RoHS Compliant

PCI Express Disk Module

M.2 PT42 Product Specifications (Toshiba 15nm)

April 19, 2016

Version 1.1

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Features:

- **Standard PCI Express Bus Interface**
  - PCI Express Specification Rev.2.0*
  - PCI Express Card Electromechanical Rev. 2.0
  - PCI Express Gen2 x 2
  - Supports Separate Reference Clock Independent SSC
- **Capacity**
  - 8, 16, 32, 64, 128 GB
- **Performance****
  - Sequential Read Speed up to 530 MB/s
  - Sequential Write Speed up to 170 MB/s
- **Flash Management**
  - Supports ECC up to 72 bit correction per 1K Byte data
  - Wear leveling
  - Flash bad-block management
  - S.M.A.R.T.
  - Power failure management
- **NAND Flash:** MLC
- **Temperature Range**
  - Operating: 0°C to 70°C
  - Storage: -40°C to 100°C
- **Supply Voltage**
  - 3.3 V ± 5%
- **Power Consumption****
  - Active mode: 780 mA
  - Idle mode: 415 mA
- **Form Factor**
  - M.2 2242-D2-B-M
  - Dimensions: 42.00x22.00x3.70, unit: mm
- **RoHS Compliant**
- **Supports NCQ (Native Command Queue) Commands**
- **Supports AHCI Programming Interface**

*Not backward compatible. Operational instability or inefficiency will occur if this device is applied on a PCIe 1.0 socket.
**Varies from capacities. The performance and power consumption values addressed here are typical and may vary from platforms.

Table of Contents

1. General Description

Apacer's M.2 PT42 module-type SSD offers a breakthrough in non-volatile memory storage. Formed as a compact M.2 2242 form factor, PT42 can fit in various types of embedded platforms, such as workstation, thin computing devices and high-end heavy duty servers where spaces are concerned. Regarding data transfer rate, PT42 delivers ideal data read/write performance.

Apacer M.2 PT42 is designed in PCI-Express 2.0 pinout, and is compatible with 5.0 Gbps maximum transfer rate. Compatibility wise, this M.2 SSD is not only fully compliant with PCI Express Specification Rev.2.0 and Electromechanical Rev.2.0, but also supports NCQ commands and AHCI operational modes.

1.1 Error Correction/Detection

The ECC engine in this device can detect and correct up to 72 bits error in 1K bytes.

1.2 Flash Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as "Initial Bad Blocks". Bad blocks that are developed during the lifespan of the flash are named "Later Bad Blocks". Thus, this device implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

1.3 Wear Leveling

NAND Flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some area get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling technique is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media. Apacer provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND Flash is greatly improved.

1.4 Power Failure Management

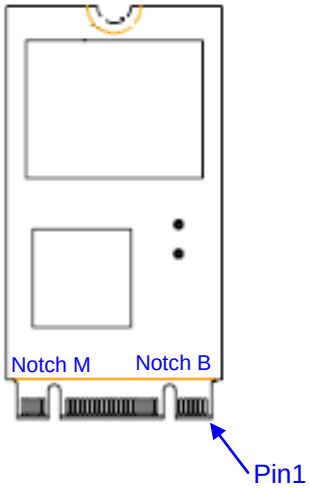
Power Failure Management plays a crucial role when experiencing unstable power supply. Power disruption may occur when users are storing data into the SSD. In this urgent situation, the controller would run multiple write-to-flash cycles to store the metadata for later block rebuilding. This urgent operation requires about several milliseconds to get it done. At the next power up, the firmware will perform a status tracking to retrieve the mapping table and resume previously programmed NAND blocks to check if there is any incompleteness of transmission.

1.5 S.M.A.R.T.

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a hard disk drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

2. Pin Assignments

This connector does not support hot plug capability. There are a total of 75 pins. 12 pin locations are used for mechanical key locations; this allows such a module to plug into both Key B and Key M connectors.



