

aSLC

SATA III CFast[™] Card

PHANES-K Series

Document No. : 100-xxCFA-PKCTMAS

Version No. : 02V1

Date : May, 2019



ISO 9001 : 2015 CERTIFIED



Product Features

■ Flash IC

- TOSHIBA 15nm NAND Flash IC.
- Multi-Level Cell (MLC) management by enhance endurance technology (aSLC)

■ Compatibility

- Compliant with SATA Revision 3.2
- Compliant with CFast™ Specification 2.0
- SATA 1.5Gb/s; SATA 3Gb/s & SATA 6Gb/s
- Interface compatible.
- ATA-8 ACS4 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

- 7-pin (data) + 17-pin (power) CFast™ Card connector
- Dimension: 42.8 mm x 36.4 mm x 3.5 mm.
- Weight:
Plastic frame-kit: 10g / 0.35 oz.
Metal frame-kit: 13g / 0.46 oz.

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

- Read Mode: 1,056.0 mW (max.)
- Write Mode: 1,320.0 mW (max.)
- Idle Mode: 231.0 mW (max.)

■ Performance (Maximum value) *²

- Sequential Read: 558.0 MB/sec. (max.)
- Sequential Write: 463.0 MB/sec. (max.)

■ Capacity

- 16GB, 32GB and 64GB

■ Reliability

- **TBW:** Up to 215 TBW at 64GB 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:** 80Hz~2000Hz/20G.
- **Shock:** 0.5ms, 1,500G, 3 axes.

■ Certifications and Declarations

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


Remarks:

1. Support official S.M.A.R.T. Utility.
2. Sequential performance is based on CrystalDiskMark 5.1.2 with file size 1000MB


Order Information

I. Part Number List

◆ APRO aSLC SATA III CFast™ Card PHANES-K Series with plastic frame kit

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp Grade (-40°C ~ +85°C)
	16GB	SPCFA016G-PKCTMAS-(T)	WPCFA016G-PKCTMASC-(T)C
	32GB	SPCFA032G-PKCTMAS-(T)	WPCFA032G-PKCTMASC-(T)C
	64GB	SPCFA064G-PKCTMAS-(T)	WPCFA064G-PKCTMASC-(T)C

◆ APRO aSLC SATA III CFast™ Card PHANES-K Series with rugged metal frame kit

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp Grade (-40°C ~ +85°C)
	16GB	SRCFA016G-PKCTMAS-(T)	WRCFA016G-PKCTMASC-(T)C
	32GB	SRCFA032G-PKCTMAS-(T)	WRCFA032G-PKCTMASC-(T)C
	64GB	SRCFA064G-PKCTMAS-(T)	WRCFA064G-PKCTMASC-(T)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** – **X19**

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

R : Rugged Metal frame kit

X3 X4 X5 : Product category

CFA : CFast™ Card

X6 X7 X8 X9 : Capacity

016G: 16GB

032G: 32GB

064G: 64GB

X11 : Controller

P : PHANES Series

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 : MLC-NAND flash IC

X16 X17 : aSLC Technology

AS : aSLC Technology extends MLC product's lifespan

X19 : Reserved for specific requirement

Blank : Standard product w/o thermal sensor and conformal-coating

T : Thermal Sensor (optional)

C : Conformal coating (optional)

Revision History

Revision	Description	Date
1.0	Initial release.	2017/11/30
1.1	Add the option for thermal sensor	2018/11/02
1.2	Updated version	2018/11/28
2.1	Updated power consumption & performance	2019/05/24

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1. Introduction

APRO aSLC SATA III CFast™ Card PHANES-K Series compliant to the CFast™ Specification 2.0 issued by CompactFlash Association (CFA), it breakthroughs the speed performance under traditional ATA-8 specification. Integrating the CompactFlash card form factor and support SATA 1.5Gb/s; SATA 3Gb/s & SATA 6Gb/s data transfer rate with high performance, the transfer speed is much higher than traditional CF Card while it keeps small form factor and rigid case as CF Card. The APRO aSLC SATA III CFast™ Card PHANES-K Series also supports Metal Frame Kit as an optional product which may endure various harsh operating environments. The main used Flash memory is aSLC-NAND Type Flash memory chips for 16GB, 32GB and 64GB capacities.

