



aSLC

# Micro Secure Digital Memory Card

PHANES-F Series

## **Product Specification**

aSLC

Micro Secure Digital Memory Card

Version 01V0

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#### Revision History

| Revision | Description     | Date       |
|----------|-----------------|------------|
| 1.0      | Initial release | 2016/04/25 |

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## 1. Introduction

APRO aSLC Micro Secure Digital Memory Card – PHANES-F Series, is specifically designed to meet the security, performance and environmental requirements of some significant applications such like networking, telecommunications and data-communications, mobile & embedded computing, medical instruments and industrial computing applications.

The main used Flash memory is aSLC-NAND Type Flash memory chips are 4GB, 8GB, 16GB and 32GB. APRO aSLC Micro SD Cards include a copyright protection that complies with the security of the SDMI standard, and the physical form-factor, pin assignment.

### 1.1. Scope

This document describes the key features and specifications of APRO aSLC Micro Secure Digital Memory Cards.

### 1.2. System Features

- aSLC-NAND Flash technology
- Capacity available are 4GB, 8GB, 16GB and 32GB.
- Supports SD command Class 2/4/6/ 10
- Supports UHS-1
- SD Memory Card Specifications, Part 1 Physical Layer Specification, version 3.1 Final
- SD Memory Card Specifications, Part 3, Security Specification, Version 3.0 Final
- 8 exposed contacts on one side
- Supports wide temp grade operating temperature -40°C to +85°C
- Supports SD mode and SPI mode
- Supports CPRM
- Performance, Read up to: 99.51 MB/sec; Write up to 92.62 MB/sec
- RoHS & REACH compliant

### 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.

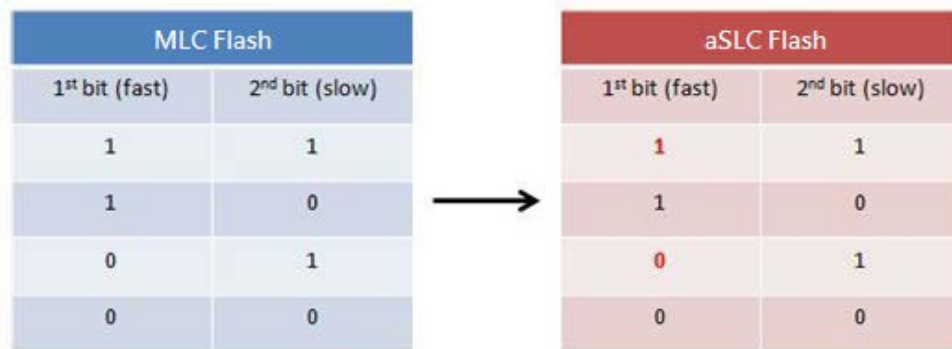


Figure 2: The concept of APRO aSLC Rugged Metal 2.5" SATA III SSD – PHANES-HR Series

#### 1.4. 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 PHANES-F Series Micro SD Card 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**

| APRO Micro Secure Digital Memory Card |                            | Wide temp Grade             |
|---------------------------------------|----------------------------|-----------------------------|
| PHANES-F Series                       |                            | WPMSDXXXG-PFITMBAS          |
| Temperature                           | Operating:                 | -40°C ~ +85°C               |
|                                       | Non-operating:             | -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 Micro Secure Digital Memory Card    |                | Wide temp Grade          |
|--|----------------|--------------------------|
| PHANES-F Series                          |                | WPMSDXXXG-PFITMBAS       |
| DC Input Voltage (VCC)                   |                | 3.3V±10%                 |
| +3.3V Current<br>(Maximum average value) | Reading Mode : | 400 mA (UHS-I Mode max.) |
|  | Writing Mode : | 400 mA (UHS-I Mode max.) |
|  | Idle Mode :    | 1000 uA (max.)           |

### 2.3. System Performance

**Table 3: System Performances**

|                               |                         |                           |       |       |       |
|-------------------------------|-------------------------|---------------------------|-------|-------|-------|
| Data Transfer Mode supporting |                         | SDA Specification Ver 3.0 |       |       |       |
| Average Access Time           |                         | 1 ms (estimated)          |       |       |       |
| Maximum Performance           | Capacity                | 4GB                       | 8GB   | 16GB  | 32GB  |
|                               | Sequential Read (MB/s)  | 97.50                     | 99.58 | 99.51 | 99.51 |
|                               | Sequential Write (MB/s) | 80.25                     | 92.47 | 92.75 | 92.62 |

