



Industrial
Secure Digital
Memory Card
PHANES-F Series

Product Specification

INDUSTRIAL

Secure Digital Memory Card

Version 01V0

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Revision History

Revision	Description	Date
1.0	Initial release	2016/04/08

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1. Introduction

APRO Industrial 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 128MB, 256MB, 512MB, 1GB, 2GB, 4GB, 8GB, 16GB and 32GB with SLC-NAND Toshiba flash IC. APRO Industrial Grade Secure Digital (SD) card version 3.0 is fully compliant to the specification released by SD Card Association. The Command List supports [Part 1 Physical Layer Specification Ver3.01 Final] definitions. Card Capacity of Non-secure Area, Secure Area Supports [Part 3 Security Specification Ver3.00 Final] Specifications.

1.1. Scope

This document describes the key features and specifications of APRO Industrial Grade Secure Digital Memory Cards.

1.2. System Features

- SLC-NAND Flash technology
- Capacities available for 128MB, 256MB, 512MB, 1GB, 2GB, 4GB, 8GB, 16GB and 32GB
- Supported SD command Class 10
- Secure Digital (SD) Card Specifications, Part 1 Physical Layer Specification, version 3.1 Final
- Secure Digital (SD) Card Specifications, Part 3, Security Specification, Version 3.0 Final
- 9 exposed contacts on one side
- Supports industrial grade operating temperature -40°C to +85°C
- It can alternate communication protocol between the SD mode and SPI mode.
- Support CPRM (Content Protection for Recordable Media) of SD Card
- Embedded mode optional.
- S.M.A.R.T. Function supportive.
- System in Package (SiP) / Chip on Board packaging design for highest robustness.
- SD card performance, sequential read up to 21.9 MB/sec; sequential write up to 20 MB/sec
- SDHC card performance, sequential read up to 65 MB/sec; sequential write up to 55 MB/sec
- 4GB to 32GB by UHS-I Bus speed mode supportive.
- 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 SD/SDHC 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 Secure Digital Memory Card PHANES-F Series		Environmental Specification
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 Secure Digital Memory Card PHANES-F Series			
DC Input Voltage (VCC) 3.3V±10%		128MB ~ 4GB Single Flash (1 x 8bit)	8GB ~ 32GB
+3.3V Current (Maximum average value)	Reading Mode :	100 mA (max.)	< 400mA max.
	Writing Mode :	100 mA (max.)	< 400mA max.
	Standby Mode :	150 uA (max.)	< 1000uA max.

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		SD Specification Ver 3.0								
Average Access Time		1 ms (estimated)								
Maximum Performance	Capacity	128MB	256MB	512MB	1GB	2GB	4GB	8GB	16GB	32GB
	Sequential Read (MB/s)	20.0	20.5	21.9	20.0	20.0	30.0	65.0	65.0	65.0
	Sequential Write(MB/s)	4.5	9.0	20.0	20.0	20.0	25.0	50.0	50.0	55.0

Note:

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

(2). Testing of the 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
Durability	10,000 inserting cycles
Bending	>10N
Torque	0.15 N +/- 2.5 deg.
Drop Test	1.5M free fall
WP Switch Cycle	1,000 cycles @ slide force 0.4N to 5N
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: +/- 15KV 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 Secure Digital Memory Card PHANES-F physical specifications and dimensions.

