

*RoHS Compliant*

# **Industrial Micro SD Card**

*Customized Specifications*

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*Version 1.0*



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## FEATURES:

- **Fully compliant with SD Card Specifications 2.0**
- **Capacity range**
  - 256, 512 MB
- **Performance\***
  - Sustained Read: Up to 19 MB/sec
  - Sustained Write: Up to 14 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)
- **Intelligent endurance design**
  - Built-in advanced ECC algorithm: 24bits/1KB
  - Wear-leveling algorithm
- **Temperature ranges**
  - Operating temperature: -40°C ~ +85°C
  - Storage temperature: -40°C ~ +85°C
- **Power consumption:**
  - Operating mode: 34 mA
  - Standby mode: 60 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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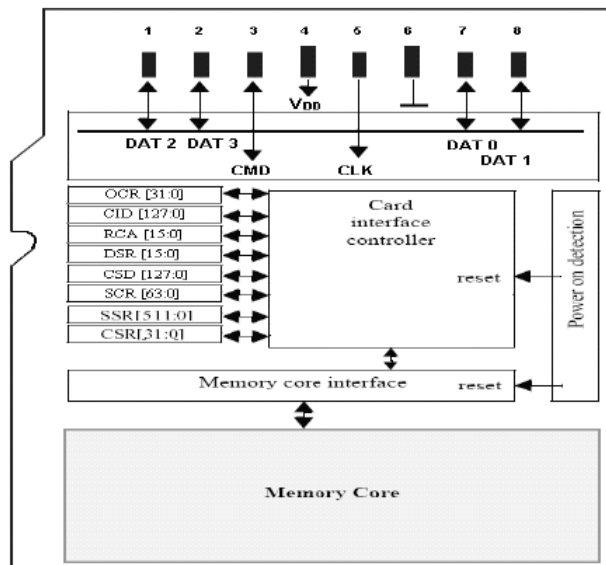
## 1. General Description

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 19 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 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.



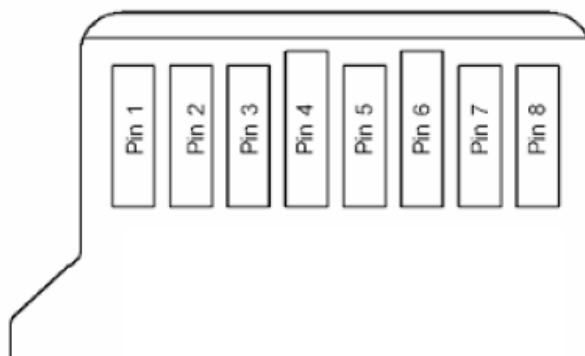
### 1.2 Functional description

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 <sup>2</sup> | 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 | LBA       | Cylinder | Head | Sector | Total Bytes |
|----------|-----------|----------|------|--------|-------------|
| 256 MB   | 499,712   | 495      | 16   | 63     | 255,852,544 |
| 512 MB   | 1,003,520 | 995      | 16   | 63     | 513,802,240 |

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.

| Modes                   | Capacity | 256 MB | 512 MB |
|-------------------------|----------|--------|--------|
|                         |          |        |        |
| Sequential Read (MB/s)  |          | 19     | 20     |
| Sequential Write (MB/s) |          | 10     | 16     |

Note: results may vary depending on settings and platforms.

## 2.5 Absolute Maximum Ratings

| Symbol               | Parameter                     | Min. | Max. | Unit |
|----------------------|-------------------------------|------|------|------|
| V <sub>DD</sub>      | Supply Voltage                | 2.7  | 3.6  | V    |
| T <sub>storage</sub> | Storage Temperature           | -40  | 85   | °C   |
| T <sub>a</sub>       | