

# MLC

## SATA III 1.8" Flash SSD

### PHANES-K Series

**Document No. :** 100-xP8SF-PKCTM

**Version No. :** 02V0

**Date :** July, 2019

ISO 9001 : 2015 CERTIFIED



### Product Features

#### ■ Flash IC

- TOSHIBA 15nm NAND Flash IC.
- Multi-Level Cell (MLC) management

#### ■ Compatibility

- Compliant with SATA Revision 3.2
- SATA 1.5Gb/s; SATA 3Gb/s & SATA 6Gb/s
- Interface compatible.
- ATA-8 ACS2 command set

#### ■ Additional Capabilities

- S.M.A.R.T.\*1 (Self-Monitoring, Analysis and Reporting Technology) feature set support.
- Native Command Queuing (NCQ) support.
- TRIM maintenance command support.
- Both Static & Dynamic wear-leveling algorithm
- Hardware Low Density Parity Check Code, LDPC support.
- Support bad Block Management
- Support DIPM/HIPM Mode for power saving

#### ■ Mechanical

- micro SATA 7 pins (data) + 9 pins (power connector) host Interface
- 1.8" form-factor ( shorter than PCMCIA Type II form-factor)
- Dimension: 54.0 mm x 78.5 mm x 5.0 mm.
- Weight: 25g /0.88oz.

#### ■ Power Operating Voltage 3.3V(+/-) 5%

- Read Mode: 2,355.0 mW (max.)
- Write Mode: 2,500.0 mW (max.)
- Idle Mode: 310.0 mW (max.)

#### ■ Performance (Maximum value) \*2

- Sequential Read: 550.0 MB/sec. (max.) \*2
- Sequential Write: 470.0 MB/sec. (max.) \*2

#### ■ Capacity

- 32GB, 64GB, 128GB, 256GB & 512GB

#### ■ Reliability

- **TBW:** Up to 540 TBW at 512GB Capacity.  
(Client workload by JESD-219A)
- **ECC:** Designed with hardware LDPC ECC engine with hard-decision and soft-decision decoding.
- **Temperature:** (Operating)  
Standard Grade: 0°C ~ +70°C  
Wide Temp. Grade: -40°C ~ +85°C
- **Vibration:** 80 Hz to 2000 Hz, 20G, 3 axes.
- **Shock:** 0.5ms, 1500 G, 3 axes.

#### ■ Certifications and Declarations

- **Certifications:** CE & FCC
- **Declarations:** RoHS & REACH


#### Remarks:

1. Support official S.M.A.R.T. Utility.
2. Test by 512GB Capacity; Sequential performance is based on CrystalDiskMark 5.1.2 with file size 1000MB

### Order Information

#### I. Part Number List

##### ◆ APRO MLC micro SATA III SSD PHANES-K Series

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp Grade ( -40°C ~ +85°C )
	32GB	SP8SF032G-PKCTM	WP8SF032G-PKCTM-C
	64GB	SP8SF064G-PKCTM	WP8SF064G-PKCTM-C
	128GB	SP8SF128G-PKCTM	WP8SF128G-PKCTM-C
	256GB	SP8SF256G-PKCTM	WP8SF256G-PKCTM-C
	512GB	SP8SF512G-PKCTM	WP8SF512G-PKCTM-C

#### Notes:

**C :** Special conformal coating treated on whole PCBA which may support industrial grade operating temperature -40°C ~ +85°C

#### II. Part Number Decoder:

**X1 X2 X3 X4 X5 X6 X7 X8 X9 X11 X12 X13 X14 X15 X16 X17 -- C**

#### **X1** : Grade

**S:** Standard Grade – operating temp. 0° C ~ 70 ° C

**W:** Wide Temp Grade- operating temp. -40° C ~ +85 ° C

#### **X2** : The material of case

**P** : Plastic frame kit

#### **X3 X4 X5** : Product category

**8SF** : 1.8" micro SATA III SSD

#### **X6 X7 X8 X9** : Capacity

**032G:** 32GB      **256G:** 256GB

**064G:** 64GB      **512G:** 512GB

**128G:** 128GB

#### **X12** : Controller version

**A, B, C.....**

#### **X13** : Controller Grade

**C** : Commercial grade

#### **X14** : Flash IC

**T** : Toshiba NAND Flash IC

#### **X15** : Flash IC grade / Type

**M** : 15nm MLC -NAND Flash IC

#### **C** : Reserved for specific requirement

**C** : Conformal-coating

#### **X11** : Controller

**P** : PHANES Solution

### **Revision History**

Revision	Description	Date
1.0	Initial release.	2019/3/15
2.0	Updated document form	2019/07/19

### Contents

Product Features .....	- 2 -
Order Information .....	- 3 -
<b>I. Part Number List</b> .....	- 3 -
<b>II. Part Number Decoder:</b> .....	- 3 -
Revision History .....	- 4 -
Contents .....	- 5 -
<b>1. Introduction</b> .....	- 6 -
<b>1.1. Scope</b> .....	- 7 -
<b>1.2. Flash Management Technology – Static &amp; Dynamic Wear Leveling</b> .....	- 7 -
<b>1.3. Bad Block Management</b> .....	- 7 -
<b>2. Product Specifications</b> .....	- 8 -
<b>2.1. System Environmental Specifications</b> .....	- 8 -
<b>2.2. System Power Requirements</b> .....	- 8 -
<b>2.3. System Performance</b> .....	- 8 -
<b>2.4. System Reliability</b> .....	- 9 -
<b>2.5. Physical Specifications</b> .....	- 9 -
<b>2.5.1. Conformal coating</b> .....	- 10 -
<b>3. Interface Description</b> .....	- 11 -
<b>3.1. APRO MLC micro SATA III SSD interface</b> .....	- 11 -
<b>3.2. Pin Assignments</b> .....	- 12 -
<b>Appendix A: Limited Warranty</b> .....	- 13 -

### 1. Introduction

APRO MLC 1.8" micro SATA III SSD PHANES-K Series provides high capacity flash memory Solid State Drive (SSD) that electrically complies with SATA Revision 3.2 standard; APRO MLC 1.8" micro SATA III SSD PHANES-K Series support SATA 1.5Gb/s; SATA 3Gb/s & SATA 6Gb/s data transfer rate with high performance.

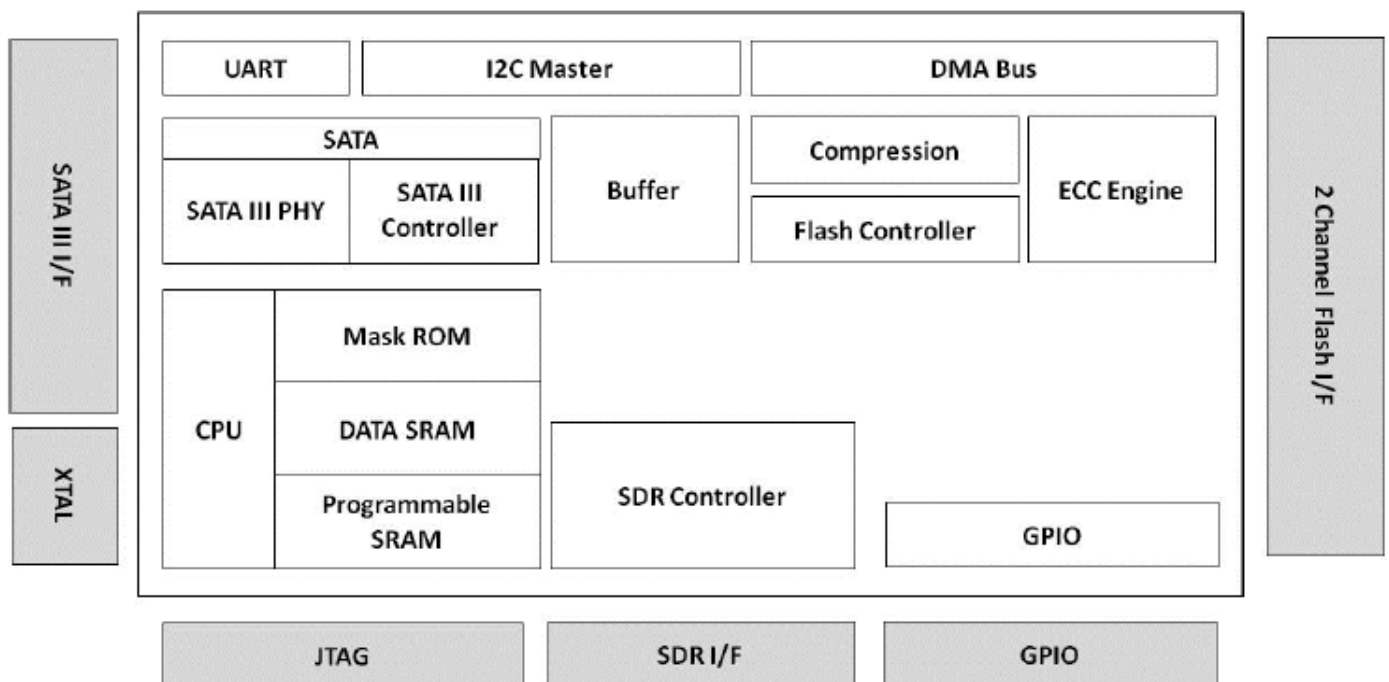
The available disk capacities are from 32GB up to 512GB. The operating temperature grade is optional for Standard grade 0°C ~ 70°C and wide temp grade with conformal coating supports -40°C ~ +85°C.

APRO MLC 1.8" micro SATA III SSD PHANES-K Series is suitable to handheld device embedded system, inventory recorder and particularly for serious environment monitor recorder system. The sequential read speed is 550 MB/sec and sequential write speed is 470 MB/se which were testing based on 512GB capacity

APRO MLC 1.8" micro SATA III SSD provides a high level interface to the host computer. This interface allows a host computer to issue commands to the APRO MLC 1.8" micro SATA III SSD PHANES-K Series to read or write blocks of memory. A powerful hardware design is architecture multiplied LDPC (Low Density Parity Check) for Error Correcting Coding (ECC).

APRO MLC 1.8" micro SATA III SSD PHANES-K Series intelligent controller manages interface protocols, data storage and retrieval as well as ECC, bad block management and diagnostics, power management and clock control.

Figure 1 shows a block diagram of the used high tech micro SATA III SSD controller.



**Figure 1: APRO MLC micro SATA III SSD PHANES-K Series block diagram**

### 1.1. Scope

This document describes features, specifications and installation guide of APRO MLC 1.8" micro SATA III SSD PHANES-K Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

### 1.2. Flash Management Technology – Static & Dynamic 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 areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

APRO MLC 1.8" micro SATA III SSD PHANES-K Series 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.

### 1.3. Bad Block Management

#### ➤ Early Bad Block

The fault block generated during the manufacturing process of NAND Flash is called Early Bad Block.

#### ➤ Later Bad Block

In the process of use, as the number of operations of writing and erasing increases, a fault block is gradually generated, which is called a Latter Bad Block.

**Bad block management** is a management mechanism for a bad block to be detected by the control IC and mark bad blocks in the NAND Flash and improve the reliability of data access. The bad block management mechanism of the control IC will establish a **Bad Block Table** when the NAND Flash is started for the first time, and will also record the errors found in the process of use in the bad block table, and data is ported to new valid blocks to avoid data loss.

In order to detect the initial bad blocks to handle run time bad blocks, APRO MLC 1.8" Slim Lite SATA III SSD HERMES-JI Series provides the **Bad Block Management** scheme. It remaps a bad block to one of the reserved blocks so that the data contained in one bad block is not lost and new data writes on a bad block is avoided.

