APRO Co., Ltd.

# MLC

# SATA III CFast™ Card

## HERMES-J Series


**Document No. :** 100-xxCFA-JJCTMB

**Version No. :** 02V0

**Date :** May, 2019

ISO 9001 : 2015 CERTIFIED

# Product Features

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

- **Compatibility**
  - Compliant with SATA Revision 3.1
  - Compliant with CFast™ Specification 2.0
  - SATA 1.5Gbps/3.0Gbps/6.0Gbps data transfer rate.
  - ATA-8 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.
  - Static wear-leveling algorithm
  - Support bad Block Management

- **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: 213.0 mA (max.)
  - Write Mode: 332.0 mA (max.)
  - Idle Mode: 125.0 mA (max.)

- **Performance (Maximum value) *2**
  - Sequential Read: 229.0 MB/sec. (max.)
  - Sequential Write: 131.0 MB/sec. (max.)

- **Capacity**
  - 4GB, 8GB, 16GB, 32GB, 64GB, 128GB and 256GB.

- **Reliability**
  - **TBW:** Up to 76.8 TBW at 256GB Capacity. (Client workload by JESD-219A)
  - **ECC:** Automatic 40 bits per 1024 bytes error correction (ECC) and retry capabilities
  - **Temperature:** (Operating)
    Standard Grade: 0ºC ~ +70ºC
    Wide Temp. Grade: -40ºC ~ +85ºC
  - **Vibration:** 70 Hz to 2K 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. Sequential performance is based on CrystalDiskMark 5.1.2 with file size 1000MB

# Order Information

## I. Part Number List

◆ **APRO MLC SATA III CFast™ Card HERMES-J Series with plastic frame kit**

| Product Picture | Grade | Standard grade (0°C ~ 70°C) | Wide Temp Grade ( -40°C ~ +85°C ) |
|---|---|---|---|
|  | 4GB | SPCFA004G-JJCTMB-(T) | WPCFA004G-JJCTMB-(T)C |
| | 8GB | SPCFA008G-JJCTMB-(T) | WPCFA008G-JJCTMB-(T)C |
| | 16GB | SPCFA016G-JJCTMB-(T) | WPCFA016G-JJCTMB-(T)C |
| | 32GB | SPCFA032G-JJCTMB-(T) | WPCFA032G-JJCTMB-(T)C |
| | 64GB | SPCFA064G-JJCTMB-(T) | WPCFA064G-JJCTMB-(T)C |
| | 128GB | SPCFA128G-JJCTMB-(T) | WPCFA128G-JJCTMB-(T)C |
| | 256GB | SPCFA256G-JJCTMB-(T) | WPCFA256G-JJCTMB-(T)C |

◆ **APRO MLC SATA III CFast™ Card HERMES-J Series with rugged metal frame kit**

| Product Picture | Grade | Standard grade (0°C ~ 70°C) | Wide Temp Grade ( -40°C ~ +85°C ) |
|---|---|---|---|
|  | 4GB | SRCFA004G-JJCTMB-(T) | WRCFA004G-JJCTMB-(T)C |
| | 8GB | SPCFA008G-JJCTMB-(T) | WPCFA008G-JJCTMB-(T)C |
| | 16GB | SRCFA016G-JJCTMB-(T) | WRCFA016G-JJCTMB-(T)C |
| | 32GB | SRCFA032G-JJCTMB-(T) | WRCFA032G-JJCTMB-(T)C |
| | 64GB | SRCFA064G-JJCTMB-(T) | WRCFA064G-JJCTMB-(T)C |
| | 128GB | SRCFA128G-JJCTMB-(T) | WRCFA128G-JJCTMB-(T)C |
| | 256GB | SRCFA256G-JJCTMB-(T) | WRCFA256G-JJCTMB-(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 — X18**

**X1** : **Grade**

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

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

| | | | |
|---|---|---|---|
| **004G:** | 4GB | **064G:** | 64GB |
| **008G:** | 8GB | **128G:** | 128GB |
| **016G:** | 16GB | **256G:** | 256GB |
| **032G:** | 32GB | | |

