



aSLC

Micro Secure Digital Memory Card

PHANES-F Series

Product Specification

aSLC

Micro Secure Digital Memory Card

Version 01V0

Document No. 100-xPMSD-PFITMBAS

April 2016

APRO CO., LTD.

Phone: +88628226-1539

Fax: +88628226-1389

This document is for information use only and is **subject to change without prior notice**. APRO Co., Ltd. assumes no responsibility for any errors that may appear in this document, nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. No part of this document may be reproduced, transmitted, transcribed, stored in a retrievable manner or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior written consent of an officer of APRO Co., Ltd.

All parts of the APRO documentation are protected by copyright law and all rights are reserved.

APRO and the APRO logo are registered trademarks of APRO Co., Ltd.

Product names mentioned herein are for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

© 2016 APRO Corporation. All rights reserved.

Revision History

Revision	Description	Date
1.0	Initial release	2016/04/25

CONTENTS

1.	INTRODUCTION	- 3 -
1.1.	SCOPE	- 3 -
1.2.	SYSTEM FEATURES	- 3 -
1.3.	ASLC TECHNOLOGY	- 3 -
1.4.	FLASH MANAGEMENT TECHNOLOGY - STATIC AND DYNAMIC WEAR LEVELING	- 4 -
2.	PRODUCT SPECIFICATIONS	- 5 -
2.1.	SYSTEM ENVIRONMENTAL SPECIFICATIONS	- 5 -
2.2.	SYSTEM POWER REQUIREMENTS	- 5 -
2.3.	SYSTEM PERFORMANCE	- 5 -
2.4.	SYSTEM RELIABILITY	- 6 -
2.5.	PHYSICAL SPECIFICATIONS	- 7 -
3.	INTERFACE DESCRIPTION	- 9 -
3.1.	APRO MICRO SECURE DIGITAL MEMORY CARD INTERFACE	- 9 -
3.2.	PIN ASSIGNMENTS	- 9 -
	APPENDIX A: ORDERING INFORMATION	- 10 -
1.	PART NUMBER LIST	- 10 -
2.	PART NUMBER DECODER:	- 10 -
	APPENDIX B: LIMITED WARRANTY	11

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.

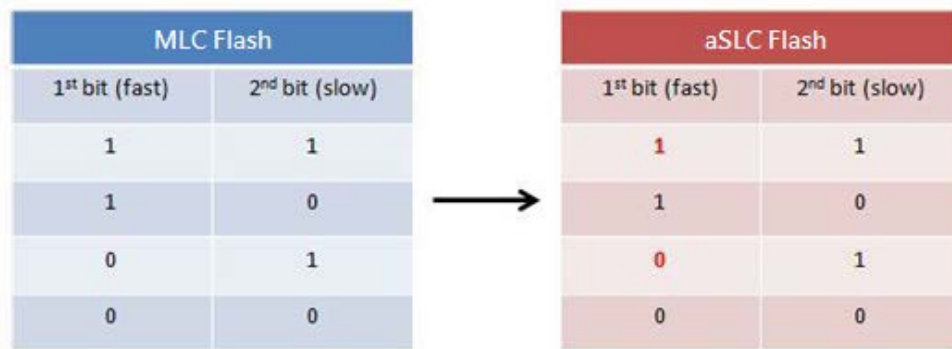


Figure 2: The concept of APRO aSLC Rugged Metal 2.5" SATA III SSD – PHANES-HR Series

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 (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