### 2. Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

#### 2.1. System Environmental Specifications

**Table 1: Environmental Specification**

APRO MLC 1.8" micro SATA III SSD		Standard Grade	Wide Temp Grade
PHANES-K Series		SP8SFxxxG-PKCTM	WP8SFxxxG-PKCTMC
Temperature	Operating:	0°C ~ +70°C	-40°C ~ +85°C
	Non-operating:	-20°C ~ +80°C	-50°C ~ +95°C
Humidity	Operating & Non-operating:	10% ~ 95% non-condensing	
Vibration	Frequency/Acceleration:	80 Hz to 2000 Hz, 20G, 3 axes	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes	
Electrostatic Discharge (ESD)	Temperature:	24°C	
	Relative Humidity:	49% (RH)	
	+/-4KV:	Device functions are affected, but EUT will be back to its normal or operational state automatically.	

#### 2.2. System Power Requirements

**Table 2: Power Requirement**

APRO MLC 1.8" micro SATA III SSD PHANES-K Series		
DC Input Voltage (VCC)	3.3V±5%	
+3.3V Current	Reading Mode :	2,355.0 mW (max.)
	Writing Mode :	2,500.0 mW (max.)
	Idle Mode :	310.0 mW (max.)

#### 2.3. System Performance

**Table 3: System Performances**

Data Transfer Mode supporting		Serial ATA Gen-III (6.0Gb/s = 768MB/s)				
Maximum Performance	Capacity	32GB	64GB	128GB	256GB	512GB
	Sequential Read (MB/s)	350.0	550.0	550.0	550.0	550.0
	Sequential Write (MB/s)	160.0	320.0	450.0	470.0	470.0

Note: The performance was measured using CrystalDiskMark by file size 1000MB (QD32).



### 2.4. System Reliability

**Table 4: System Reliability**

<b>Wear-leveling Algorithms</b>	Static & Dynamic Wear-leveling	
<b>Bad Block Management</b>	Supportive	
<b>ECC Technology</b>	Hardware design LDPC (Low Density Parity Check)	
<b>Erase counts</b>	NAND MLC Flash Cell Level : 3K P/E Cycles	
<b>TBW (Tera Bytes Written)</b>		
<b>Capacity</b>	<b>32GB</b>	13.0
	<b>64GB</b>	30.0
	<b>128GB</b>	87.0
	<b>256GB</b>	198.0
	<b>512GB</b>	540.0

Note:

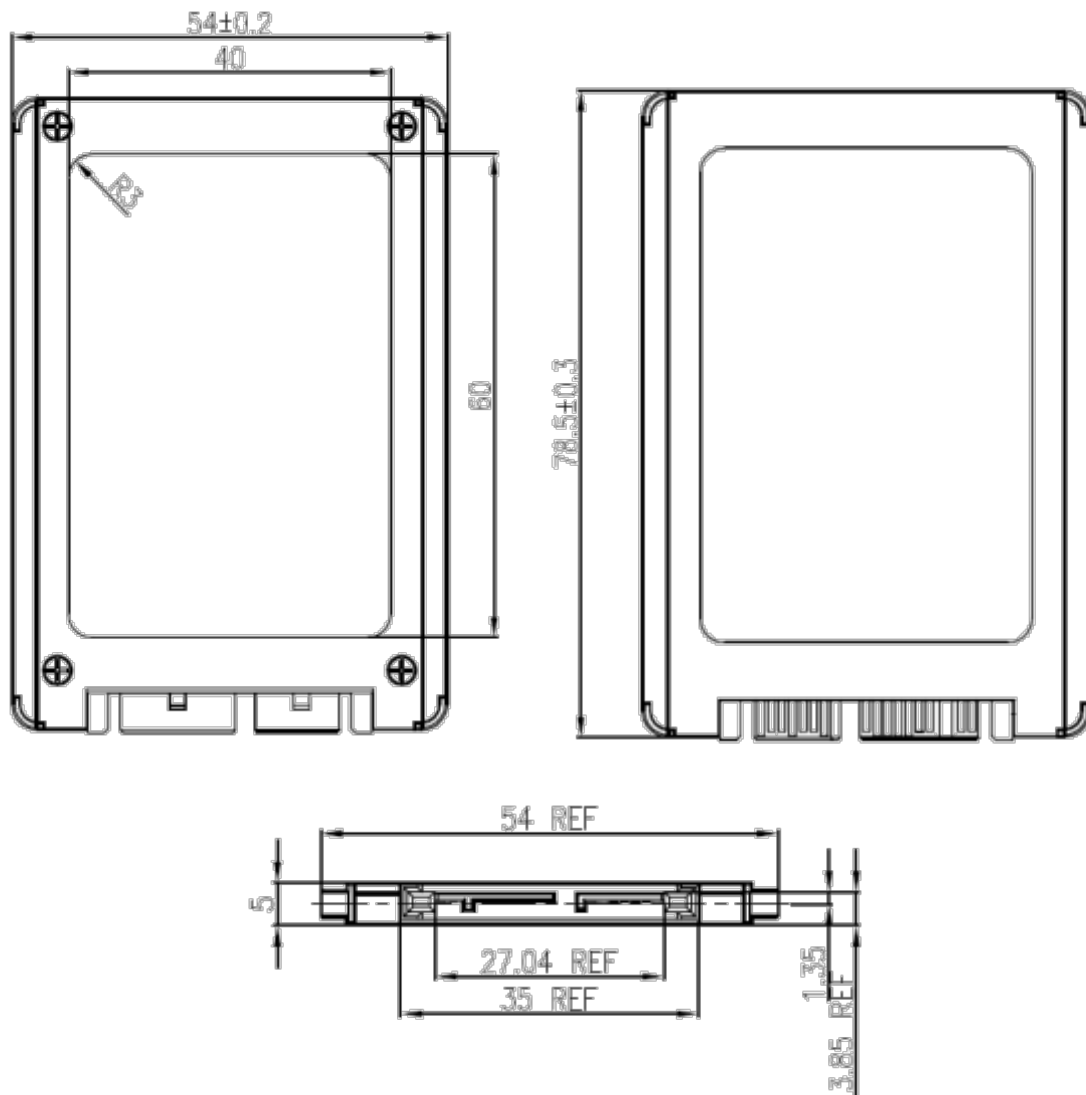
- Client workload by JESD-219A.
- *The endurance of SSD could be varying based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.*

### 2.5. Physical Specifications

Refer to Table 5 and see Figure 2 for APRO MLC 1.8" micro SATA III SSD PHANES-K Series physical specifications and dimensions.

**Table 5: Physical Specifications of APRO MLC micro SATA III SSD PHANES-K Series**

<b>Length:</b>	54.0 mm
<b>Width:</b>	78.5 mm
<b>Thickness:</b>	5.0 mm
<b>Weight:</b>	25g / 0.88 oz.



**Figure 2: APRO MLC micro SATA III SSD Dimension**

### 2.5.1. Conformal coating

Conformal coating is a protective, dielectric coating designed to conform to the surface of an assembled printed circuit board. Commonly used conformal coatings include silicone, acrylic, urethane and epoxy. APRO applies only silicone on APRO storage products upon requested especially by customers. The type of silicone coating features good thermal shock resistance due to flexibility. It is also easy to apply and repair.

Conformal coating offers protection of circuitry from moisture, fungus, dust and corrosion caused by extreme environments. It also prevents damage from those Flash storages handling during construction, installation and use, and reduces mechanical stress on components and protects from thermal shock. The greatest advantage of conformal coating is to allow greater component density due to increased dielectric strength between conductors.

