RoHS Compliant

PCI Express Disk Module

M.2 PT42 Product Specifications

April 13, 2015

Version 1.3

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 GB

- **Performance****
  - Sequential Read Speed up to 540 MB/s
  - Sequential Write Speed up to 180 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 ranges**
  - Operating case temperature: 0°C to 80°C
  - Storage temperature: -40°C to 85°C

- **Supply voltage**
  - 3.3 V ±5%

- **Power consumption****
  - Active mode: 1,025 mA
  - Idle mode: 530 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.
**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.
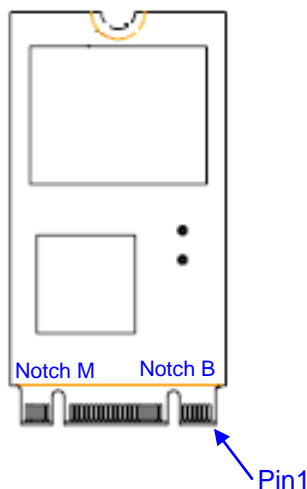
Pin	Type	Description
1	CONFIG_3	Ground (according to M.2 configurations for PCIe SSD definition)
2	3.3V	Supply Pin, 3.3V
3	GND	Ground
4	3.3V	Supply pin, 3.3V
5	No connect	No connect
6	Not available	No connect (used for other purposes)
7	Not available	No connect (used for other purposes)
8	Not available	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)

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
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 Specification

3.1 Capacity

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

*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

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

Table 3-2: Performance

Capacity / Performance	8 GB	16 GB	32 GB	64 GB
Sustained read (MB/s)	145	290	515	540
Sustained write (MB/s)	44	85	155	180

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

3.3 Environmental Specification

Environmental specification of M.2 PT42 product family follows the MIL-STD-810F standard.

Table 3-3: Environmental specifications

Environment		Specification
Temperature	Operation (case)	0 to 80°C
	Storage	-40°C to 85°C
Humidity		5% to 95% RH (Non-condensing)
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 Specification

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.
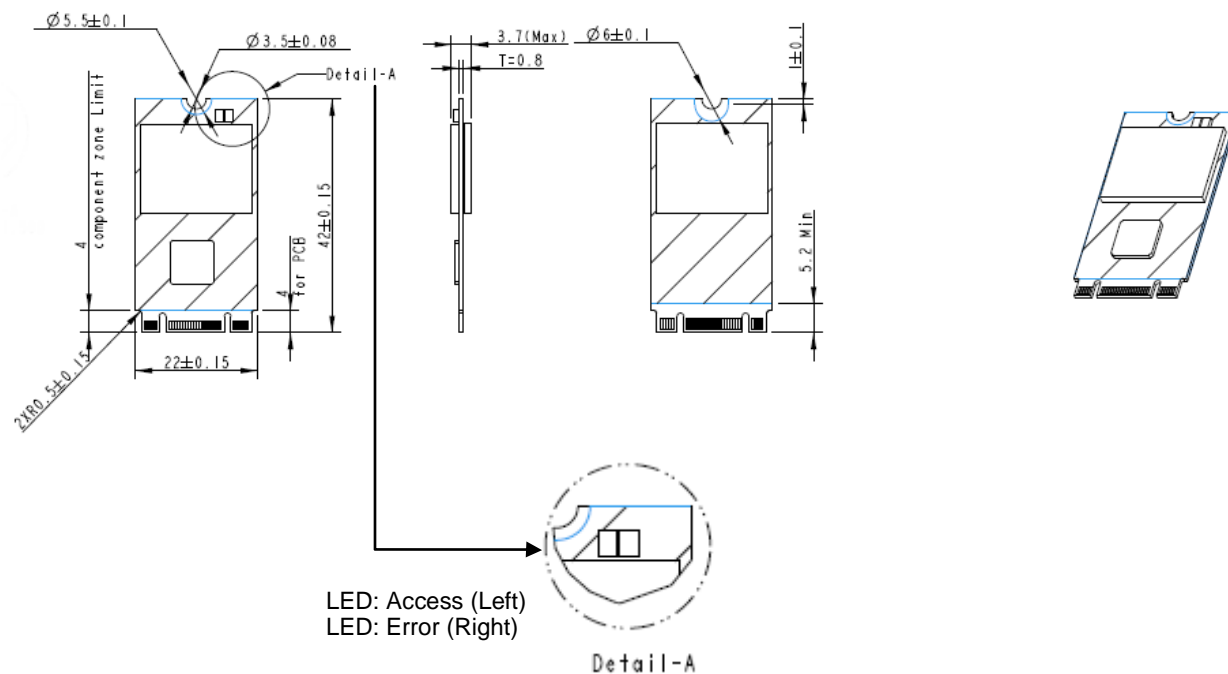
Table 4-1: Absolute maximum stress ratings

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
Active (mA)	760	850	960	1025
Idle (mA)	530	530	530	530

*Results may differ from various flash configurations and platforms.
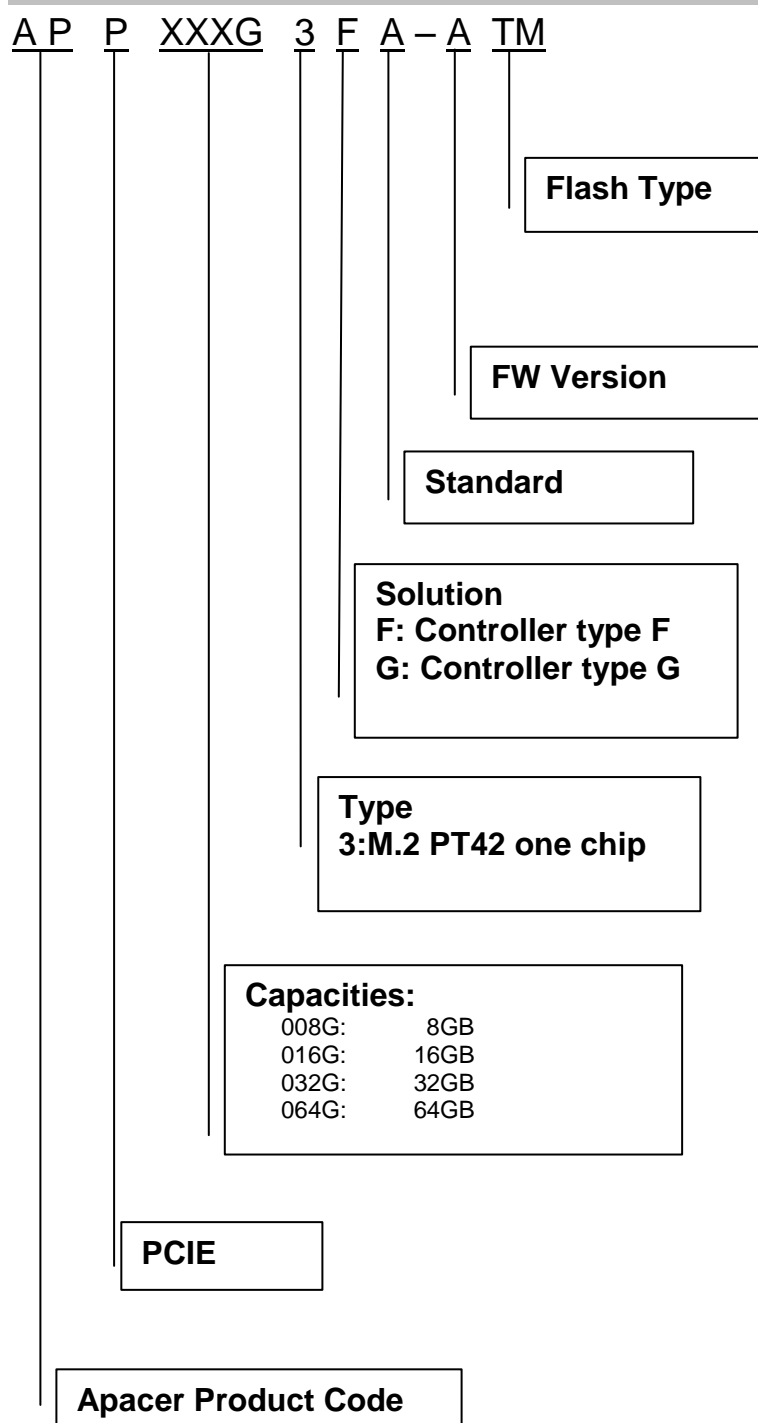
5. Mechanical specifications

LED: Access (Left)
LED: Error (Right)

Detail-A

Unit: ㎜
Tolerance: ± 0.25

6. Product Ordering Information

6.1 Product Code Designations

A P P XXXG 3 F A – A TM

Flash Type

FW Version

Standard

Solution
F: Controller type F
G: Controller type G

Type
3:M.2 PT42 one chip

Capacities:
008G: 8GB
016G: 16GB
032G: 32GB
064G: 64GB

PCIE

Apacer Product Code

6.2 Valid Combinations

6.2.1 Standard Solution

Capacity	M/N
8GB	APP008G3FA-ATM
16GB	APP016G3FA-ATM
32GB	APP032G3FA-ATM
64GB	APP064G3FA-ATM

Note: For availability or customized requests, please consult with Apacer sales representatives.

Revision History

Revision	Date	Description	Remark
1.0	10/29/2014	Official release	
1.1	12/17/2014	Updated product ordering information	
1.2	01/05/2015	Updated mechanical specifications	
1.3	04/13/2015	Revised product code designations	

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