APRO Co., Ltd.

Industrial Micro Secure Digital Memory Card

PHANES-F Series

Product Specification

INDUSTRIAL

Micro Secure Digital Memory Card

Version 01V0

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Revision History

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1. Introduction

APRO Industrial 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.
Available capacities are 1GB, 2GB and 4GB with SLC-NAND Toshiba flash IC. APRO Industrial Grade 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 Industrial Grade Micro Secure Digital Memory Cards.

1.2. System Features

- SLC-NAND Flash technology
- Capacities available from 1GB, 2GB and 4GB
- Supports SD3.0 (Backward compatible to 2.0 host) Class 2/4/6/10
- 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 industrial grade operating temperature -40°C to +85°C
- Supports SD mode and SPI mode
- Supports CPRM
- 1GB and 2GB are Non-UHS
- 4GB supports UHS-1
- 1GB and 2GB high Speed Mode performance, sequential read up to 20.0 MB/sec; sequential write up to 20.0 MB/sec
- 4GB performance, up to 30 MB/sec; sequential write up to 25.0 MB/sec
- RoHS & REACH compliant

1.3. Flash Management Technology - Static and Dynamic Wear Leveling

In order to gain the best management for flash memory, APRO PHANES-F Series Micro SD Card supports both Static and Dynamic 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.
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 data, it moves that data to a more heavily used location before it moves the newly written data. Wear leveling maximizes effective endurance Flash array compared to no wear leveling products.

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 **PHANES-F Series**		**Industrial Grade** **WPMSDxxxG-PFITI**
Temperature	**Operating:** **Non-operating:**	-40ºC ~ +85ºC -50ºC ~ +95ºC
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 **PHANES-F Series**		**WPMSDxxxG-PFITI**		
		Non-UHS		**UHS-I Mode**
		Default Speed	**High Speed**	
DC Input Voltage (VCC)		3.3V±10%		
+3.3V Current **(Maximum average value)**	**Power Up :**	250 uA (max.)	250 uA (max.)	250 uA (max.)
	Reading Mode :	150 mA (max.)	200 mA (max.)	400 mA (max.)
	Writing Mode :	150 mA (max.)	200 mA (max.)	400 mA (max.)
	Standby Mode :	1000 uA (max.)	1000 uA (max.)	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**	**1GB**	**2GB**	**4GB**
	Sequential Read (MB/s)	20.0	20.0	30.0
	Sequential Write (MB/s)	20.0	20.0	25.0

Note:

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

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

- *Computer with Intel i5 3.5GHz processor*
- *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	68 bits per 1024 bytes
Erase counts	NAND SLC Flash Cell Level : 60K P/E Cycles
Durability	10,000 inserting cycles
Bending	>10N
Torque	0.1N +/- 2.5 deg.
Drop Test	1.5M free fall
Salt Spray Test	3% NaCl @ 35ºC
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
Data Retention	10 years

