

RoHS Compliant

Industrial Micro SD Card

Customized Specifications

October 1, 2015

Version 1.2



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FEATURES:

- **Fully compliant with SD Card Specifications 1.1 and 2.0**
- **Capacity range**
 - 256, 512 MB
 - 1, 2, 4 GB
- **Performance***
 - Sustained Read: Up to 20 MB/sec
 - Sustained Write: Up to 16 MB/sec
- **SD-protocol compatible**
- **Standard interface**
 - 8-pins SD interface
- **NAND flash type: SLC**
- **Operating voltage: 2.7V ~ 3.6V**
- **Physical dimension : 15.0 mm(L) x 11.0 mm(W) x 1.0 mm(H)**
- **Flash Management**
 - Built-in advanced ECC algorithm: 24bits/1KB
 - Wear-leveling algorithm
- **Endurance (TBW: Terabytes Written)**
 - 256MB: 3 TBW
 - 512MB: 6 TBW
 - 1GB: 12 TBW
 - 2GB: 24 TBW
 - 4GB: 49 TBW
- **Temperature ranges**
 - Operating temperature: -40°C to 85°C
 - Storage temperature: -40°C to 85°C
- **Power consumption:**
 - Operating mode: 50 mA
 - Standby mode: 100 uA
- **Supports S.M.A.R.T.**
- **RoHS Compliant**

*Vary from capacities. Performance values presented here are typical and may vary depending on settings and platforms.

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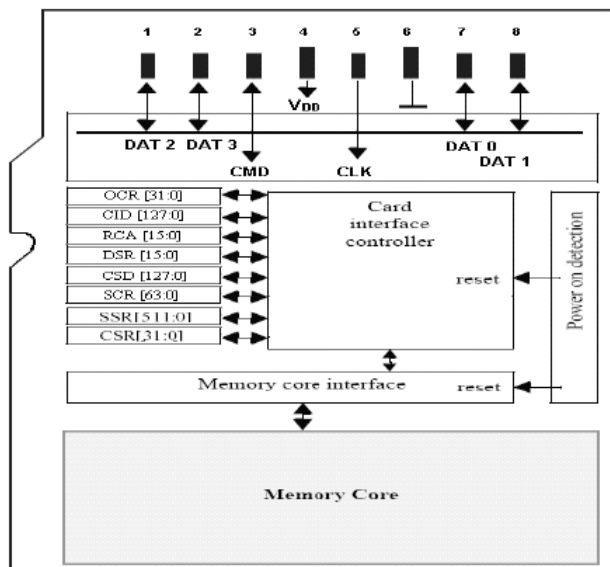
1. General Description

Micro SD card has been the favorable storage in both enterprise and consumer electronic devices for its compact size, relatively fast transfer speed and decent reliability. Apacer industrial micro SD card is capable of delivering optimal speed up to 20 MB/s. Reliability wise, the card can be put in operations with ambient temperatures ranging -40 to 85°C. Built with SLC NAND Flash, the card surpasses most of the typical of its kind in the market with regard in program/erase cycles.

The industrial SD card is compatible with SD Card 1.1/2.0 specification and delivers compatibility as well as reliability. The card is built in with hardware ECC engine that can detect and correct up to 24bits/1KB of transferring data. Moreover, this industrial card is designed with power smart mechanism that supports standby and sleep mode, making it an ideal portable storage when power supply is limited.

1.1 Product Function Block

The Micro SD contains a card controller and a memory core for the SD standard interface.



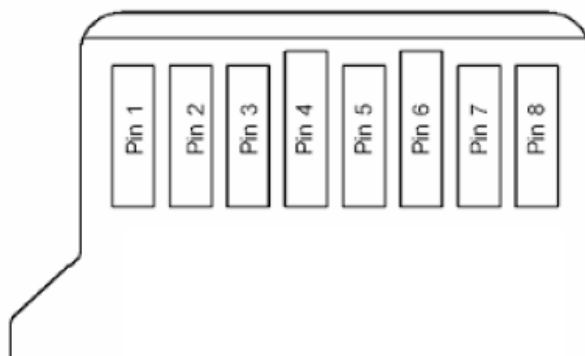
1.2 Functional description

The Micro SD device contains a high level, intelligent flash management that provides many capabilities including:

- Powerful ECC – correcting up to 24bits/1KB
- Wear-leveling

2. Product Characteristics

2.1 Card Architecture



2.2 Pin Assignment

Pin	SD Mode		SPI Mode	
	Name	Description	Name	Description
1	DAT2	Data line[bit 2]	RSV	Reserved
2	CD/DAT3 ²	Card Detect/Data line [bit 3]	CS	Chip select
3	CMD	Command/Response	DI	Data in
4	VDD	Supply voltage	VDD	Supply voltage
5	CLK	Clock	SCLK	Clock
6	VSS	Supply voltage ground	VSS	Supply voltage ground
7	DAT0	Data line[bit 0]	DO	Data out
8	DAT1	Data line[bit 1]	RSV	Reserved

2.3 Capacity Specification

Capacity	Total (LBA) Sectors	Total Partition Sectors	User Data Sectors	User Data Bytes
256 MB	499,712	499,611	499,456	255,721,472
512 MB	985,088	984,851	984,576	504,102,912
1 GB	2,000,896	2,000,651	2,000,128	1,024,065,536
2 GB	4,009,984	4,009,739	4,009,216	2,052,718,592
4 GB	8,019,968	8,011,776	8,003,584	4,097,835,008

Note: results may vary depending on settings and platforms. Please be noted that products are shipped with unformatted capacity. The number of user data bytes and usable storage space may vary from different host operating systems.

2.4 Performance

Performances of the SD card are shown in the table below.

Capacity Modes	256 MB	512 MB	1 GB	2GB	4GB
Sequential Read (MB/s)	19	20	19	19	20
Sequential Write (MB/s)	10	16	11	14	16

Note: results may vary depending on settings and platforms.

2.5 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Supply Voltage	2.7	3.6	V
$T_{storage}$	Storage Temperature	-40	85	°C
T_a	Ambient Operating Temperature	-40	85	°C

2.6 Power consumption (typical)

Capacity Modes	256 MB	512 MB	1 GB	2 GB	4 GB
Operating (mA)	34	34	33	34	50
Idle (uA)	60	60	60	60	100

*Power consumption may differ from host system configurations.

2.7 Endurance

The endurance of a storage device is predicted by TeraBytes Written based on several factors related to usage, such as the amount of data written into the drive, block management conditions, and daily workload for the drive. Thus, key factors, such as Write Amplifications and the number of P/E cycles, can influence the lifespan of the drive.

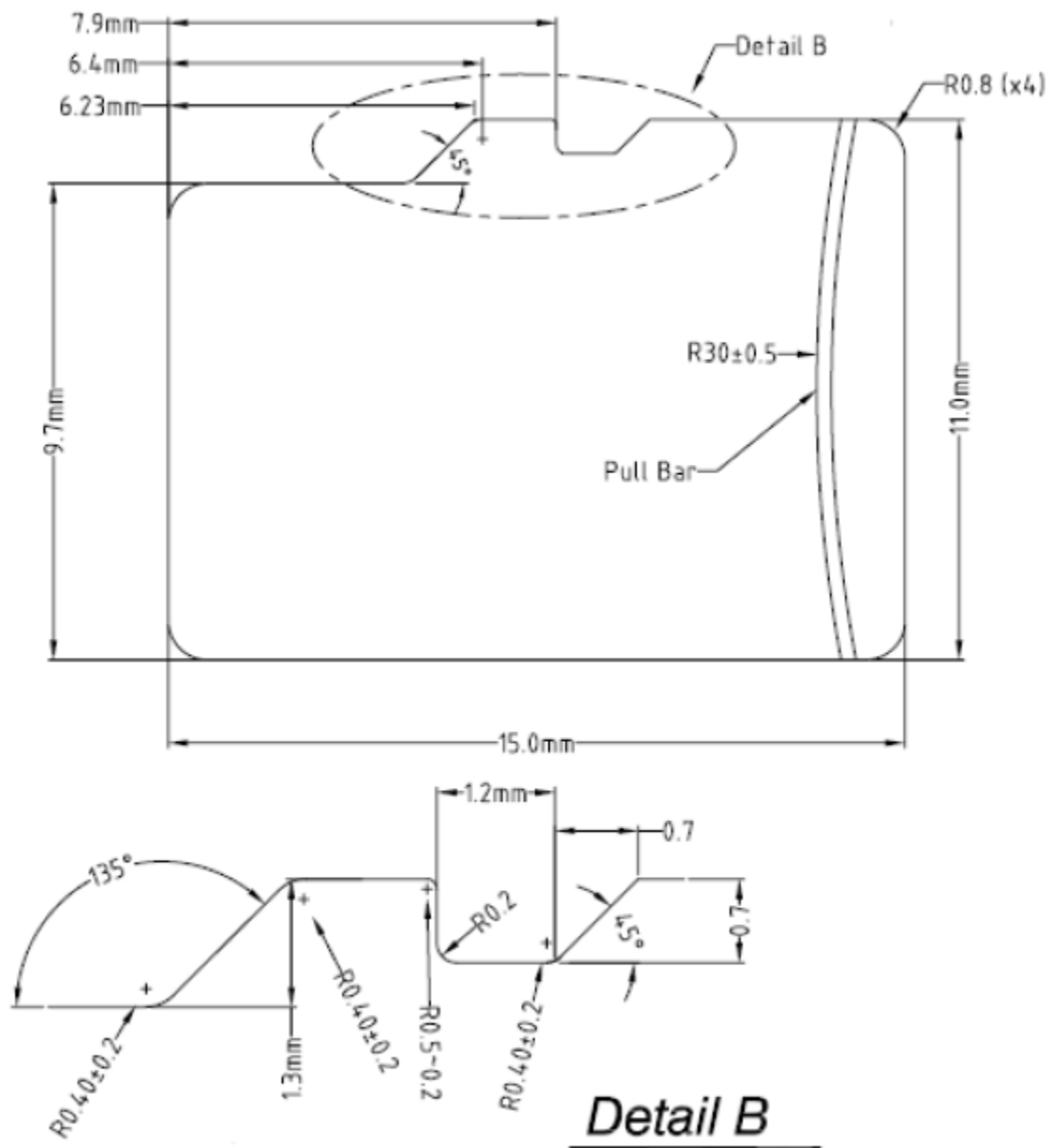
Capacity	TeraBytes Written
256 MB	3
512 MB	6
1 GB	12
2 GB	24
4 GB	49