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

Length:	15.00 mm
Width:	11.00 mm
Thickness:	1.0 mm
Weight:	0.3 g / 0.01 oz

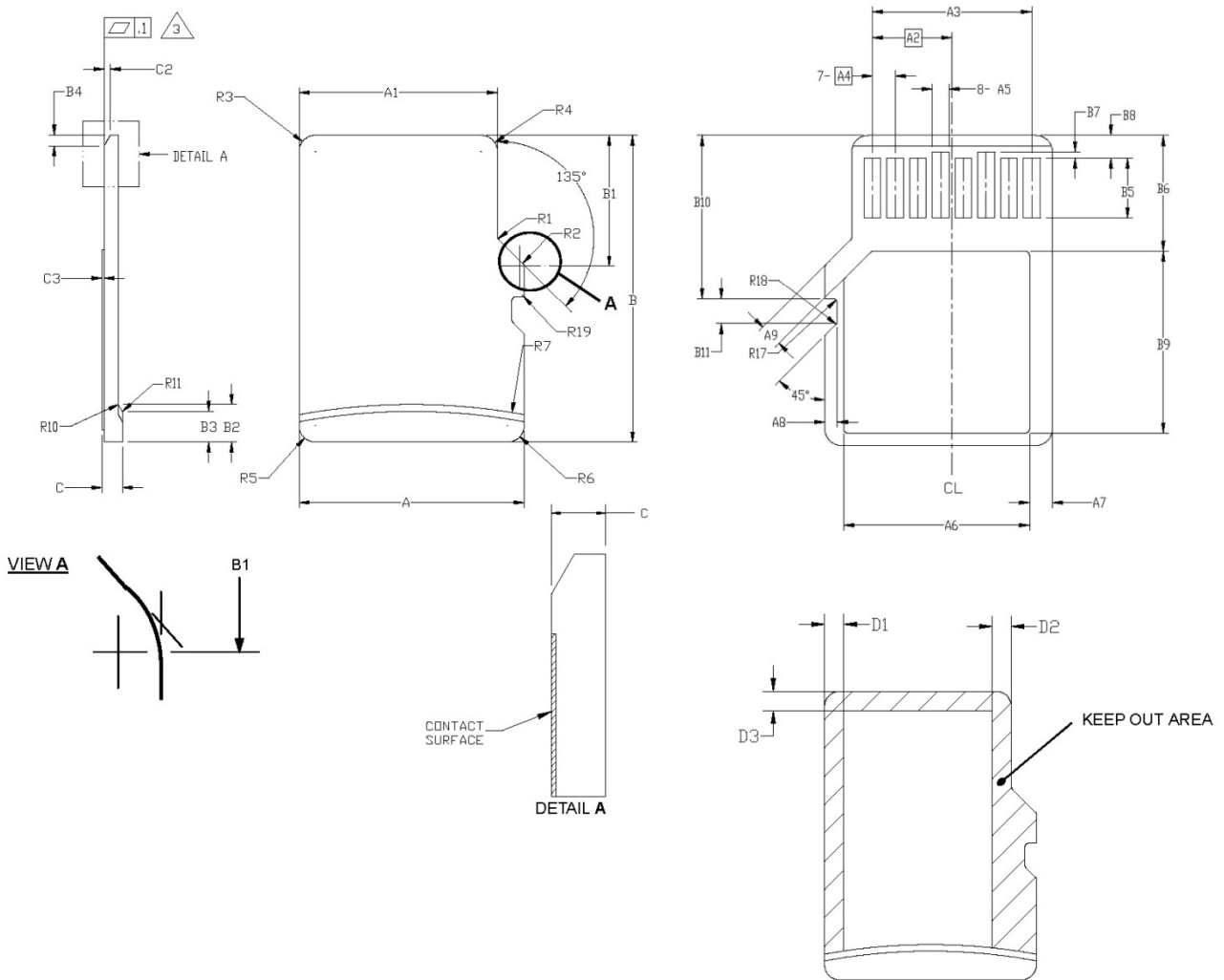



Figure 1: APRO Micro Secure Digital Memory Card Dimension

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.

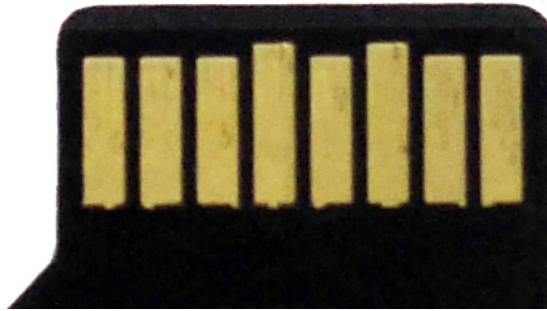


Figure 2: 8 Pins Connector

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 ¹	Description	Pin Name	Type	Description
Pin 1	DAT2	I/O/PP	Data Line [bit2]	RSV		
Pin 2	CD / DAT3 ²	I/O/PP ³	Card Detect / Data Line [bit3]	CS	I ³	Chip Select
Pin 3	CMD	PP	Command / Response	DI	I	Data in
Pin 4	V _{DD}	S	Supply voltage	V _{DD}	S	Supply voltage
Pin 5	CLK	I	Clock	SCLK	I	Clock
Pin 6	V _{SS}	S	Supply voltage ground	V _{SS}	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)
	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) 3 years / Within 20K Erasing Counts

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