Note:

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

(2). Testing of the Micro Secure Digital Memory Card maximum performance was performed under the following platform:

- TestMetrix Test; Test 500MB

**2.4. System Reliability**

**Table 4: System Reliability**

|                                      |   |
|--------------------------------------|---|
| <b>Wear-leveling Algorithms</b>      | Static and Dynamic Wear-leveling  |
| <b>Bad Blocks Management</b>         | Supportive  |
| <b>ECC Technology</b>                | BCH ECC   |
| <b>Erase counts</b>                  | NAND MLC Flash w/aSLC Technology : 20K P/E Cycles   |
| <b>Durability</b>                    | 10,000 inserting cycles   |
| <b>Bending</b>                       | >10N  |
| <b>Torque</b>                        | 0.1N +/- 2.5 deg.   |
| <b>Drop Test</b>                     | 1.5M free fall  |
| <b>Salt Spray Test</b>               | 3% NaCl @ 35°C  |
| <b>Waterproof</b>                    | 1000mm submerge for 30 minutes, IPx7 compliance   |
| <b>Electrostatic Discharge (ESD)</b> | Contact: +/- 4KV each item 25 times<br>Air: +/- 8KV 10 times  |
| <b>X-Ray Exposure Test</b>           | 0.1 Gy of medium energy radiation (70 keV to 140keV, cumulative does per year) to both sides of the card. |
| <b>Endurance</b>                     | Un-limited Read Cycles<br>Endurance Management enables ten years minimal useful life                      |

2.5. Physical Specifications

Refer to Table 5 and see Figure 1 for Micro Secure Digital Memory Card PHANES-F Series physical specifications and dimensions.

Table 5: Physical Specifications of APRO Micro Secure Digital Memory Card PHANES-F Series

|                   |                 |
|-------------------|-----------------|
| <b>Length:</b>    | 15.00 mm        |
| <b>Width:</b>     | 11.00 mm        |
| <b>Thickness:</b> | 1.0 mm          |
| <b>Weight:</b>    | 0.3 g / 0.01 oz |