APRO aSLC SATA III CFast™ Card PHANES-K Series features with great portability and resistance against vibration. The sequential read speed is 558.0 MB/sec and sequential write speed is 463.0 MB/sec for Multiple Level Cell (aSLC) solution.

Furthermore, APRO also provide 1.8" SATA to CFast™ card Adapter (**P/N: AD-CA128SATA200AR**) to increase the application flexibility.

APRO aSLC SATA III CFast™ Card PHANES-K Series supports optional standard grade operating temperature 0°C ~ 70°C and wide temperature -40°C ~ +85°C.

APRO aSLC SATA III CFast™ Card PHANES-K Series provide a high level interface to the host computer. This interface allows a host computer to issue commands to the APRO aSLC SATA III CFast™ Card 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 aSLC SATA III CFast™ Card 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.

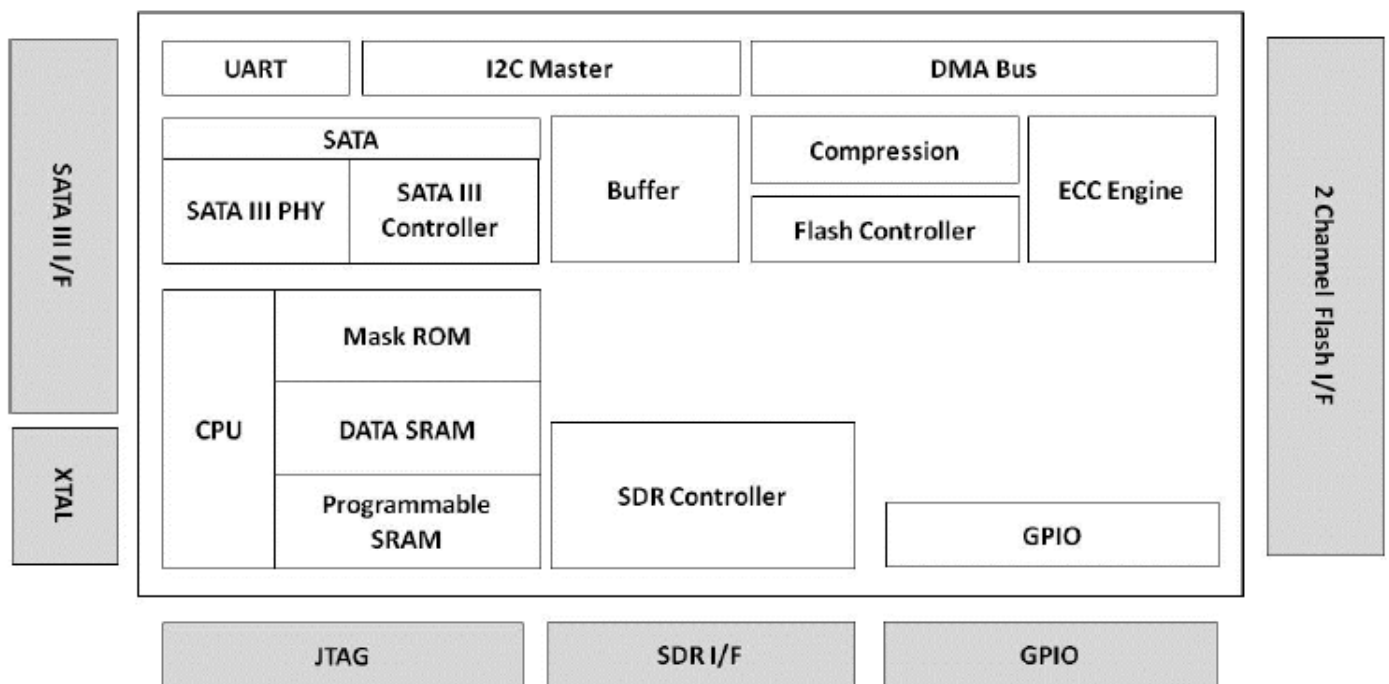


Figure 1: APRO aSLC SATA III CFast™ Card PHANES-K Series controller block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO aSLC SATA III CFast™ Card 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 aSLC SATA III CFast™ Card 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 Later 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 aSLC SATA III CFast™ Card PHANES-K 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.