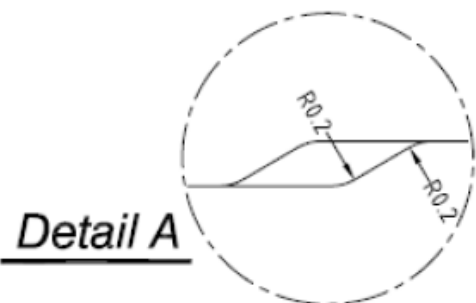
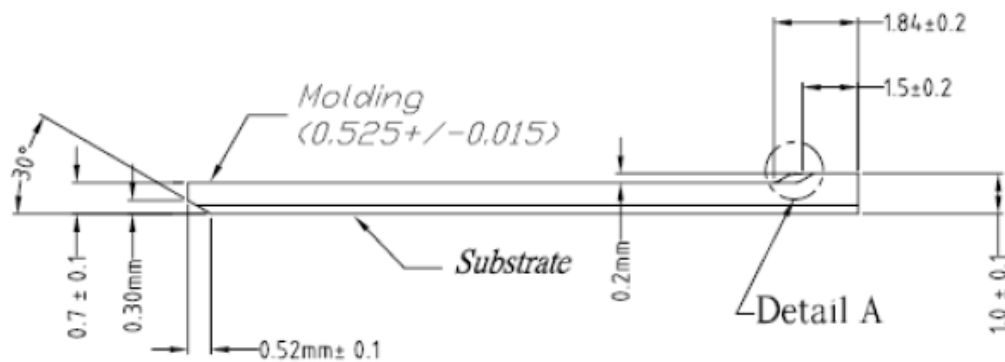
Notes:

- The measurement assumes the data written to the SSD for test is under a typical and constant rate.
- The measurement follows the standard metric: 1 TB (Terabyte) = 1000 GB.

