 hours

Result: No abnormality is detected.

■ Low Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	0°C	0% RH	72 hours
Operation (Wide)	-40°C	0% RH	72 hours
Storage (Standard)	-40°C	0% RH	72 hours
Storage (Wide)	-40°C	0% RH	168 hours

Result: No abnormality is detected.

■ High Humidity Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	40°C	93% RH	24 hours
Operation (Wide)	55°C	95% RH	72 hours
Storage (Standard)	40°C	95% RH	72 hours
Storage (Wide)	55°C	95% RH	96 hours

Result: No abnormality is detected.

■ Temperature Cycle Test

	Temperature	Test Time	Cycle
Operation (Standard)	0°C	30 min	10 cycles
	70°C	30 min	
Operation (Wide)	-40°C	30 min	20 cycles
	85°C	30 min	
Storage (Standard)	-40°C	30 min	10 cycles
	85°C	30 min	
Storage (Wide)	-40°C	30 min	50 cycles
	85°C	30 min	

Result: No abnormality is detected.

3.1.2. Shock

■ Shock Specification

	Acceleration Force	Half Sin Pulse Duration
Non-Operational	1500G	0.5ms
Operational	1500G	0.5ms

Result: No abnormality is detected when power on.

3.1.3. Vibration

■ Vibration Specification

	Condition		Vibration Orientation
	Frequency/Displacement	Frequency/Acceleration	
Operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G	X, Y, Z axis/60 min for each

Result: No abnormality is detected when power on.

3.1.4. Drop

■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	80cm free fall	6 face of each unit, 2 times each

Result: No abnormality is detected when power on.

3.1.5. Bending

■ Bending Specification

	Force	Action
Non-operational	≥ 20N	Hold 1min/5times

Result: No abnormality is detected when power on.

3.1.6. Electrostatic Discharge (ESD)

■ Contact ESD Specification

Device	Capacity	Temperature	Relative Humidity	+/- 4KV	Result
M.2 2280	256GB	24.0°C	49% (RH)	Device functions are affected, but EUT will be back to its normal or operational state automatically.	PASS

4. ELECTRICAL SPECIFICATIONS



4.1. Supply Voltage

Parameter	Rating
Operating Voltage	3.3V

4.2. Power Consumption

■ SLC

Capacity	Flash Structure	Flash Type	Read	Write	Idle
4GB	4GB x 1	24nm, TSOP	700	700	315
8GB	8GB x 1	24nm, TSOP	935	945	385
	4GB x 2	24nm, TSOP	790	790	320
16GB	16GB x 1	24nm, TSOP	935	935	385
	8GB x 2	24nm, TSOP	1300	1340	450
32GB	16GB x 2	24nm, TSOP	1170	1170	385
64GB	32GB x 2	24nm, BGA	TBD	TBD	TBD

Unit: mW

■ MLC

Capacity	Flash Structure	Flash Type	Read	Write	Idle
8GB	8GB x 1	15nm, TSOP	830	850	350
16GB	8GB x 2	15nm, TSOP	890	875	350
	16GB x 1	15nm, TSOP	830	850	350
32GB	16GB x 2	15nm, TSOP	890	875	350
	32GB x 1	15nm, BGA	1220	1210	445
64GB	32GB x 2	15nm, BGA	1710	1650	455
	64GB x 1	15nm, BGA	1385	1380	445
128GB	64GB x 2	15nm, BGA	2260	2265	460
256GB	128GB x 2	15nm, BGA	3800	3790	470
512GB	256GB x 2	15nm, BGA	3800	3870	510

Unit: mW

■ **pSLC**

Capacity	Flash Structure	Flash Type	Read	Write	Idle
32GB	32GB x 2	15nm, BGA	1820	1790	470
	64GB x 1	15nm, BGA	1560	1560	460
64GB	64GB x 2	15nm, BGA	2330	2370	470
128GB	128GB x 2	15nm, BGA	2410	2510	470
256GB	256GB x 2	15nm, BGA	2315	2315	470

Unit: mW

Notes:

1. It's average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage is 3.3V.
3. Sequential R/W is measured while testing 1000MB sequential R/W by CyrstalDiskMark.
4. Power Consumption may differ according to flash configuration and platform.

