



aSLC

SATA III CFast Card

PHANES-C Series

Product Specification

APRO aSLC SATA III CFast Card

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1. Introduction

APRO aSLC CFast Card PHANES-C 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-C 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 aSLC-NAND Type Flash memory chips from 2GB up to 64GB. APRO aSLC CFast Card PHANES-C Series features with great portability and resistance against vibration. The sequential read speed is 520 MB/sec and sequential write speed is 190 MB/sec. Furthermore, APRO also provide 1.8" SATA to CFast card Adapter (P/N: AD-CA128SATA200AR) to increase the application flexibility.

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

APRO aSLC CFast Card PHANES-C 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 aSLC CFast Card PHANES-C Series can be high speed booting SSD to varieties of IPC motherboards and PC structure system and which is support trim commands for better performance and endurance. Figure 1 shows a block diagram of the used high tech CFast Card controller.

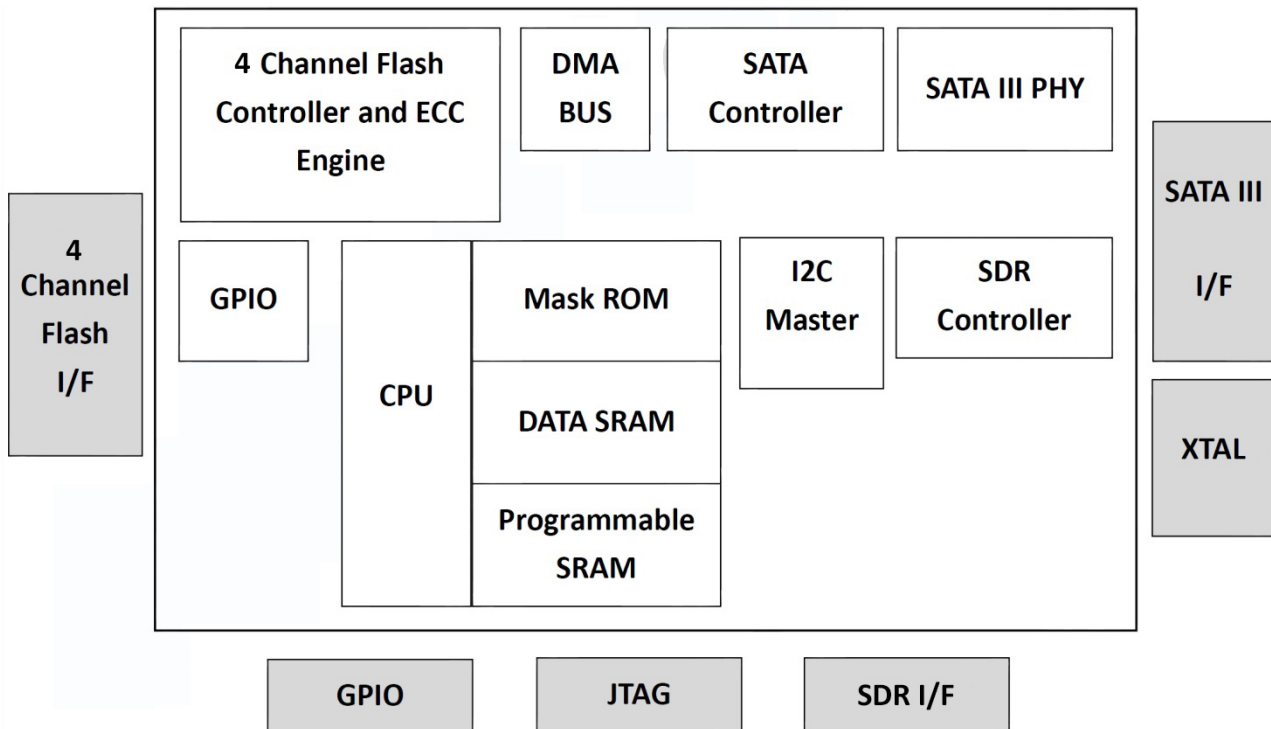


Figure 1: APRO SATA III CFast Card PHANES-C Series controller block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO's aSLC SATA III CFast Card – PHANES-C Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. System Features