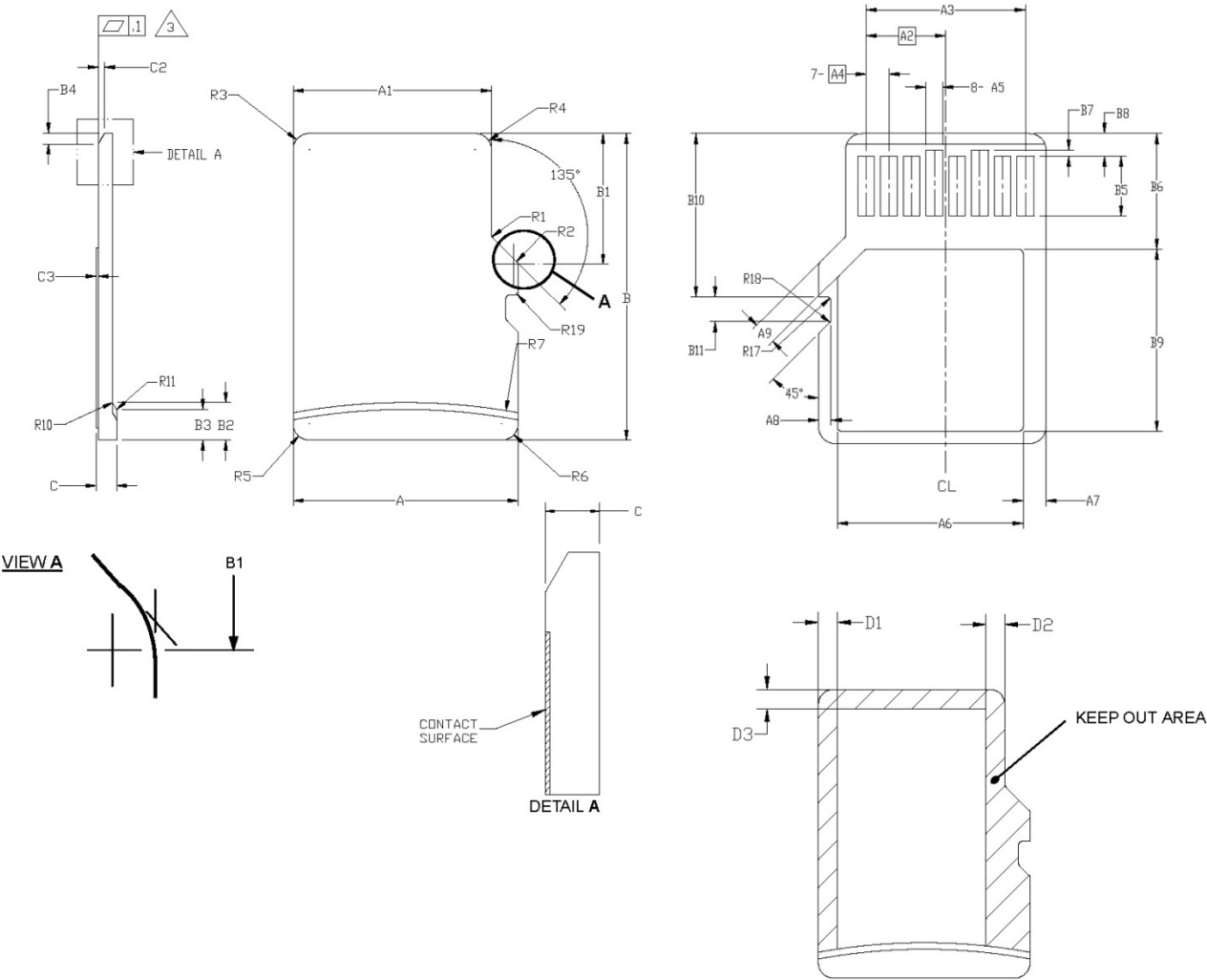


Figure 1: APRO Micro Secure Digital Memory Card Dimension




| SYMBOL | COMMON DIMENSIONS |       |       | NOTE  |
|--------|-------------------|-------|-------|-------|
|        | MIN               | NOM   | MAX   |       |
| A      | 10.90             | 11.00 | 11.10 |       |
| A1     | 9.60              | 9.70  | 9.80  |       |
| A2     | -                 | 3.85  | -     | BASIC |
| A3     | 7.60              | 7.70  | 7.80  |       |
| A4     | -                 | 1.10  | -     | BASIC |
| A5     | 0.75              | 0.80  | 0.85  |       |
| A6     | -                 | -     | 8.50  |       |
| A7     | 0.90              | -     | -     |       |
| A8     | 0.60              | 0.70  | 0.80  |       |
| A9     | 0.80              | -     | -     |       |
| B      | 14.90             | 15.00 | 15.10 |       |
| B1     | 6.30              | 6.40  | 6.50  |       |
| B2     | 1.64              | 1.84  | 2.04  |       |
| B3     | 1.30              | 1.50  | 1.70  |       |
| B4     | 0.42              | 0.52  | 0.62  |       |
| B5     | 2.80              | 2.90  | 3.00  |       |
| B6     | 5.50              | -     | -     |       |
| B7     | 0.20              | 0.30  | 0.40  |       |
| B8     | 1.00              | 1.10  | 1.20  |       |
| B9     | -                 | -     | 9.00  |       |
| B10    | 7.80              | 7.90  | 8.00  |       |
| B11    | 1.10              | 1.20  | 1.30  |       |
| C      | 0.90              | 1.00  | 1.10  |       |
| C1     | 0.60              | 0.70  | 0.80  |       |
| C2     | 0.20              | 0.30  | 0.40  |       |
| C3     | 0.00              | -     | 0.15  |       |
| D1     | 1.00              | -     | -     |       |
| D2     | 1.00              | -     | -     |       |
| D3     | 1.00              | -     | -     |       |
| R1     | 0.20              | 0.40  | 0.60  |       |
| R2     | 0.20              | 0.40  | 0.60  |       |
| R3     | 0.70              | 0.80  | 0.90  |       |
| R4     | 0.70              | 0.80  | 0.90  |       |
| R5     | 0.70              | 0.80  | 0.90  |       |
| R6     | 0.70              | 0.80  | 0.90  |       |
| R7     | 29.50             | 30.00 | 30.50 |       |
| R10    | -                 | 0.20  | -     |       |
| R11    | -                 | 0.20  | -     |       |
| R17    | 0.10              | 0.20  | 0.30  |       |
| R18    | 0.20              | 0.40  | 0.60  |       |
| R19    | 0.05              | -     | 0.20  |       |

Notes:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

2. DIMENSIONS ARE IN MILLIMETERS.

3.  COPLANARITY IS ADDITIVE TO C1 MAX THICKNESS.

### 3. Interface Description

#### 3.1. APRO Micro Secure Digital Memory Card interface

APRO aSLC Micro Secure Digital Memory Card has eight exposed contacts on one side.