5. INTERFACE



5.1. Pin Assignment and Descriptions

The follow table defines the signal assignment of the internal NGFF connector for SSD usage, described in the PCI Express M.2 Specification version 1.0 of the PCI-SIG.

Pin #	SATA Pin	Description
1	CONFIG_3 = GND	Ground
2	3.3V	Supply pin
3	GND	Ground
4	3.3V	Supply pin
5	N/C	No Connect
6	N/C	No Connect
7	N/C	No Connect
8	N/C	No Connect
9	N/C or GND ^{Note}	No Connect or Ground
10	DAS/DSS# (O) (OD)	Status indicators via LED devices that will be provided by the system Active Low. A pulled-up LED with series current limiting resistor should allow for 9mA when On.
11	N/C	No Connect
12	Module Key	
13	Module Key	
14	Module Key	
15	Module Key	
16	Module Key	
17	Module Key	
18	Module Key	
19	Module Key	
20	N/C	No Connect
21	CONFIG_0 = GND	Ground
22	N/C	No Connect
23	N/C	No Connect
24	N/C	No Connect
25	N/C	No Connect
26	N/C	No Connect
27	GND	Ground
28	N/C	No Connect

Pin #	SATA Pin	Description
29	N/C	No Connect
30	N/C	No Connect
31	N/C	No Connect
32	N/C	No Connect
33	GND	Ground
34	N/C	No Connect
35	N/C	No Connect
36	N/C	No Connect
37	N/C	No Connect
38	DEVSLP (I) (0/3.3V)	Device Sleep, Input. When driven high the host is informing the SSD to enter a low power state
39	GND	Ground
40	N/C	No Connect
41	SATA-B+	SATA differential signals in the SATA specification
42	N/C	No Connect
43	SATA-B-	SATA differential signals in the SATA specification
44	N/C	No Connect
45	GND	Ground
46	N/C	No Connect
47	SATA-A-	SATA differential signals in the SATA specification
48	N/C	No Connect
49	SATA-A+	SATA differential signals in the SATA specification
50	N/C	No Connect
51	GND	Ground
52	N/C	No Connect
53	N/C	No Connect
54	N/C	No Connect
55	N/C	No Connect
56	Reserved for MFG Data	Manufacturing Data line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.
57	GND	Ground
58	Reserved for MFG Clock	Manufacturing Clock line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket

Pin #	SATA Pin	Description
59	Module Key	
60	Module Key	
61	Module Key	
62	Module Key	
63	Module Key	
64	Module Key	
65	Module Key	
66	Module Key	
67	N/C	No Connect
68	SUSCLK (I) (0/3.3V)	No Connect
69	CONFIG_1 = GND	Ground
70	3.3V	Supply pin
71	GND	Ground
72	3.3V	Supply pin
73	GND	Ground
74	3.3V	Supply pin
75	CONFIG_2 = GND	Ground

Note: N/C for Socket 2, and GND for Socket 3.

6. SUPPORTED COMMANDS



6.1. ATA Command List

Code	Command Description	Protocol
General Feature Set		
90h	Execute Device Diagnostic	Execute device diagnostic
92h	Download Microcode	PIO data-out
93h	Download Microcode DMA	DMA
E7h	Flush Cache	Non-data
ECh	Identify Device	PIO data-in
91h	Initialize Drive Parameters	Non-data
00h	NOP	Non-data
E4h	Read Buffer	PIO data-in
E9h	Read Buffer DMA	DMA
C8h or C9h	Read DMA	DMA
2Fh	Read Log Ext	PIO data-in
47h	Read Log DMA Ext	DMA
C4h	Read Multiple	PIO data-in
20h or 21h	Read Sector(s)	PIO data-in
40h or 41h	Read Verify Sector(s)	Non-data
EFh	Set Feature	Non-data
C6h	Set Multiple Mode	Non-data
E8h	Write Buffer	PIO data-out
EBh	Write Buffer DMA	DMA
CAh or CBh	Write DMA	DMA
3Fh	Write Log Ext	PIO data-out
57h	Write Log DMA Ext	DMA
C5h	Write Multiple	PIO data-out
30h	Write Sector(s)	PIO data-out
Power Management Feature Set		
E5h or 98h	Check Power Mode	Non-data
E3h or 97h	Idle	Non-data
E1h or 95h	Idle Immediate	Non-data
E6h or 99h	Sleep	Non-data
E2h or 96h	Standby	Non-data
E0h or 94h	Standby Immediate	Non-data

Code	Command Description	Command Description
Security Mode Feature Set		
F1h	Security Set Password	PIO data-out
F2h	Security Unlock	PIO data-out
F3h	Security Erase Prepare	Non-data
F4h	Security Erase Unit	PIO data-out
F5h	Security Freeze Lock	Non-data
F6h	Security Disable Password	PIO data-out
SMART Feature Set		
B0h	SMART Disable Operations	Non-data
B0h	SMART Enable/Disable Autosave	Non-data
B0h	SMART Enable Operations	Non-data
B0h	SMART Execute OFF-LINE Immediate	Non-data
B0h	SMART Read Log	PIO data-in
B0h	SMART Read Data	PIO data-in
B0h	SMART Read Threshold	PIO data-in
B0h	SMART Return Status	Non-data
B0h	SMART Save Attribute Values	Non-data
B0h	SMART Write Log	PIO data-out
Host Protected Area Feature Set		
F8h	Read Native Max Address	Non-data
F9h	Set Max Address	Non-data
F9h	Set Max Set Password	PIO data-out
F9h	Set Max Lock	Non-data
F9h	Set Max Freeze Lock	Non-data
F9h	Set Max Unlock	PIO data-out
48-bit Address Feature Set		
EAh	Flush Cache Ext	Non-data
24h	Read Sector(s) Ext	PIO data-in
25h	Read DMA Ext	DMA
29h	Read Multiple Ext	PIO data-in
27h	Read Native Max Address Ext	Non-data
42h	Read Verify Sector(s) Ext	Non-data
37h	Set Max Address Ext	Non-data
35h	Write DMA Ext	DMA
3Dh	Write DMA FUA Ext	DMA

Code	Command Description	Command Description
39h	Write Multiple Ext	PIO data-out
CEh	Write Multiple FUA Ext	PIO data-out
34h	Write Sector(s) Ext	PIO data-out
NCQ Feature Set		
60h	Read FPDMA Queued	DMA Queued
61h	Write FPDMA Queued	DMA Queued
Trusted Computing Feature Set¹		
5Ch	Trusted Receive	PIO data-in
5Dh	Trusted Receive DMA	DMA
5Eh	Trusted Send	DMA
5Fh	Trusted Send DMA	DMA
DCO Feature Set		
B1h	Device Configuration	/
Sanitize Device Feature Set		
B4h	Sanitize Device	/
Miscellaneous and Historical Commands		
06h	Data Set Management	DMA
70h	Seek	Non-data
10h	Recalibrate	Non-data
3Ch	Write Verify	PIO data-out
45h	Write Uncorrectable Ext	Non-data

6.2. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command.

Word	F / V	Default Value	Description
0	F	0040h	General configuration
1	X	XXXXh	Default number of cylinders
2	V	0000h	Reserved
3	X	00XXh	Default number of heads
4	X	0000h	Obsolete
5	X	0240h	Obsolete
6	F	XXXXh	Default number of sectors per track
7 - 8	V	XXXXh	Number of sectors per card (Word 7 = MSW, Word 8 = LSW)
9	X	0000h	Obsolete
10 - 19	F	XXXXh	Serial number in ASCII (Right justified)
20	X	0002h	Obsolete
21	X	0002h	Obsolete
22	X	0000h	Obsolete
23 - 26	F	XXXXh	Firmware revision in ASCII Big Endian Byte Order in Word
27 - 46	F	XXXXh	Model number in ASCII (Left justified) Big Endian Byte Order in Word
47	F	8001h	Maximum number of sectors on Read/Write Multiple command
48	F	0000h	Reserved
49	F	0F00h	Capabilities
50	F	4000h	Capabilities
51	F	0200h	PIO data transfer cycle timing mode
52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	XXXXh	Current numbers of cylinders
55	X	XXXXh	Current numbers of heads
56	X	XXXXh	Current sectors per track
57 - 58	X	XXXXh	Current capacity in sectors (LBAs) (Word 57 = LSW , Word 58 = MSW)
59	F	0101h	Multiple sector setting
60 - 61	F	XXXXh	Total number of user addressable logical sectors for 28-bit commands (DWord)