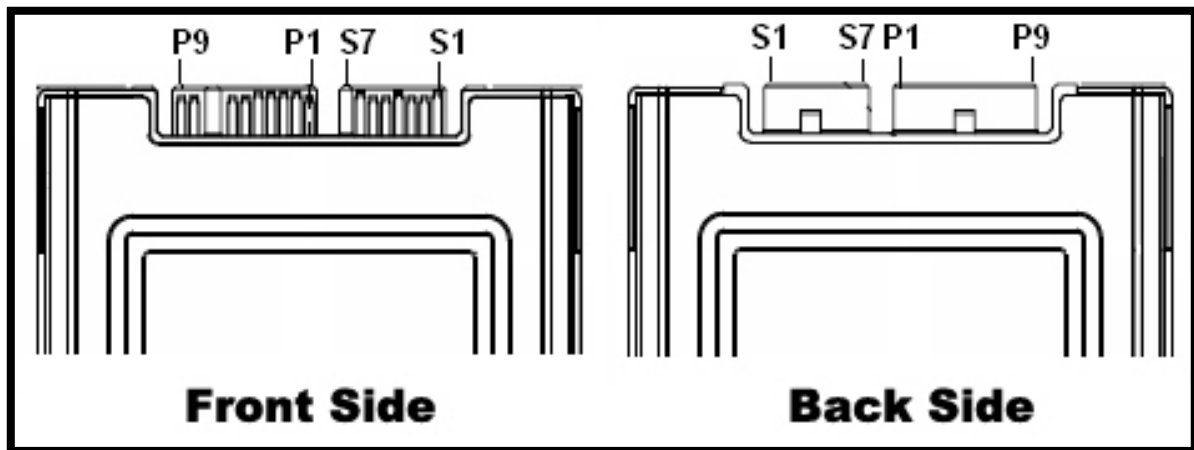
APRO use MIL-I-46058C silicon conformal coating

### 3. Interface Description

#### 3.1. micro SATA III SSD interface

Refer to Table 6 and see Figure 3 for APRO 1.8" MLC micro SATA III SSD PHANES-K Series pin assignments.

There are total of 7 pins in the signal segment and 9 pins in the power segment. The pin assignments are listed in below table 6.



*Figure 3: The connectors of SATA 7-pin (data) + 9-pin (power)*

### 3.2. Pin Assignments

APRO MLC 1.8" micro SATA III SSD PHANES-K Series operates with standard SATA pin-out.

The pin assignments are listed in below table 6.

Signal Segment Pin Assignment and Descriptions		
Pin Number	Function	
S1	GND	
S2	A+ (Differential Signal Pair A)	
S3	A – (Differential Signal Pair A)	
S4	GND	
S5	B – (Differential Signal Pair B)	
S6	B+ (Differential Signal Pair B)	
S7	GND	
Power Segment Pin Assignment and Description		
Pin Number	Type	Function
P1	V <sub>33</sub>	3.3V Power Input
P2	V <sub>33</sub>	3.3V Power Input
P3	GND	GND
P4	GND	GND
P5	V <sub>5</sub>	Reserved for 5V Power Input (Option)
P6	V <sub>5</sub>	Reserved for 5V Power Input (Option)
P7	Optional	Reserved for Active LED (Option)
Key	Key	N/C
P8	Optional	Erase function (Option)
P9	Optional	Reserved (Not Connected)

**Table 6 - Pin Assignments**

### **Appendix A: Limited Warranty**

APRO warrants your MLC SATA III micro SATA III SSD PHANES-K Series against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair. The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered. In no event shall APRO be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

**BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM APRO.**

Product shall be returned to APRO with shipping prepaid. If the product fails to conform based on customers' purchasing orders, APRO will reimburse customers for the transportation charges incurred.

#### **WARRANTY PERIOD:**

- **MLC ( Standard grade / Wide temp. grade )    2 years / Within 3K Erasing Counts**

This document is for information use only and is **subject to change without prior notice**. APRO Co., Ltd. assumes no responsibility for any errors that may appear in this document, nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. No part of this document may be reproduced, transmitted, transcribed, stored in a retrievable manner or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior written consent of an officer of APRO Co., Ltd.

All parts of the APRO documentation are protected by copyright law and all rights are reserved.

APRO and the APRO logo are registered trademarks of APRO Co., Ltd.

Product names mentioned herein are for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

© 2020 APRO Corporation. All rights reserved