- aSLC-NAND type flash technology
- Compliant with CFast™ specification V2.0
- CFast Type I form-factor
- 7-pin (data) + 17-pin (power) CFast Card connector
- SATA 1.0a, SATA 2.6 and SATA 3.0 specification compliance
- S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) function supported.
- TRIM commands supported.
- Non-volatile memory and no moving parts
- Capacity from 2GB up to 64GB
- Sequential read performance up to 520 MB/sec (max.)
- Sequential write performance up to 190 MB/sec (max.)
- Automatic 72 bits per 1024 bytes error correction (ECC) and retry capabilities
- +3.3V $\pm 5\%$ operation
- Shock : 0.5ms, 1500 G, 3 axes
- Vibration : 20 Hz to 2K Hz, 20G, 3 axes
- Very high performance, very low power consumption
- Low weight, Noiseless
- Standard grade supports operating temperature 0°C to +70°C, and wide temp Grade with conformal coating, -40°C to +85°C

1.3. 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.

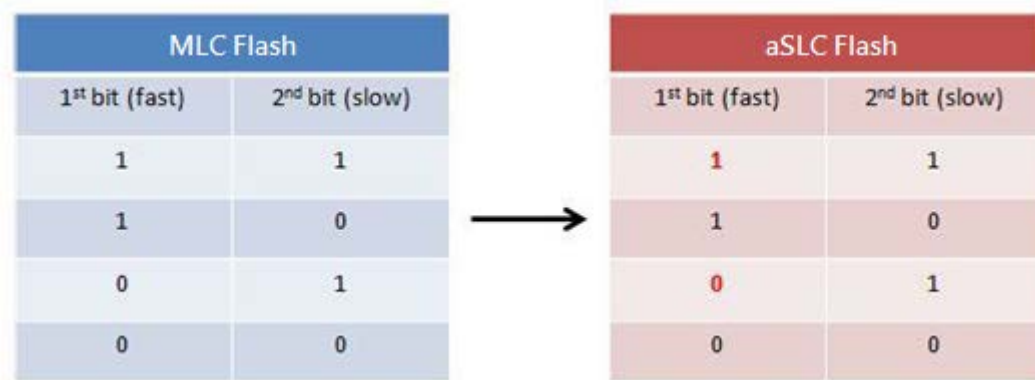


Figure 2: The concept of APRO aSLC CFast Card PHANES-C Series

1.4. TRIM Command

TRIM is a feature which helps improve the read/write performance and speed of Solid-State Drives (SSD). Unlike Hard Disk Drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks all the time.

1.5. Flash Management Technology - Static and 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 CFast Card PHANES-C 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.

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

PHANES-C Series aSLC SATA III CFast Card		Standard Grade	Wide Temp Grade
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	Operating & Non-operating:	20 Hz to 2K Hz, 20G, 3 axes	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes	

2.2. System Power Requirements

Table 2: Power Requirement

APRO aSLC SATA III CFast Card		
PHANES-C Series		
DC Input Voltage (VCC) 100mV max. ripple(p-p)		3.3V±5%
+3.3V Current (Maximum average value)	Reading Mode :	970 mW (max.)
	Writing Mode :	980 mW (max.)
	Idle Mode :	4.9 mW (max.)

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		Serial ATA Gen-III (6.0Gb/s = 768MB/s)					
Average Access Time		0.1 ms (estimated)					
Maximum Performance	Capacity	2GB	4GB	8GB	16GB	32GB	64GB
	Sequential Read (MB/s)	120	240	280	260	520	520
	Sequential Write(MB/s)	55	110	160	155	185	190

Note:

(1). All values quoted are typically at 25 °C and nominal supply voltage.

(2). Testing of the aSLC SATA III CFast Card maximum performance was performed under the following platform:

- Computer with Intel i5 3.5GHz processor with Windows 7 Professional operating system

2.4. System Reliability

Table 4: System Reliability

Wear-leveling Algorithms	Static and Dynamic Wear-leveling	
Bad Blocks Management	Supportive	
ECC Technology	72 bits per 1024 bytes	
Endurance	TBW (Tera Bytes Written) ; Based on Sequential Write Test.	
Capacity	TBW(TB)	DWPD & Lifespan
2GB	33	DWPD=9.284 DWPD (Drive Written Per Day) Lifespan = 3 Years, or < 20,000 Erase Counts
4GB	66	
8GB	132	
16GB	264	
32GB	529	
64GB	1,059	

NOTES:

- (1). Samples were built using Toshiba 15 nm Toggle MLC NAND flash.
- (2). TBW may differ according to flash configuration, SDR configuration, and platform.
- (3). The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor.

2.5. Physical Specifications

Refer to Table 5 and see Figure 3 for APRO aSLC CFast Card – PHANES-C Series physical dimensions.

Table 5: Physical Specifications of aSLC CFast Card-PHANES-C Series

Length:	42.8 + 0.10mm / 1.69 in
Width:	36.4 + 0.15mm / 1.43 in
Thickness:	3.5 (3.6 max) + 0.1mm / 0.13 in (Based on Cfast 1.0 Specification, the max. thickness is 3.6mm.)
Weight:	Plastic: 10g / 0.4oz ; Metal: 13g / 0.46oz