Word	F / V	Default Value	Description
62	X	0000h	Reserved
63	F	0207h	Multiword DMA transfer Supports MDMA mode 0, 1 and 2
64	F	0003h	Advanced PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	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	F	4000h	Additional supported
70 - 74	F	0000h	Reserved
75	F	001Fh	Queue depth
76	F	070Eh	Serial ATA capabilities <ul style="list-style-type: none"> • Supports Serial ATA Gen3 • Supports Serial ATA Gen2 • Supports Serial ATA Gen1 • Supports Phy event counters log • Supports receipt of host initiated power management requests • Supports Native Command Queuing
77	F	0080h	Serial ATA additional capability <ul style="list-style-type: none"> • DevSleep_to_ReducedPwrState
78	F	0148h	Serial ATA features supported <ul style="list-style-type: none"> • Supports Device Sleep • Supports software settings preservation • Device supports initiating power management
79	V	0040h	Reserved
80	F	03F0h	Major version number (ACS-2)
81	F	0000h	Minor version number
82	F	742Bh	Command sets supported 0
83	F	7500h	Command sets supported 1
84	F	4023h	Command sets supported 2
85 - 87	V	XXXXh	Command set/feature enabled
88	V	007Fh	Ultra DMA mode supported and selected
89	F	0003h	Time required for a Normal Erase mode Security Erase Unit command

Word	F / V	Default Value	Description
90	F	0001h	Time required for an Enhanced Erase mode Security Erase Unit command
91	V	0000h	Current advanced power management value
92	V	FFFEh	Master password identifier
93 - 99	V	0000h	Reserved
100 - 103	V	XXXXh	Maximum user LBA for 48-bit address feature set
104	V	0000h	Reserved
105	F	0100h	Maximum number of 512-byte blocks per Data Set Management command
106 - 127	V	0000h	Reserved
128	V	0001h	Security status
129 - 159	X	XXXXh	Vendor specific
160	F	0000h	Power requirement description
161	X	0000h	Reserved
162	F	0000h	Key management schemes supported
163	F	0000h	CF Advanced True IDE Timing mode capability and setting
164 - 168	V	0000h	Reserved
169	F	0001h	Data Set Management supported
170 - 216	V	XXXXh	Reserved
217	F	0001h	Non-rotating media (SSD)
218 - 221	X	0000h	Reserved
222	F	107Fh	Transport major revision (SATA Rev 3.1)
223 - 254	X	0000h	Reserved
255	X	XXXXh	Integrity word

Notes:

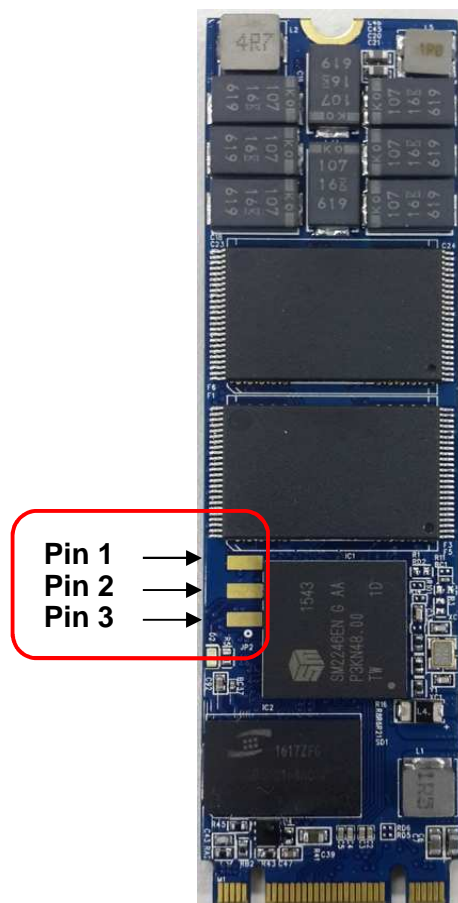
1. F = content (byte) is fixed and does not change.
2. V = content (byte) is variable and may change depending on the state of the device or the commands executed by the device.
3. X = content (byte) is vendor specific and may be fixed or variable.

