

MLC

SATA-III CFast™ Card

PHANES-K Series

APRO MLC SATA-III CFast™ Card

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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
- Compliant with CFast™ Specification 2.0
- 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

- 7-pin (data) + 17-pin (power) CFast™ Card connector
- Dimension: 42.8 mm x 36.4 mm x 3.5 mm.
- Weight: 10.0 g / 0.4 o.z.

■ Power

- Operating Voltage 3.3V(+/-) 5%
- Read Mode: 1,090mW (max.)
- Write Mode: 1,475mW (max.)
- Idle Mode: 260mW (max.)
- Partial Mode: 19mW (max.)
- Slumber Mode: 14mW (max.)

■ Performance (Maximum value) *2

- Sequential Read (1GB Data): 555 MB/sec. *2
- Sequential Write (1GB Data): 465 MB/sec. *2

■ Capacity

- 32GB, 64GB and 128GB

■ Reliability

- **TBW:** Up to 87 TBW at 128GB Capacity.
(Client workload by JESD-219A)
- **MTBF:** > 2,000,000 hours.
- **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:** 20G (IEC 68-2-6).
- **Shock:** 1500G (IEC 68-2-27)

■ Certifications and Declarations

- **Certifications:** CE & FCC
- **Declarations:** RoHS2 & 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

1. Part Number List

◆ APRO MLC 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)
	32GB	SPCFA032G-PKCTM	WPCFA032G-PKCTMC
	64GB	SPCFA064G-PKCTM	WPCFA064G-PKCTMC
	128GB	SPCFA128G-PKCTM	WPCFA128G-PKCTMC

◆ APRO MLC 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)
	32GB	SRCFA032G-PKCTM	WRCFA032G-PKCTMC
	64GB	SRCFA064G-PKCTM	WRCFA064G-PKCTMC
	128GB	SRCFA128G-PKCTM	WRCFA128G-PKCTMC

Notes:

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

2. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 X11 X12 X13 X14 X15 / 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

R : Rugged Metal frame kit

X3 X4 X5 : Product category

CFA : CFast™ Card

X6 X7 X8 X9 : Capacity

032G: 32GB

064G: 64GB

128G: 128GB

X11 : Controller

P : PHANES Solution

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

Revision History

Revision	Description	Date
1.0	Initial release.	2017/11/30

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1. Introduction

APRO MLC 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/ATAPI specification. Integrating the CompactFlash card form factor and Serial ATA (SATA I/ II/ III) interface, the transfer speed is much higher than traditional CF Card while it keeps small form factor and rigid case as CF Card. The PHANES-K Series CFast™ Card also supports Metal Frame Kit as an optional product which may endure various harsh operating environments. The main used Flash memory is MLC-NAND Type Flash memory chips from 32GB up to 128GB. APRO MLC CFast™ Card PHANES-K Series features with great portability and resistance against vibration. The sequential read speed is 555 MB/sec and sequential write speed is 465 MB/sec for Multiple Level Cell (MLC) solution. Furthermore, APRO also provide 1.8" SATA to CFast card Adapter (P/N: AD-CA128SATA200AR) to increase the application flexibility.

APRO's MLC CFast™ Card supports optional standard grade operating temperature 0°C ~ 70°C and wide temperature -40°C ~ +85°C.

APRO MLC CFast™ Card PHANES-K Series is suitable to handheld device embedded system, inventory recorder and particularly for serious environment monitor recorder system. Also, through APRO 1.8" SATA to CFast card Adapter, APRO MLC CFast™ Card PHANES-K Series can be high speed booting SSD to varieties of IPC motherboards and PC structure system. Figure 1 shows a block diagram of the used high tech CFast™ Card controller.

APRO MLC SATA III CFast™ Card provide a high level interface to the host computer. This interface allows a host computer to issue commands to the APRO MLC 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 MLC 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.

