APRO Co., Ltd.

Industrial Secure Digital Memory Card

HERMIT-D Series

Product Specification

INDUSTRIAL

Secure Digital Memory Card

Version 01V0

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Revision History

Revision	Description	Date
1.0	Initial release	2015/08/18

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1. Introduction

APRO Industrial Secure Digital Memory Card 3.0 – HERMIT-D 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 from 128MB up to 32GB with SLC-NAND Toshiba flash IC. APRO Industrial Grade SD & SDHC Memory Cards 3.0 include a copyright protection that complies with the security of the SDMI standard, and the physical form-factor, pin assignment and data transfer protocol are forward compatible with SD Card, with some additions.

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 from 128MB up to 32GB
- Fully compatible to SDA Specifications V2.0 / V3.0
- Supports SD command Class 10
- Supports UHS-1
- SD Memory Card Specifications, Part 1 Physical Layer Specification, version 4.10
- SD Memory Card Specifications, Part 2, File System Specification, Version 3.0
- SD Memory Card Specifications, Part 3, Security Specification, Version 3.0
- 9 pins gold fingers
- Supports industrial grade operating temperature -40°C to +85°C
- Supports SD mode and SPI mode
- Supports CPRM
- Copyright Protection Mechanism-Complies with highest security of SDMI standard
- Write protect feature using mechanical switch
- Power protection mechanism by advanced technology
- SD performance up to 29.4 MB/sec; SDHC performance up to 29.3 MB/sec
- RoHS & REACH compliant

1.3. Flash Management Technology - Global Wear Leveling

In order to gain the best management for flash memory, APRO HERMIT-D Series SD Card supports Global 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.

1.4. Power Loss Data Protection Mechanism

HERMIT-D Series SD & SDHC Memory Card applies the advance technology of installing two sets of firmware in the storage. Whenever customer's application encounters sudden power failure and the primary firmware is damaged, secondary firmware will automatically replace the damaged firmware and becomes the updated primary firmware to ensure system reliability. Simultaneously, the new primary firmware will generate a backup firmware and becomes the new secondary firmware.

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 HERMIT-D Series		Industrial Grade WPSDHxxxG-HDITI
Temperature	**Operating:**	-40ºC ~ +85ºC
	Non-operating:	-50ºC ~ +95ºC
Humidity	**Operating & Non-operating:**	10% ~ 95% non-condensing
Vibration	**Operating & Non-operating:**	7 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 HERMIT-D Series		Industrial Grade WPSDHxxxG -HDITI
DC Input Voltage (VCC) 100mV max. ripple(p-p)		3.3V±5%
+3.3V Current (Maximum average value)	**Reading Mode :**	43 mA (max.)
	Writing Mode :	69 mA (max.)
	Idle Mode :	1.1 mA (max.)

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		SDA Specification Ver 3.0				
Average Access Time		1 ms (estimated)				
SD Maximum Performance	**Capacity**	**128MB**	**256MB**	**512MB**	**1GB**	**2GB**
	Sequential Read (MB/s)	23.4	27.9	30.0	29.3	29.4
	Sequential Write(MB/s)	5.2	10.7	19.4	17.5	19.6
SDHC Maximum Performance	**Capacity**	**4GB**	**8GB**	**16GB**	**32GB**	
	Sequential Read (MB/s)	29.3	29.3	27.1	27.0	
	Sequential Write(MB/s)	22.6	22.8	22.9	22.8	

Note:

(1). All values quoted are typically at 25℃ 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	Global Wear-leveling
Bad Blocks Management	Supported
ECC Technology	96 bits per 1024 bytes
Endurance	Un-limited Read Cycles Endurance Management enables ten years minimal useful life
Data Retention	10 years

2.5. User Capacity and LBA Values

Table 5: User Capacity and LBA Values

Product Capacity	User Capacity	Total LBA
128MB	117 MB	240,128
256MB	235 MB	482,816
512MB	472 MB	967,680,
1GB	959 MB	1,965,056
2GB	1,920 MB	3,932,160
4GB	3,870 MB	7,925,760
8GB	7,740 MB	15,851,520
16GB	15,608 MB	31,965,184
32GB	31,328 MB	64,159,744

2.6. Physical Specifications

Refer to Table 6 and see Figure 1 for Secure Digital Memory Card HERMIT-D Series physical specifications and dimensions.