6.3. Write Protect Function (Optional)

The write protect function is triggered by pin1 and pin2 short of pin header. This used to set the SSD as a write protection device after power up. When the function is triggered, the data can't be written to the device. The device is then set as read only.

6.4. Quick Erase Function (Optional)

The Quick Erase is a special feature to allow users to erase user data in SSD by hardware trigger. When this feature is triggered by pin2 and pin3 short of pin header, the SSD controller will write all "0x00" to wipe all the data except firmware area, and the SSD will return to its factory default setting. This feature is particularly useful for emergent circumstances to quickly erase user data.



7. POWER LOSS PROTECTION (PLP)



7.1. General Description

The Power-Loss Protection (PLP) is a scheme to protect data during a sudden power off when SSD drive is under programming or writing. It will ensure the system is stable and the data in the DRAM will be flushed to NAND. It needs to have controller firmware support with additional power source from PCBA as backup power.

7.2. Data Protection

The SSD drive includes controller, DRAM for temporary data, and NAND for non-volatile memory. The PLP needs to have controller firmware support first. When the controller detects the power is dropping to certain level, the controller will inform the host and to stop the host from sending more data.

The 2nd step is to flush the data in the DRAM to the NAND flash, since DRAM cannot work when power is off. Therefore it needs enough extra power generated from Polymer Tantalum capacitors add-on PCBA to hold up several mini-seconds to ensure the data is flushed out to NAND completely.

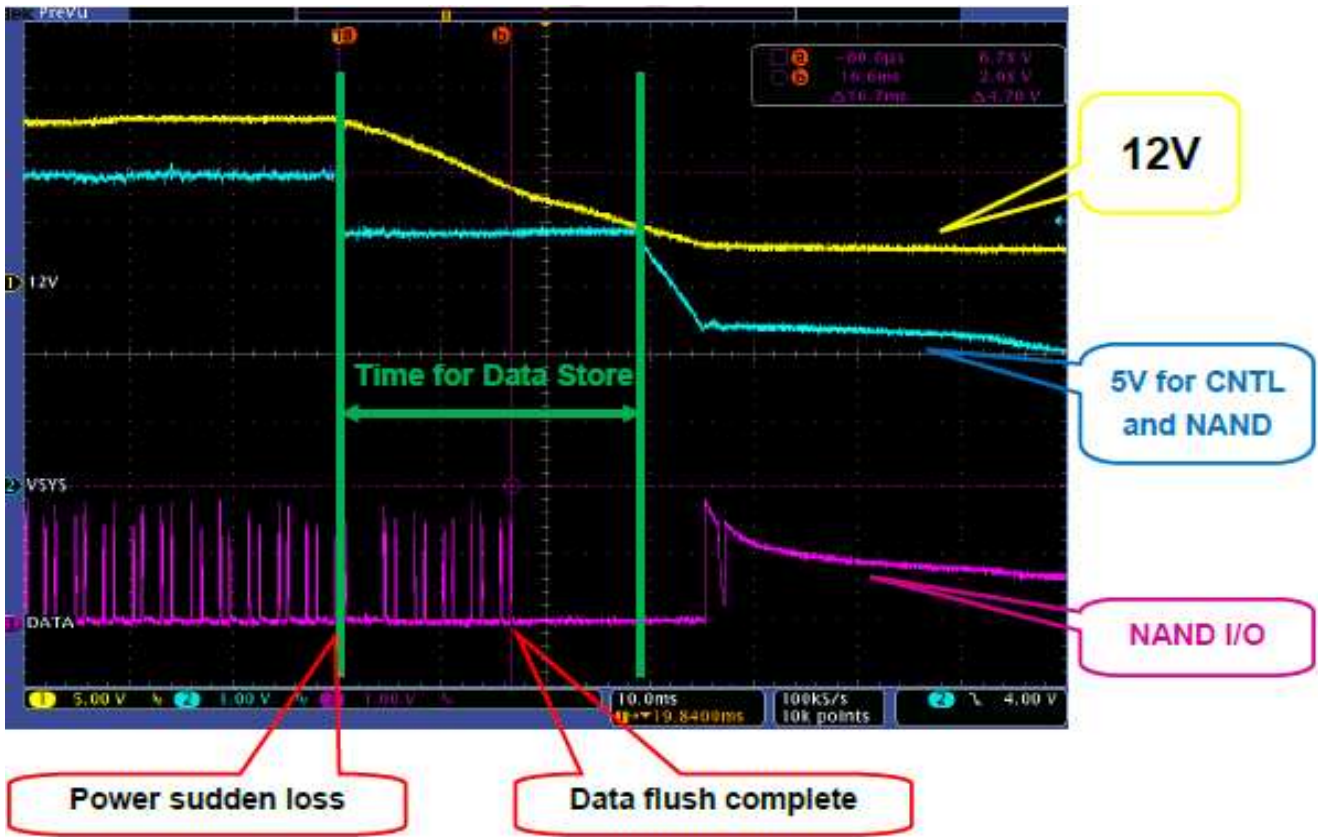
The PLP system is to offer about 45ms to ensure the data is flush out. Since the controller is featured with 4-ch process, the flush time will be short if it is full 4-ch operation. However, if the flush speed is slower for small capacity, it takes longer time. The PLP system will make sure all the capacity combinations have last data stored in NAND flash safely with additional margin.