**X11** : **Controller**

**J :** HERMES Series

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

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

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

**C :** Commercial grade

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

**T :** Toshiba MLC-NAND Flash IC

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

**M :** MLC-NAND Flash IC

**X16** : **MLC Technology**

**B :** Toshiba 15nm MLC

**X18** : **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 | 2016/3/16 |
| 1.1 | Add the option for thermal sensor | 2018/11/02 |
| 1.2 | Updated Version | 2018/11/28 |
| 2.0 | Updated document form | 2019/05/24 |

# Contents

## 1. Introduction

APRO MLC SATA III CFast™ Card HERMES-J 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. APRO MLC SATA III CFast™ Card HERMES-J Series 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 for 4GB, 8GB, 16GB, 32GB, 64GB, 128GB and 256GB capacities.

APRO MLC SATA III CFast™ Card HERMES-J Series features with great portability and resistance against vibration. The sequential read speed is 220.0 MB/sec and sequential write speed is 130.0 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 MLC SATA III CFast™ Card HERMES-J Series supports optional standard grade operating temperature 0°C ~ 70°C and wide temperature -40°C ~ +85°C.

APRO MLC SATA III CFast™ Card HERMES-J 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 SATA III CFast™ Card HERMES-J Series can be booting SSD to varieties of IPC motherboards and PC structure system.
Figure 1 shows a block diagram of APRO MLC SATA III CFast™ Card HERMES-J Series.

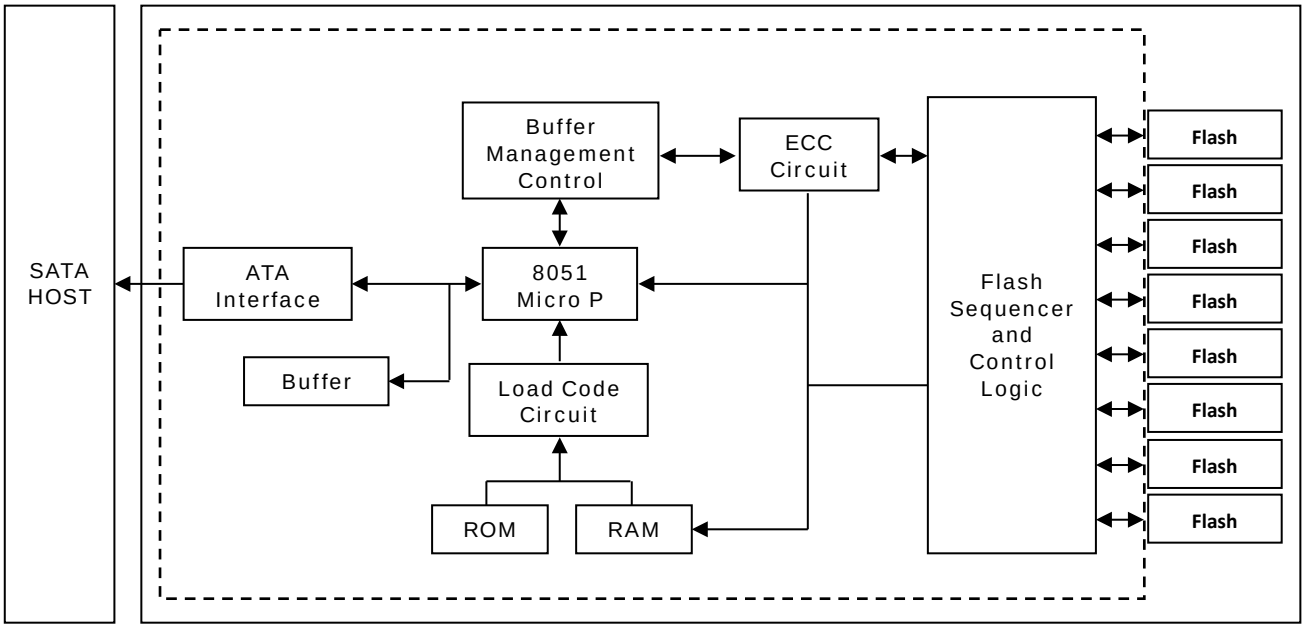


***Figure 1: APRO MLC SATA III CFast™ Card HERMES-J Series block diagram***

## 1.1. *Scope*

This document describes features, specifications and installation guide of APRO MLC SATA III CFast™ Card HERMES-J Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

## 1.2. *Flash Management Technology – Static Wear Leveling*

Flash memory can be programed and erased within a limited number of times, and the limited of the P/E cycle is defined by the flash array vendor. The P/E cycle limited applies to each individual erase block in the flash device.