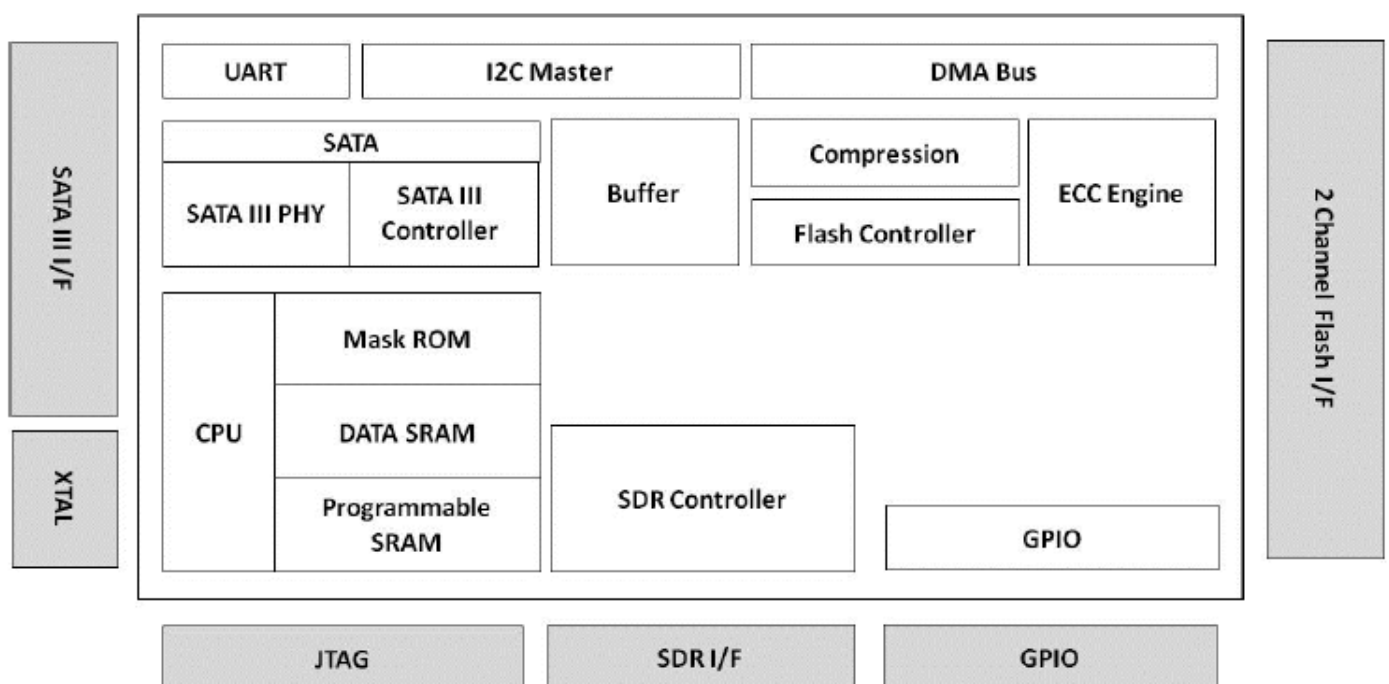


Figure 1: APRO MLC SATA III CFast™ Card PHANES-K Series controller block diagram

1.1. *Scope*

This document describes features, specifications and installation guide of APRO MLC 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 MLC 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*

Bad blocks of NAND flash may accumulate up to 2% of entire number of blocks during its manufacturing process and during the flash operational usage.

A system must be able to recognize bad block(s) based on the original bad block information and create a bad block table to keep track of blocks that fail during use. The first block of NAND Flash (block 0) is guaranteed to be good. The bad block information is stored in the reservoir area that is located in the highest address region of the NAND flash. Once the bad blocks have been located, and the bad blocks be no longer accessed.

To locate the bad blocks on a brand new device, read out each block. Any block that is not all FFFFh in 1st sector of 1st or 2nd page in a spare area is a bad block. Although random bit errors may occur during use, this does not necessarily mean that a block is bad. Generally, a block should be marked as bad only when there is a problem or erase failure. This can be determined by doing a status read after erase/program operation. The flash memory is initialized by formatting the flash memory into a reserved area and user area.

In order to detect the initial bad blocks to handle run time bad blocks, APRO MLC 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.

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 SATA III CFast™ Card PHANES-K Series		Standard Grade SxCFAxxxG-PKCTM	Wide Temp Grade WxCFAxxxG-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 (IEC 68-2-6)	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes (IEC 68-2-27)	
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 SATA III CFast™ Card PHANES-K Series		
DC Input Voltage (VCC)		3.3V±5%
+3.3V Current (Maximum average value)	Reading Mode :	1,090mW (max.)
	Writing Mode :	1,475mW (max.)
	Idle Mode :	260mW (max.)
	Partial Mode:	19mW (max.)
	Slumber Mode:	14mW (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
	Sequential Read (MB/s)	350	555	555
	Sequential Write (MB/s)	165	320	465

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

2.4. System Reliability

Table 4: System Reliability

Wear-leveling Algorithms	Static & Dynamic Wear-leveling	
Bad Block Management	Supportive	
ECC Technology	Hardware design LDPC (Low Density Parity Check)	
TBW (Tera Bytes Written)		
Capacity	32GB	13.0
	64GB	30.0
	128GB	87.0

Note:

- TBW value calculation is based on JESD219A standards client endurance workload.
- 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 SATA III CFast™ Card – PHANES-K Series physical specifications and dimensions.