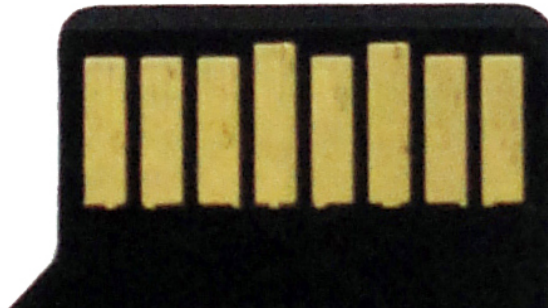


Figure 2: 8 Pins Connector

#### 3.2. Pin Assignments

There are total of 8 pins in the Micro SD Connector. The pin assignments are listed in below table 6.

Table 6 - Pin Assignments

| Pin Number | SD Mode                |                     |                                | SPI Mode        |                |                       |
|------------|------------------------|---------------------|--------------------------------|-----------------|----------------|-----------------------|
|            | Pin Name               | Type <sup>1</sup>   | Description                    | Pin Name        | Type           | Description           |
| Pin 1      | DAT2                   | I/O/PP              | Data Line [bit2]               | RSV             |                |                       |
| Pin 2      | CD / DAT3 <sup>2</sup> | I/O/PP <sup>3</sup> | Card Detect / Data Line [bit3] | CS              | I <sup>3</sup> | Chip Select           |
| Pin 3      | CMD                    | PP                  | Command / Response             | DI              | I              | Data in               |
| Pin 4      | V <sub>DD</sub>        | S                   | Supply voltage                 | V <sub>DD</sub> | S              | Supply voltage        |
| Pin 5      | CLK                    | I                   | Clock                          | SCLK            | I              | Clock                 |
| Pin 6      | V <sub>SS</sub>        | S                   | Supply voltage ground          | V <sub>SS</sub> | S              | Supply voltage ground |
| Pin 7      | DAT0                   | I/O/PP              | Data Line [bit0]               | DO              | O/PP           | Data Out              |
| Pin 8      | DAT1                   | I/O/PP              | Data Line [bit1]               | RSV             |                |                       |

(1) S: power supply, I:input; O:output using push-pull drivers; PP:I/O using push-pull drivers.


(2) The extended DAT lines (DAT1-DAT3) are input on power up. They start to operate as DAT lines after SET\_BUS\_WIDTH command. The Host shall keep its own DAT1-DAT3 lines in input mode, as well, while they are not used. It is defined so, in order to keep compatibility to Multi-Media Cards.

(3) At power up this line has a 50KOhm pull up enabled in the card. This resistor serves two functions Card detection and Mode Selection. For Mode Selection, the host can drive the line high or let it be pulled high to select SD mode. If the host wants to select SPI mode it should drive the line low. For Card detection, the host detects that the line is pulled high. This pull-up should be disconnected by the user during regular data transfer period, with SET\_CLR\_CARD\_DETECT(ACMD42) command.

**Appendix A: Ordering Information**

**1. Part Number List**

◆ **APRO Micro Secure Digital Memory Card – PHANES-F Series**

| Product Picture   | Grade | Wide temp Grade ( -40°C ~ +85°C ) |
|---|-------|-----------------------------------|
|  <p>APRO Co., Ltd.<br/>aSLC MicroSD I<br/>16GB</p> | 4GB   | WPMSD004G-PFITMBAS                |
|   | 8GB   | WPMSD008G-PFITMBAS                |
|   | 16GB  | WPMSD016G-PFITMBAS                |
|   | 32GB  | WPMSD032G-PFITMBAS                |

**2. Part Number Decoder:**

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

**X1: Grade**

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

**X12: Controller version**

A, B, C.....

**X2 : The material of case**

P : Plastic casing

**X13 : Controller Grade**

I : Industrial grade

**X3 X4 X5 : Product category**

MSD : Micro Secure Digital (SD) memory card

**X14 : Flash IC**

T : Toshiba Flash IC

**X6 X7 X8 X9 : Capacity**

**004G:** 4GB      **016G:** 16GB

**008G:** 8GB      **032G:** 32GB

**X15 : Flash IC grade**

M : MLC-NAND Flash

**X11 : Controller**

P : PHANES Series

**X16 : Generation**

B : 15 nm

**X17 X18 : Flash IC grade / Type**

AS : aSLC technology

### ***Appendix B: Limited Warranty***

APRO warrants your Micro Secure Digital Memory Card 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

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