1.4. aSLC Technology

The aSLC can be considered as an extended version of the MLC. While MLC contains both fast and slow pages, aSLC only utilizes fast pages for programming. The concept of aSLC is demonstrated in the Figure 2 below. The first and second bits of a memory cell represent a fast and slow page respectively, as shown in the left table. Since only fast pages are programmed when applying aSLC, the bits highlighted in red are used, as shown in the right table. As a result, aSLC provides better performance and endurance than MLC does. Moreover, the aSLC performs similarly to the SLC, yet more cost effective.

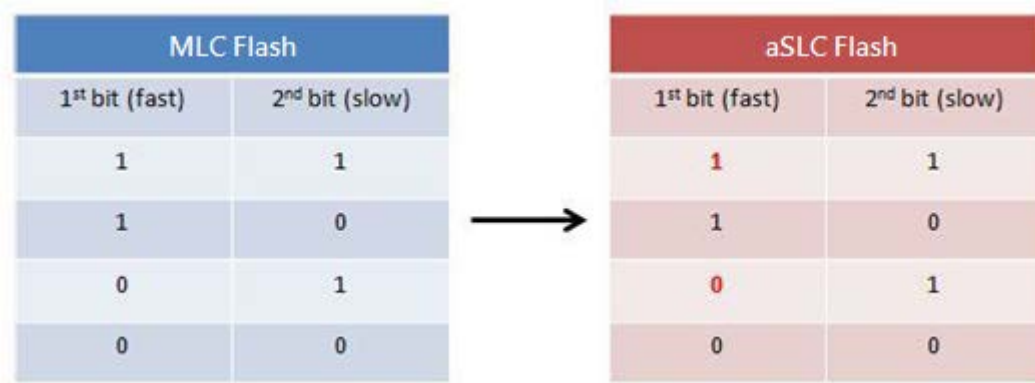


Figure 2: The concept of APRO aSLC SATA III CFast™ Card PHANES-K Series

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 aSLC SATA III CFast™ Card PHANES-K Series		Standard Grade SxCFAxxxG-PKCTMAS	Wide Temp Grade WxCFAxxxG-PKCTMASC
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 aSLC SATA III CFast™ Card PHANES-K Series		
DC Input Voltage (VCC)		3.3V±5%
Maximum average value	Reading Mode :	1,056.0 mW (max.)
	Writing Mode :	1,320.0 mW (max.)
	Idle Mode :	231.0 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	16GB	32GB	64GB
	Sequential Read (MB/s)	350.0	558.0	558.0
	Sequential Write (MB/s)	160.0	351.0	463.0

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

2.4. System Reliability

Table 4: System Reliability

Wear-leveling Algorithms	Static and Dynamic wear-leveling algorithms		
Bad Block Management	Supportive		
ECC Technology	Hardware design LDPC (Low Density Parity Check)		
Erase counts	NAND MLC Flash w/aSLC Technology : 20K P/E Cycles		
TBW (Tera Bytes Written)			
Capacity	16GB	49.0	
	32GB	106.0	
	64GB	215.0	

Note:

- Samples were built using Toshiba 15nm Toggle MLC NAND flash w/aSLC Technology.
- Client workload by JESD-219A.
- The endurance of SSD could be estimated 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 aSLC SATA III CFast™ Card PHANES-K Series physical specifications and dimensions.

Table 5: Physical Specifications of APRO aSLC SATA III CFast™ Card PHANES-K Series

Length:	36.4 mm
Width:	42.8 mm
Thickness:	3.5 mm
Weight:	Plastic frame-kit: 10g / 0.35 oz. Metal frame-kit: 13g / 0.46 oz.