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

Length:	42.8 mm
Width:	36.4 mm
Thickness:	3.5 mm
Weight:	10.0 g / 0.4 o.z.

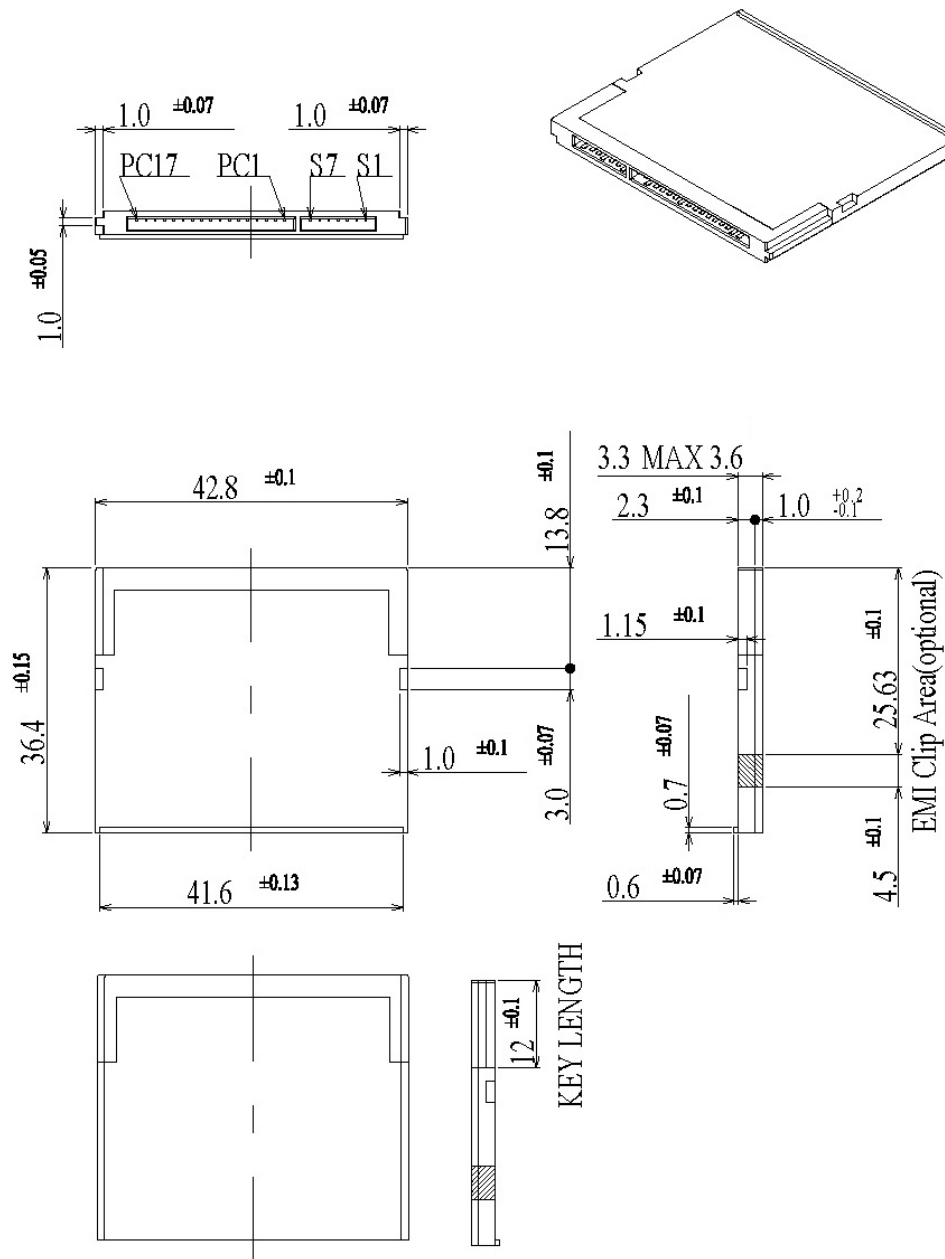


Figure 2: APRO MLC SATA III CFast™ Card Dimension

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. APRO MLC SATA III CFast™ Card interface

APRO CFast™ Card 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 MLC 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 MLC 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:

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

The warranty period is able to extend. Please contact APRO and/or Your APRO distributors for more information.

APRO

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