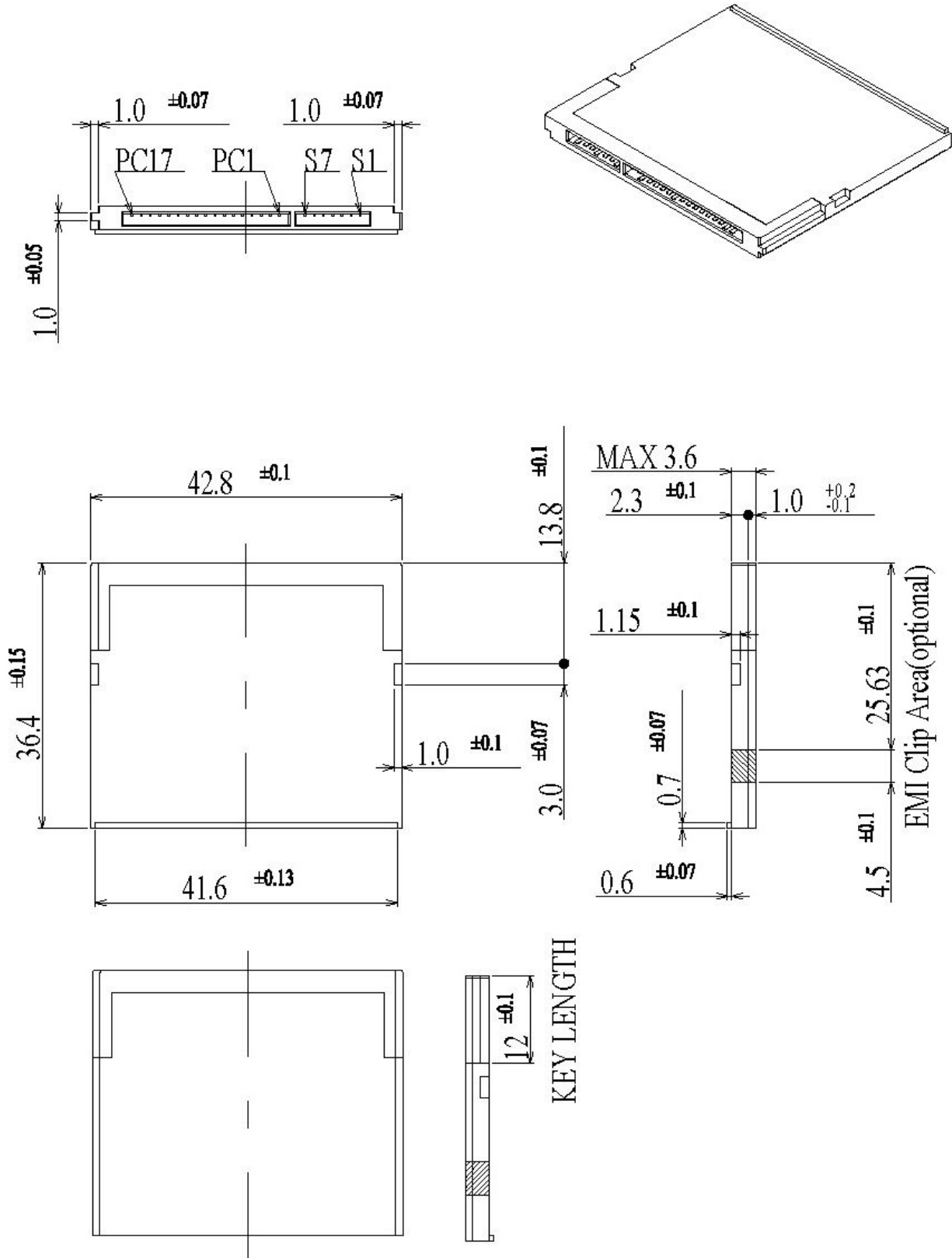


Figure 3: APRO aSLC SATA III CFast Card Dimension

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 uses MIL-I-46058C silicon conformal coating

3. Interface Description

3.1. APRO CFast Card interface

APRO CFast Card is equipped with 7 pins in the signal segment and 17 pins in the power segment.



Figure 4: SATA 7-pin (data) + 17-pin (power)

3.2. Pin Assignments

Refer to Table 6 and see Figure 4 for APRO aSLC CFast Card – PHANES-C Series pin assignments. There are total of 7 pins in the signal segment and 17 pins in the power segment. The pin assignments are listed in below table 6.

Table 6 - Pin Assignments


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

Key and Spacing separate signal and power segments		
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


Appendix A: Ordering Information

1. Part Number List

◆ **APRO aSLC SATA III CFast Card – PHANES-C Series with Plastic frame Kit**

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp Grade (-40°C ~ +85°C)
	2GB	SPCFA002G-PCCTMBAS	WPCFA002G-PCCTMBASC
	4GB	SPCFA004G-PCCTMBAS	WPCFA004G-PCCTMBASC
	8GB	SPCFA008G-PCCTMBAS	WPCFA008G-PCCTMBASC
	16GB	SPCFA016G-PCCTMBAS	WPCFA016G-PCCTMBASC
	32GB	SPCFA032G-PCCTMBAS	WPCFA032G-PCCTMBASC
	64GB	SPCFA064G-PCCTMBAS	WPCFA064G-PCCTMBASC

◆ **APRO aSLC SATA III CFast Card – PHANES-C Series with Rugged Metal frame Kit**

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp Grade (-40°C ~ +85°C)
	2GB	SRCFA002G-PCCTMBAS	WRCFA002G-PCCTMBASC
	4GB	SRCFA004G-PCCTMBAS	WRCFA004G-PCCTMBASC
	8GB	SRCFA008G-PCCTMBAS	WRCFA008G-PCCTMBASC
	16GB	SRCFA016G-PCCTMBAS	WRCFA016G-PCCTMBASC
	32GB	SRCFA032G-PCCTMBAS	WRCFA032G-PCCTMBASC
	64GB	SRCFA064G-PCCTMBAS	WRCFA064G-PCCTMBASC

2. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 — X11 X12 X13 X14 X15 X16 X17 X18 C

X1 : Grade

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

W: Wide Temp Grade- operating temp. -40° C ~ +85 ° C
(With Conformal Coating treatment on PCBA)

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

002G:	2GB	016G:	16GB
004G:	4GB	032G:	32GB
008G:	8GB	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 X18 : Flash IC

B : 15 nm

AS : aSLC Technology.

C : Reserved for specific requirement

C : Conformal-coating

Appendix B: Limited Warranty

APRO warrants your SATA III CFast Cards 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) 3 years / Within 20K Erasing Counts

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