In order to gain the best management for flash memory, APRO SATA III MLC SATA III CFast™ Card HERMES-J Series supports Static Wear-leveling technology to manage the Flash system. The life of flash memory is limited; the management is to increase the life of the flash product.

A static wear-leveling algorithm evenly distributes data over an entire Flash cell array and searches for the least used physical blocks. The identified low cycled sectors are used to write the data to those locations. If blocks are empty, the write occurs normally. If blocks contain static data, it moves that data to a more heavily used location before it moves the newly written data. The static wear leveling maximizes effective endurance Flash array compared to no wear leveling or dynamic wear leveling.

## 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 MLC SATA III CFast™ Card HERMES-J 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 HERMES-J Series | | Standard Grade SxCFAxxxG-JJCTMB | Wide Temp Grade WxCFAxxxG-JJCTMBC |
|---|---|---|---|
| Temperature | Operating: | 0ºC ~ +70ºC | -40ºC ~ +85ºC |
| | Non-operating: | -20ºC ~ +80ºC | -50ºC ~ +95ºC |
| Humidity | Operating & Non-operating: | 10% ~ 95% non-condensing | |
| Vibration | Frequency / Acceleration: | 70 Hz to 2K Hz, 20G, 3 axes | |
| Shock | Operating & Non-operating: | 0.5ms, 1500 G, 3 axes | |
| Electrostatic Discharge (ESD) | Temperature: | 24ºC | |
| | 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 HERMES-J Series | | |
|---|---|---|
| DC Input Voltage (VCC) | | 3.3V±5% |
| Maximum average value | Reading Mode : | 213.0 (max.) |
| | Writing Mode : | 332.0 (max.) |
| | Idle Mode : | 125.0 (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 | | 0.4 ms (estimated) | | | | | | |
| Maximum Performance | Capacity | 4GB | 8GB | 16GB | 32GB | 64GB | 128GB | 256GB |
| | Sequential Read (MB/s) | 104.0 | 104.0 | 103.0 | 202.0 | 231.0 | 229.0 | 229.0 |
| | Sequential Write(MB/s) | 24.0 | 24.0 | 21.0 | 42.0 | 81.0 | 136.0 | 131.0 |

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

## 2.4. System Reliability

***Table 4: System Reliability***

| | |
|---|---|
| **Wear-leveling Algorithms** | Static wear-leveling algorithms |
| **Bad Blocks Management** | Supportive |
| **ECC Technology** | 40 bits per 1024 bytes |
| **Thermal Sensor** | Supportive |
| **Erase counts** | NAND MLC Flash Cell Level : 3K P/E Cycles |
| **Capacity** | **TBW(TB)** |
| **4GB** | 1.2 |
| **8GB** | 2.4 |
| **16GB** | 4.8 |
| **32GB** | 9.6 |
| **64GB** | 19.2 |
| **128GB** | 38.4 |
| **256GB** | 76.8 |

*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 SATA III CFast™ Card HERMES-J Series physical specifications and dimensions.