Pin	Type	Description
1	CONFIG_3	Ground (according to M.2 configurations for PCIe SSD definition)
2	3.3V	Supply Pin, 3.3V
3	GND	Ground
4	3.3V	Supply pin, 3.3V
5	No connect	No connect
6	Not available	No connect (used for other purposes)
7	Not available	No connect (used for other purposes)
8	Not available	No connect (used for other purposes)
9	No connect	No connect
10	DAS/DSS	Device Activity Signal/Disable Staggered Spin-up
11	No connect	No connect (used for other purposes)
12	(removed for key)	Mechanical notch B
13	(removed for key)	Mechanical notch B
14	(removed for key)	Mechanical notch B
15	(removed for key)	Mechanical notch B
16	(removed for key)	Mechanical notch B
17	(removed for key)	Mechanical notch B
18	(removed for key)	Mechanical notch B
19	(removed for key)	Mechanical notch B
20	Not available	No connect (used for other purposes)
21	CONFIG_0	Ground (according to M.2 configurations for PCIe SSD definition)

Pin	Type	Description
22	Not available	No connect (used for other purposes)
23	Not available	No connect (used for other purposes)
24	Not available	No connect (used for other purposes)
25	Not available	No connect (used for other purposes)
26	Not available	No connect (used for other purposes)
27	GND	Ground
28	Not available	No connect (used for other purposes)
29	PETn1	
30	Not available	No connect (used for other purposes)
31	PETp1	
32	Not available	No connect (used for other purposes)
33	GND	Ground
34	Not available	No connect (used for other purposes)
35	PERn1	
36	Not available	No connect (used for other purposes)
37	PERp1	
38	Not available	No connect (used for other purpose)
39	GND	Ground
40	Not available	No connect (used for other purposes)
41	PETn0	
42	Not available	No connect (used for other purposes)
43	PETp0	
44	Not available	No connect (used for other purposes)
45	GND	Ground
46	Not available	No connect (used for other purposes)
47	PERn0	
48	Not available	No connect (used for other purposes)
49	PERp0	
50	PERST#	
51	GND	Ground
52	Not Available	No connect (used for other purposes)
53	REFCLKN	
54	Not Available	No connect (used for other purposes)
55	REFCLKP	
56	Not Available	No connect (used for other purposes)
57	GND	Ground

Pin	Type	Description
58	Not Available	No connect (used for other purposes)
59	(removed for key)	Mechanical notch B
60	(removed for key)	Mechanical notch B
61	(removed for key)	Mechanical notch B
62	(removed for key)	Mechanical notch B
63	(removed for key)	Mechanical notch B
64	(removed for key)	Mechanical notch B
65	(removed for key)	Mechanical notch B
66	(removed for key)	Mechanical notch B
67	Not available	No connect (used for other purposes)
68	Not available	No connect (used for other purposes)
69	CONFIG_1	No connect (according to M.2 configurations for PCIe SSD definition)
70	3.3V	Supply pin, 3.3V
71	GND	Ground
72	3.3V	Supply pin, 3.3V
73	GND	Ground
74	3.3V	Supply pin, 3.3V
75	CONFIG_2	Ground

3. Product Specifications

3.1 Capacity

Capacity specifications of M.2 PT42 are available in the table below. It lists the specific capacity and the default numbers of heads, sectors and cylinders for each product line.

Table 3-1 Capacity Specifications

Capacity	Total bytes*	Cylinders	Heads	Sectors	Max LBA
8 GB	8,012,390,400	15,525	16	63	15,649,200
16 GB	16,013,942,784	16,383	16	63	31,277,232
32 GB	32,017,047,552	16,383	16	63	62,533,296
64 GB	64,023,257,088	16,383	16	63	125,045,424
128 GB	128,035,676,160	16,383	16	63	250,069,680

*Display of total bytes varies from file systems.
**Cylinders, heads or sectors are not applicable for these capacities. Only LBA addressing applies.
LBA count addressed in the table above indicates total user storage capacity and will remain the same throughout the lifespan of the device. However, the total usable capacity of M.2 PT42 is most likely to be less than the total physical capacity because a small portion of the capacity is reserved for device maintenance usages.

3.2 Performance

Performance and random read/write specifications of M.2 PT42 are listed in following tables.

Table 3-2 Performance

Performance \ Capacity	8 GB	16 GB	32 GB	64 GB	128 GB
Sustained read (MB/s)	150	275	445	530	515
Sustained write (MB/s)	105	150	160	165	170

Note: Results may differ from various flash configurations or host system settings.

3.3 Environmental Specifications

Environmental specifications of M.2 PT42 product family follow the MIL-STD-810F standard.

Table 3-3 Environmental Specifications

Environment		Specifications
Temperature	Operating	0 to 70°C
	Storage	-40°C to 100°C
Vibration (Non-Operating)		Sine wave : 10~2000Hz, 15G (X, Y, Z axes)
Shock (Non-Operating)		Half sine wave, 1500 G (X, Y, Z ; All 6 axes)

4. Electrical Specifications

Caution: **Absolute Maximum Stress Ratings –** Applied conditions greater than those listed under "Absolute Maximum Stress Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.