3. Physical Characteristics

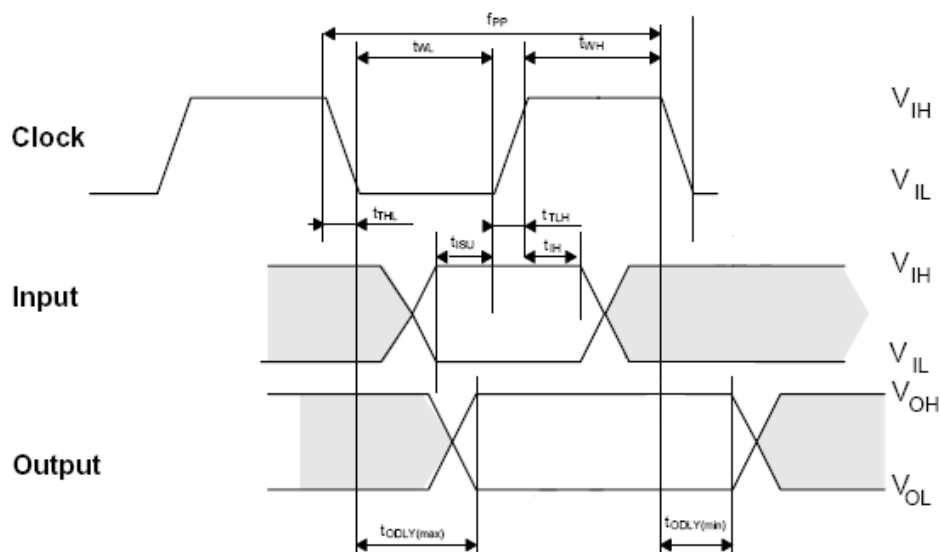
Top View





4. Electrical Characteristics

4.1 Bus Interface Timing (Standard)

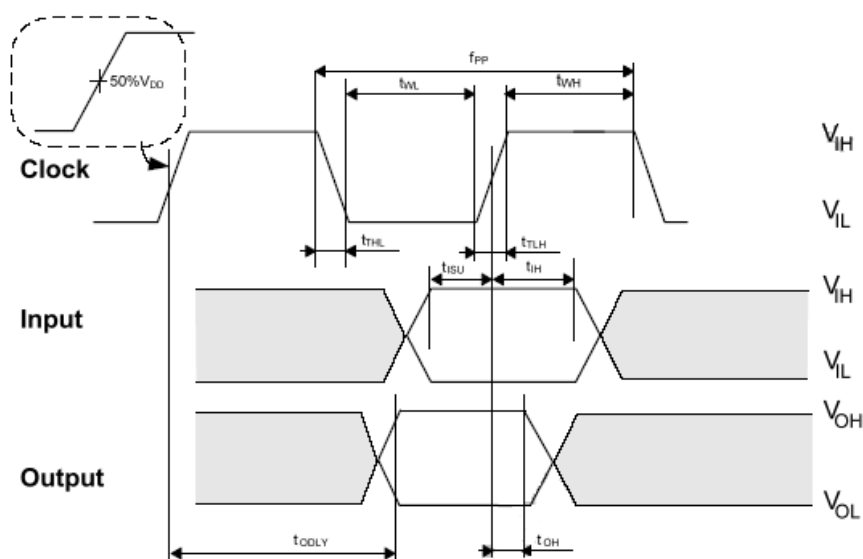


Shaded areas are not valid

SYMBOL	PARAMETER	MIN	MAX	UNIT	Note
Clock CLK (All values are referred to min(V_{IH}) and max(V_{IL}))					
f_{PP}	Clock frequency Data Transfer Mode	0	25	MHz	$C_{card} \leq 10$ pF (1 card)
f_{OD}	Clock frequency Identification Mode	0 ₍₁₎ /100	400	kHz	$C_{card} \leq 10$ pF (1 card)
t_{WL}	Clock low time	10	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{WH}	Clock high time	10	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{TLH}	Clock rise time	-	10	ns	$C_{card} \leq 10$ pF (1 card)
t_{THL}	Clock fall time	-	10	ns	$C_{card} \leq 10$ pF (1 card)
t_{ISU}	Input setup time	5	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{IH}	Input hold time	5	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{ODLY}	Output delay time	0	14	ns	$C_L \leq 40$ pF (1 card)
t_{ODLY}	Output Delay time during Identification Mode	0	50	ns	$C_L \leq 40$ pF (1 card)

(1)0Hz means to stop the clock. The given minimum frequency range is for cases that requires the clock to be continued.

4.2 Bus Interface Timing (High-speed)



Shaded areas are not valid

SYMBOL	PARAMETER	MIN	MAX	UNIT	Note
f_{PP}	Clock frequency data transfer mode	0	50	MHz	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{WL}	Clock low time	7	-	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{WH}	Clock high time	7	-	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{TLH}	Clock rise time	-	3	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{THL}	Clock fall time	-	3	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{ISU}	Input setup time	6	-	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{IH}	Input hold time	2	-	ns	$C_{card} \leq 10 \text{ pF}$ (1 card)
t_{ODLY}	Output delay time		14	ns	$CL \leq 40 \text{ pF}$ (1 card)
T_{OH}	Output hold time	2.5	50	ns	$CL \leq 15 \text{ pF}$ (1 card)
C_L	System capacitance of each line*		40	pF	$CL \leq 15 \text{ pF}$ (1 card)