***Table 5: Physical Specifications of APRO MLC SATA III CFast™ Card-HERMES-J Series***

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

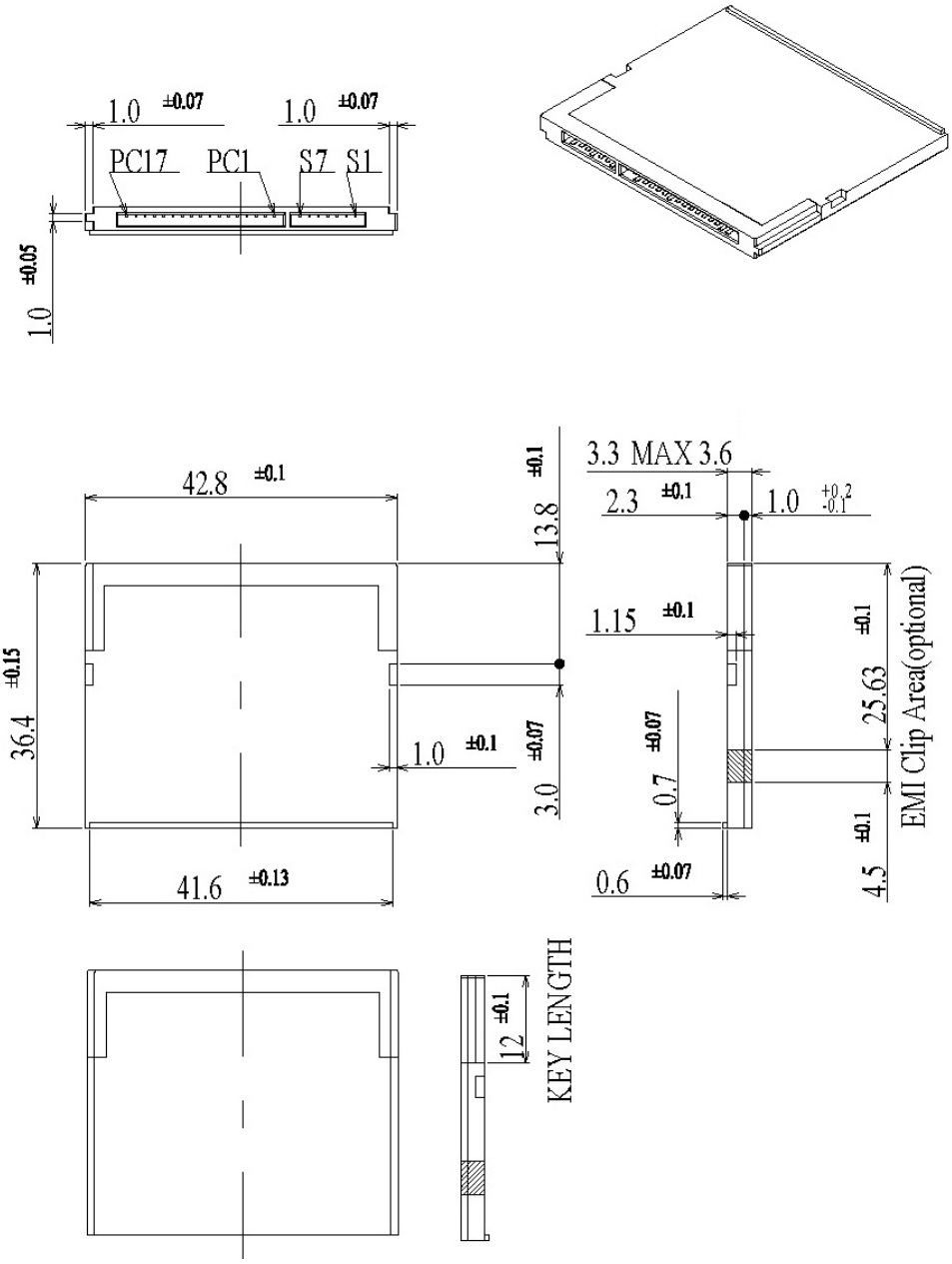


***Figure 2: APRO MLC SATA III CFast™ Card Dimension***

## 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 storages 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. MLC SATA III CFast™ Card interface

APRO MLC SATA III CFast™ Card HERMES-J Series is equipped with 7 pins in the signal segment and 17 pins in the power segment.

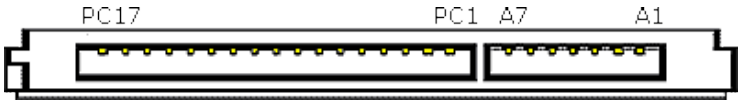


***Figure 3: The connectors of Signal Segment and Power Segment***

## 3.2. Pin Assignments

APRO MLC SATA III CFast™ Card HERMES-J 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** |
| **A1** | GND | NA |
| **A2** | A+ | Differential Signal Pair A |
| **A3** | A- | |
| **A4** | GND | NA |
| **A5** | B- | Differential Signal Pair B |
| **A6** | B+ | |
| **A7** | 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 HERMES-J 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**

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