The following figure shows the PCBA of Amtron M.2 SATA SSD with PLP feature by adding Polymer Tantalum capacitors.

Additional figure shows when power is suddenly lost, a trigger to host stops sending data and the data are stored into NAND safely and completely with some margin.



Polymer Tantalum Capacitors



8. ACRONYMS



Acronym	Definition
AES	Advanced Encryption Standard
APST	Autonomous Power State Transition
ASPM	Active States Power Management
ATTO	Commercial performance benchmark application
ECC	Error Correcting Code
DDR	Double Data Rate (SDRAM)
LBA	Logical Block Addressing
LDPC	Low-Density Parity Check
MTBF	Mean Time Between Failures
NVMe	Non-Volatile Memory Express
OPAL	Open Physics Abstraction Layer
PCBA	Print Circuit Board Assembly
PCIe	PCI Express / Peripheral Component Interconnect Express
PLP	Power Loss Protection
SMART	Self-Monitoring, Analysis and Reporting Technology
TCG	Trusted Computing Group
TLC	Triple Level Cell
UBER	Uncorrectable Bit Error Rate

9. PART NUMBER DECODER



M2S80-ASX¹X²X³X⁴X⁵X⁶X⁷

Item	Series	Capacity	NAND Flash & Temperature Grade	Option
		X ¹ X ² X ³ X ⁴	X ⁵	X ⁶ X ⁷
M2S80	AS	004G (4GB) 008G (8GB) 016G (16GB) 032G (32GB) 064G (64GB) 128G (128GB) 256G (256GB) 512G (512GB)	C : SLC , Standard (0°C to +70°C) I : SLC , Wide (-40°C to +85°C) P : pSLC , Standard (0°C to +70°C) F : pSLC , Wide (-40°C to +85°C) K : MLC , Standard (0°C to +70°C) M : MLC , Wide (-40°C to +85°C)	See below
<p>X⁶ X⁷ (Reserved for specific requirement)</p> <p>Blank: Standard</p> <p>01: Write Protection (WP)</p> <p>03: Quick Erase Jumper (QEJ)</p> <p>05: WP+QEJ</p> <p>06: Conformal Coating (CC)</p> <p>07: CC + WP</p> <p>09: CC + QEJ</p> <p>11: CC+WP+QEJ</p> <p>20: Power Loss Protection (PLP)</p> <p>31: AES+OPAL (PSID code)</p> <p>32: PLP+AES+OPAL (PSID code)</p>				