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

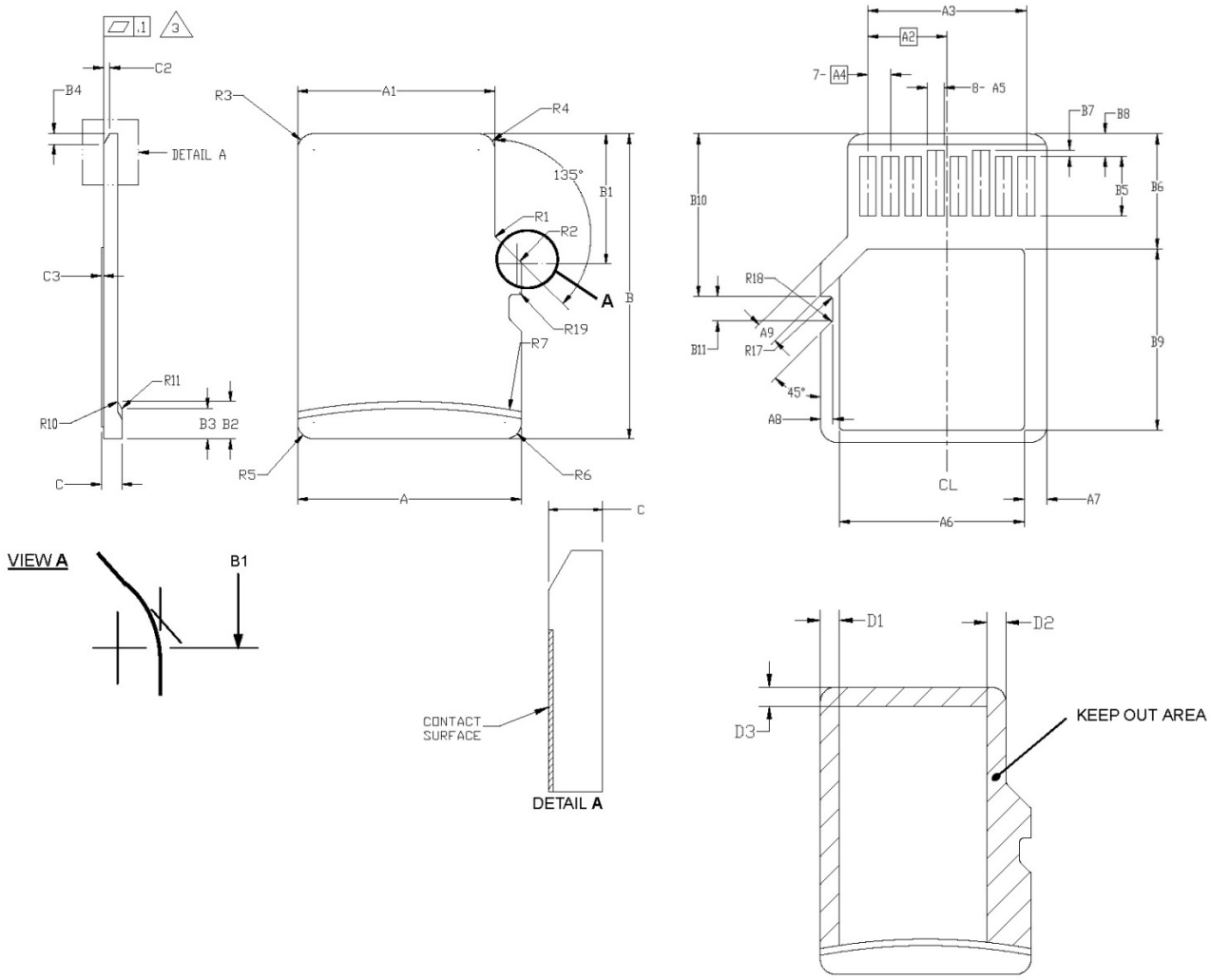

Figure 1: APRO Micro Secure Digital Memory Card Dimension

	COMMON DIMENSIONS			
SYMBOL	MIN	NOM	MAX	NOTE
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 Industrial Grade Micro Secure Digital Memory Card has eight exposed contacts on one side.

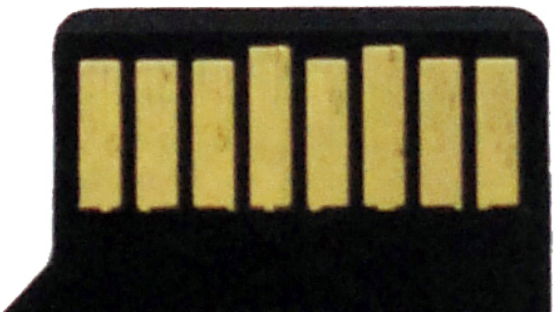

Figure 2: 8 Pins Connector

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, withSET_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*	*Industrial Grade (-40ºC ~ +85ºC)*
	*1GB*	WPMSD001G-PFITI
	2GB	WPMSD002G-PFITI
	4GB	WPMSD004G-PFITI

2. Part Number Decoder:

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

X1 : **Grade**
W: Industrial grade - operating temp. -40º C ~ +85 º C

X2 : **The material of case**
P : Plastic casing

X3 X4 X5 : **Product category**
MSD : Micro Secure Digital (SD) memory card

X6 X7 X8 X9 : **Capacity**

001G:	1GB	**004G:**	4GB
002G:	2GB		

X11 : **Controller**
P : Phison (PHANES-F Series)

X12 : Controller version
A, B, C…..

X13 : **Controller Grade**
I : Industrial grade

X14 : **Flash IC**
T : Toshiba SLC-NAND Flash IC

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

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:

- **SLC IND. Grade 5 years / Within 60K Erasing Counts**

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