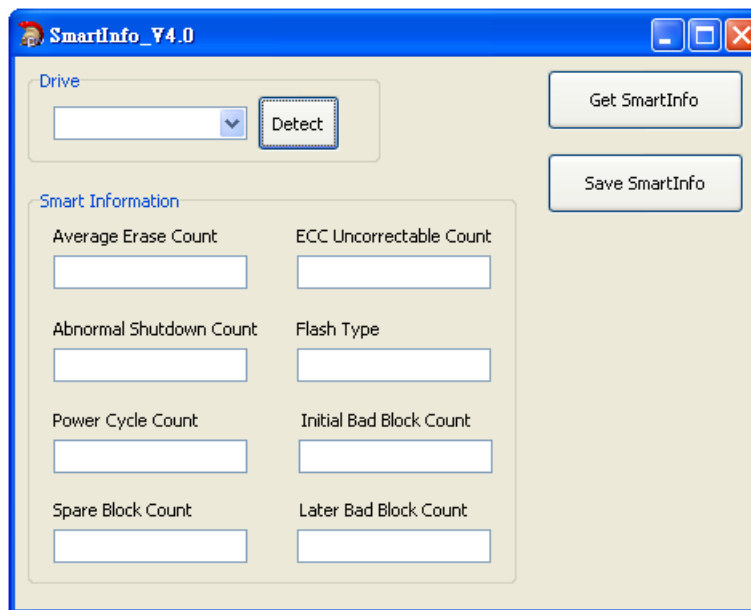
*In order to satisfy severe timing, host shall run on only one card

5. S.M.A.R.T.

S.M.A.R.T. is the abbreviation for Self-Monitoring, Analysis and Reporting Technology, an open standard allowing disk drives to automatically monitor their own health and report potential problems. It provides users critical drive status information and attributes parameters for anticipation purposes. Ideally, this should prevent unexpected drive failure and data loss.

Depending on product ordering requests, we provide customizable user interfaces for our S.M.A.R.T utility. The utility program comes in two types of interfaces versions: complete and simple.

Complete User Interface Version:



Detailed Description for SMART Information

1. Average Erase Count

Value: To record average erase ratio.

This value is calculated by “total erase counts”, “Flash P/E cycles”, “Flash total blocks”.

Initial value = 00.00%

Maximum value = 100.00%

2. Abnormal Shutdown Count

Value: To record abnormal shutdown condition.

Increasing this value by 1 when detected error in the power on stage.

Initial value = 0.

Maximum value = 4294967295.

3. Power Cycle Count

Value: To record power cycle condition.

Increasing this value by 1 when a power Cycle (both normal and abnormal) occurred.

Initial value = 0.

Maximum value = 4294967295.

4. Spare Block Count

Value: To record spare block counts.

Decreasing this variable when detected run-time bad blocks.

(Note:run-time bad blocks may be “erase error”, “program error”, “read error”.)

Initial value = depend on Flash.

Maximum value = 255.

Minimum value = 0.

5. ECC Uncorrectable Count

Value: To record ECC uncorrectable block counts.

Increase this value by 1 when fatal error occurred in Flash read operation.

Initial value = 0.

Maximum value = 255.

6. Flash Type

Value: To determinate mounted Flash type, and always keep in original value.

0: SLC, 1:MLC.

Initial value = depend on Flash.

7. Initial Bad Block Count

Value: To record initial bad blocks when MP process, and always keep in original value.

Initial value = depend on Flash.

Maximum value = 65535.

8. Later Bad Block Count

Value: To record run time bad blocks.

Increasing this variable when detected run-time bad blocks.

Initial value = 0.

Maximum value = 65535.

Simple User Interface Version:



Average Erase Count

Value: To record average erase ratio.

This value is calculated by “total erase counts”, “Flash P/E cycles”, “Flash total blocks”.