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

Length:	32.00 mm
Width:	24.00 mm
Thickness:	2.10 mm
Weight:	2.5 g / 0.09 oz

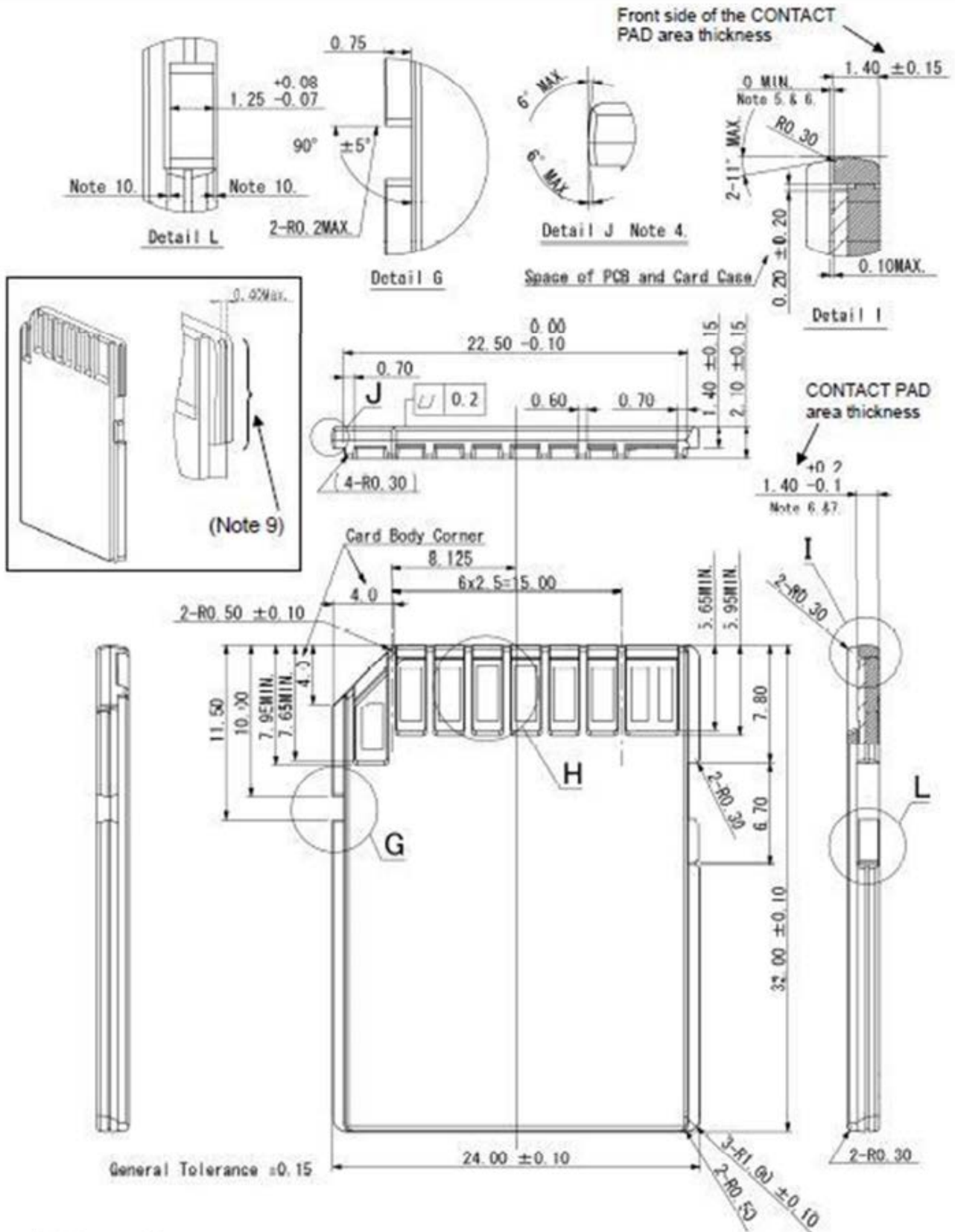


Figure 1: APRO Secure Digital Memory Card Dimension

3. Interface Description

3.1. APRO Secure Digital Memory Card interface

APRO Industrial Grade Secure Digital Memory Card has nine exposed contacts on one side.

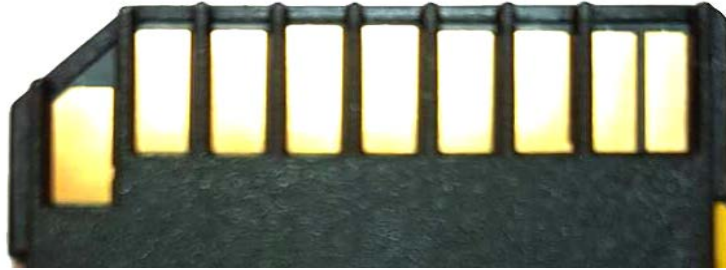


Figure 2: 9 Pins Connector

3.2. Pin Assignments

There are total of 9 pins in the SD/SDHC 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	CD / DAT3 ²	I/O/PP ³	Card Detect / Data Line [bit3]	CS	I ³	Chip Select
Pin 2	CMD	PP	Command / Response	DI	I	Data in
Pin 3	V _{SS1}	S	Supply voltage ground	V _{SS1}	S	Supply voltage ground
Pin 4	V _{DD}	S	Supply voltage	V _{DD}	S	Supply voltage
Pin 5	CLK	I	Clock	SCLK	I	Clock
Pin 6	V _{SS2}	S	Supply voltage ground	V _{SS2}	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		
Pin 9	DAT2	I/O/PP	Data Line [bit2]	RSV		

Appendix A: Ordering Information

1. Part Number List

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

Product Picture	Grade	Industrial Grade (-40°C ~ +85°C)
	128MB	WPSDC128M-PFITI
	256MB	WPSDC256M-PFITI
	512MB	WPSDC512M-PFITI
	1GB	WPSDC001G-PFITI
	2GB	WPSDC002G-PFITI
	4GB	WPSDH004G-PFITI
	8GB	WPSDH008G-PFITI
	16GB	WPSDH016G-PFITI
	32GB	WPSDH032G-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. -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

SDC : Secure Digital (SD) memory card

SDH : Secure Digital High Capacity (SDHC) card

X14 : Flash IC

T : Toshiba SLC-NAND Flash IC

X6 X7 X8 X9 : Capacity

128M:	128MB	002G:	2GB
256M	256MB	004G	4GB
512M:	512MB	008G:	8GB
001G	1GB	016G	16GB
		032G	32GB

X15 : Flash IC grade / Type

I : Industrial grade

X11 : Controller

P : PHANES Series

Appendix B: Limited Warranty

APRO warrants your 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.