Table 4-1 Absolute Maximum Stress Ratings

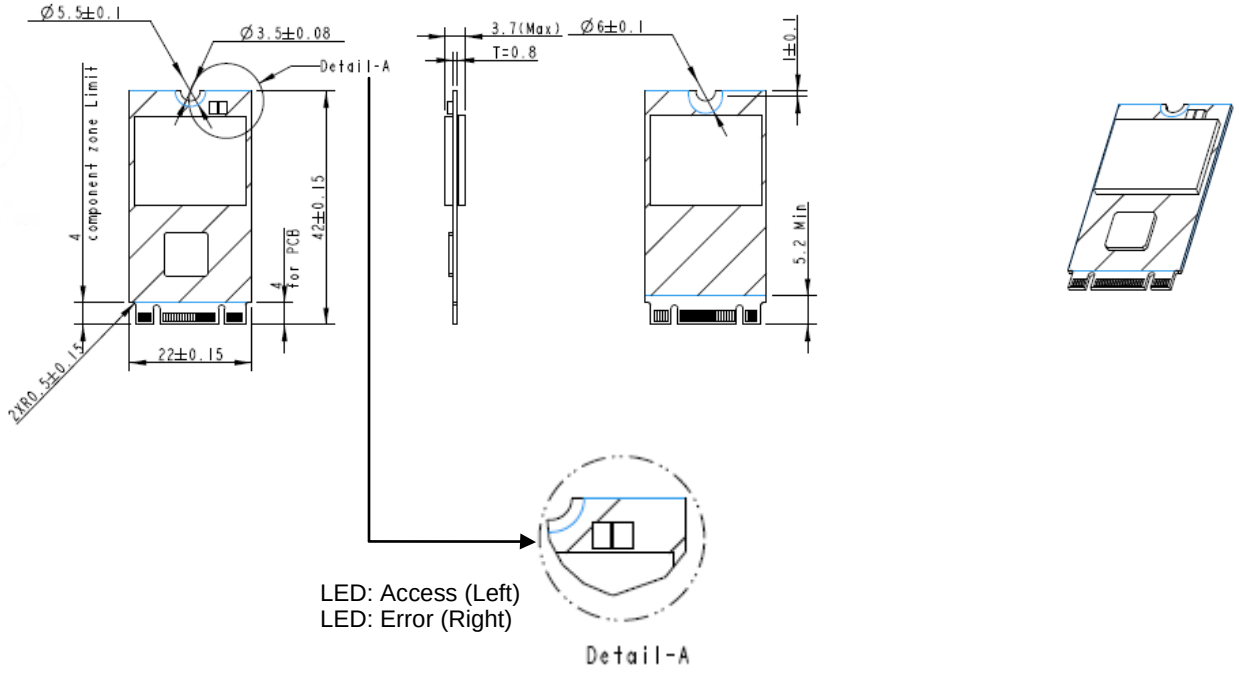
Parameter	Min.	Typical	Max.	Units
Power supply	3.13	3.3	3.46	V
Operating case temperature	0		80	°C
Storage temperature	-40		85	°C

Table 4-2 Power Consumption

Capacity / State	8 GB	16 GB	32 GB	64 GB	128 GB
Active (mA)	620	650	665	755	780
Idle (mA)	415	385	385	405	395

*Results may differ from various flash configurations and platforms.

5. Mechanical Specifications



Unit: mm

Tolerance: ± 0.25

6. Product Ordering Information

6.1 Product Code Designations

AP P xxxG 3 F B – A TM

Flash Type

FW Version

Standard

Solution
F: Controller type F

Type
3: M.2 PT42 one chip

Capacity
008G = 8GB
016G = 16GB
032G = 32GB
064G = 64GB
128G = 128GB

PCIE

Apacer Product Code

6.2 Valid Combinations

Capacity	M/N
8GB	APP008G3FB-ATM
16GB	APP016G3FB-ATM
32GB	APP032G3FB-ATM
64GB	APP064G3FB-ATM
128GB	APP128G3FB-ATM

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

Revision History

Revision	Date	Description	Remark
1.0	3/8/2016	Official release	
1.1	4/19/2016	Added 8GB support	

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