Initial value = 00.00%

Maximum value = 100.00%

Detect

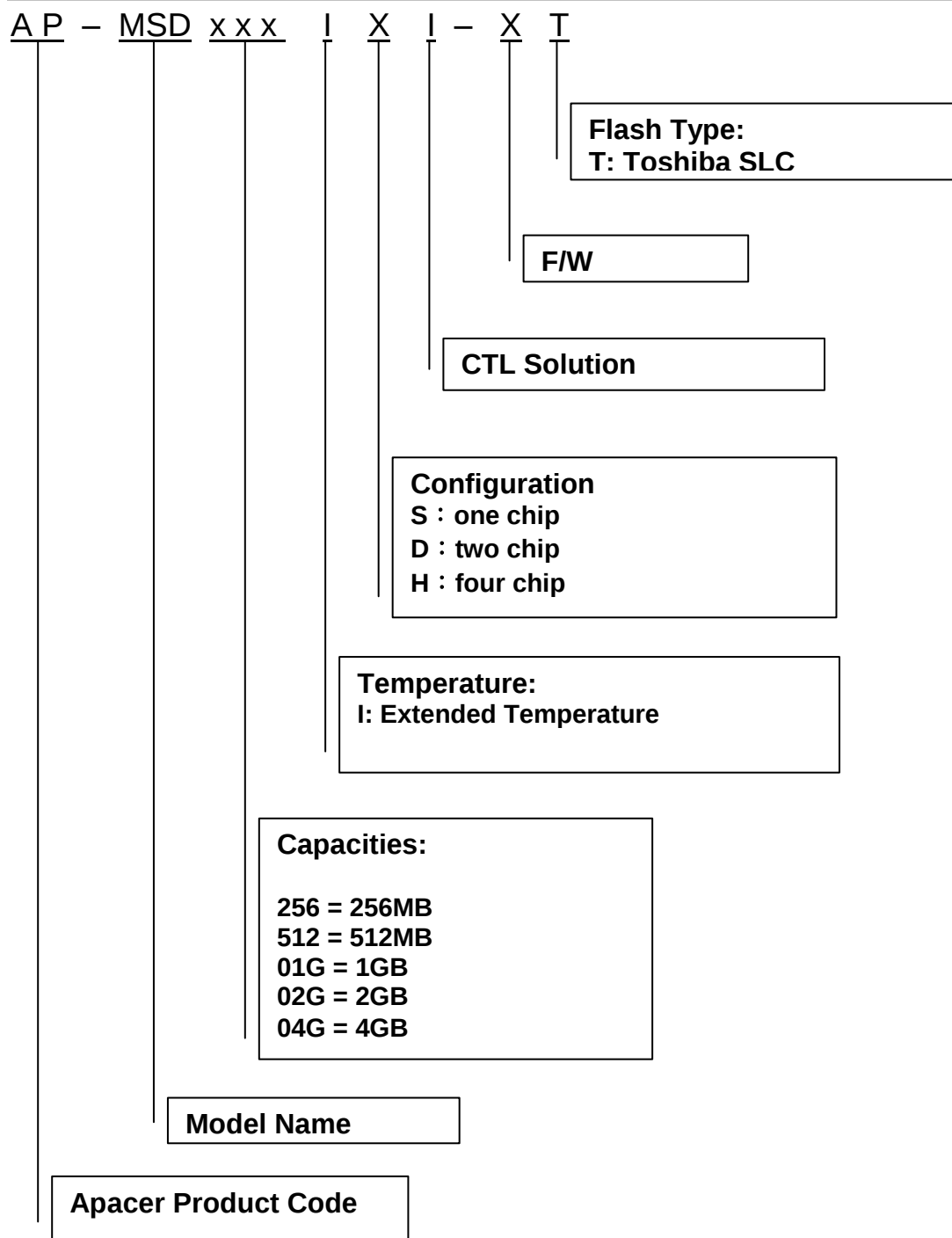
Detect the available drive for S.M.A.R.T. monitoring.

Get SmartInfo

Click it to display the health status of the monitored drive, which appears as a dashboard presence.

6. Product Ordering Information

6.1 Product Code Designations



6.2 Valid Combinations

<i>Capacity</i>	<i>AP/N</i>
256MB	AP-MSD256ISI-1T
512MB	AP-MSD512IDI-1T
1GB	AP-MSD01GISI-T
2GB	AP-MSD02GIDI-T
4GB	AP-MSD04GIHI-T

Note:

- Valid combinations list out the available models for mass production.
- Products are normally shipped in unformatted capacities unless required otherwise.
- For customization request, please consult with Apacer sales representatives.

Revision History

Revision	Description	Date
1.0	Official release	03/21/2014
1.1	SD Card Specifications 1.1 compliant. Modified "Features" page -> Fully compliant with SD Card Specifications 1.1 and 2.0	04/02/2015
1.2	Combine microSD SLC models of all capacities into one spec sheet.	10/01/2015

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