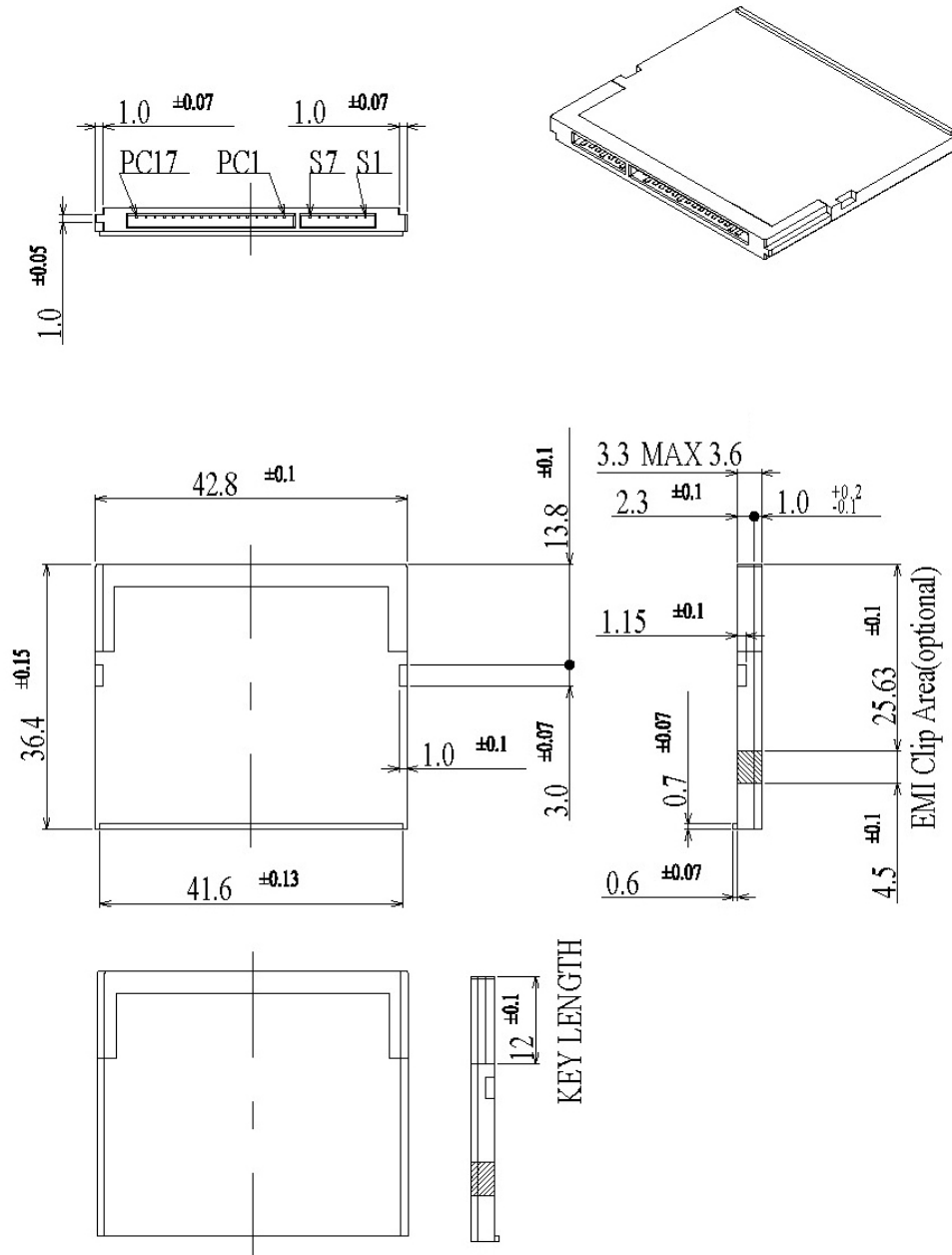


Figure 2: APRO aSLC SATA III CFast™ Card Dimension

2.6. 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

2. Interface Description

3.1. aSLC SATA III CFast™ Card interface

APRO aSLC SATA III CFast™ Card PHANES-K Series is equipped with 7 pins in the signal segment and 17 pins in the power segment.



Figure 3: The connectors of Signal Segment and Power Segment

3.2. Pin Assignments

APRO aSLC SATA III CFast™ Card PHANES-K Series operates with standard SATA pin-out.

The pin assignments are listed in below table 6.

Key and Spacing separate signal and power segments		
Name	Type	Description
S1	GND	NA
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	NA
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	NA

P1	CDI	Card Detect In
P2	PGND	Device Ground
P3	DEVSLP	Device Sleep
P4	NA	Reserved
P5	NA	Reserved
P6	NA	Reserved
P7	PGND	Device Ground
P8	LED1	LED Output
P9	LED2	LED Output
P10	NA	Reserved
P11	NA	Reserved
P12	IFDET	NA
P13	PWR	Device Power
P14	PWR	Device Power
P15	PGND	Device Ground
P16	PGND	Device Ground
P17	CDO	Card Detect Out

Table 6 - Pin Assignments

Appendix A: Limited Warranty

APRO warrants your aSLC SATA III CFast™ Card 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:

- **aSLC (Standard grade / Wide temp. grade) 2 years / Within 20K Erasing Counts**

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