Table 6: Physical Specifications of APRO Secure Digital Memory Card HERMIT-D Series

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

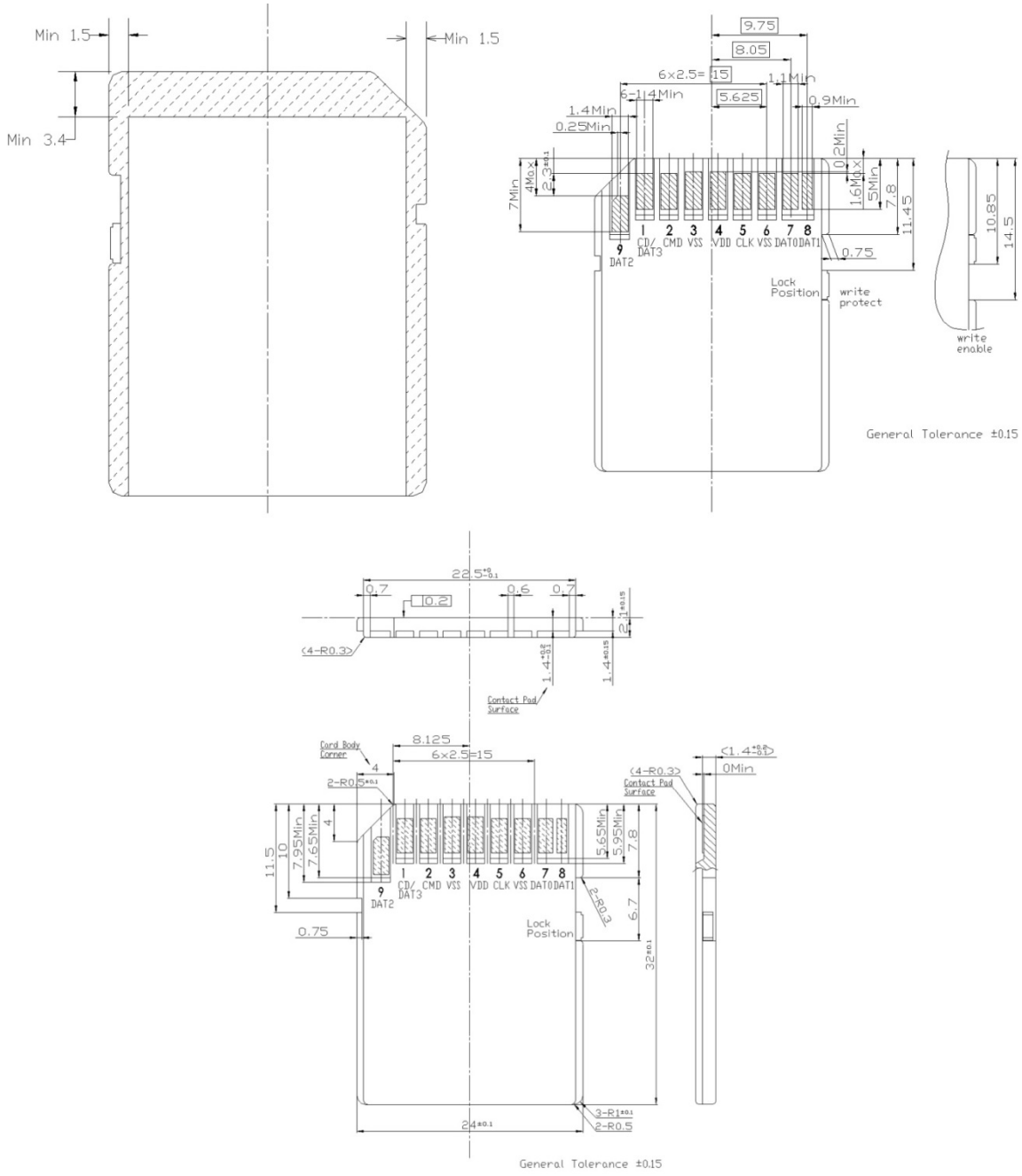

Figure 1: APRO Secure Digital Memory Card Dimension

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.

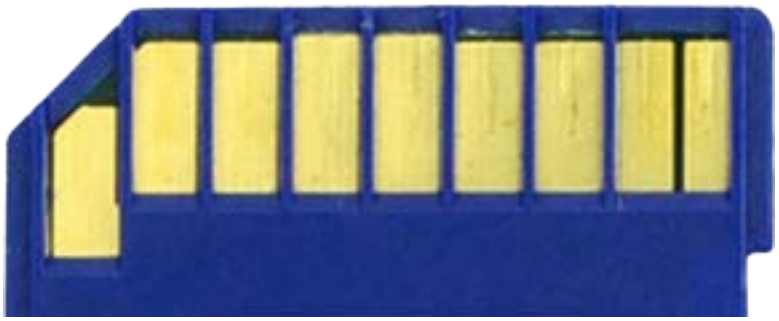

Figure 2: 9 Pins Connector

3.2. Pin Assignments

There are total of 9 pins in the SD Connector. The pin assignments are listed in below table 6.

Table 7 - Pin Assignments

Pin #	Operating under SPI Mode			Operating under SD Mode		
	Pin Name	Type[1]	Function	Pin Name	Type[1]	Function
Pin 1	CS	I[3]	Chip Select (neg true)	CD/DAT3[2]	I/O/PP3	Card Detect/Data Line [Bit 3]
Pin 2	DI	I	Data In	CMD	I/O/PP	Command/Response
Pin 3	V_{SS}	S	Supply Voltage Ground	V_{SS1}	S	Supply voltage ground
Pin 4	V_{DD}	S	Supply Voltage	V_{DD}	S	Supply voltage
Pin 5	SCLK	I	Clock	CLK	I	Clock
Pin 6	V_{SS2}	S	Supply Voltage Ground	V_{SS2}	S	Supply voltage ground
Pin 7	DO	O/PP	Data Out	DAT0	I/O/PP	Data Line [Bit 0]
Pin 8	RSV			DAT1[4]	I/O/PP	Data Line [Bit 1]
Pin 9	RSV			DAT2[5]	I/O/PP	Data Line [Bit 2]

Appendix A: Ordering Information

1. Part Number List

◆ **APRO Secure Digital Memory Card – HERMIT-D Series**

Product Picture	*Grade*	*Industrial Grade (-40ºC ~ +85ºC)*
	*128MB*	WPSDC128M-HDITI
	256MB	WPSDC256M-HDITI
	512MB	WPSDC512M-HDITI
	1GB	WPSDC001G-HDITI
	2GB	WPSDC002G-HDITI

Product Picture	*Grade*	*Industrial Grade (-40ºC ~ +85ºC)*
	*4GB*	WPSDH004G-HDITI
	8GB	WPSDH008G-HDITI
	16GB	WPSDH016G-HDITI
	32GB	WPSDH032G-HDITI

2. Part Number Decoder:

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

X1 : **Grade**
W: Wide Temp Grade- operating temp. -40º C ~ +85 º C

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

X3 X4 X5 : **Product category**
SDC : Secure Digital (SD) memory card
SDH : Secure Digital High Capacity (SDHC) card

X6 X7 X8 X9 : **Capacity**

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

X11 : **Controller**
H : Hyperstone (HERMIT-D 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 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:

- **WPSDCxxxx-HDITI** **5 years**

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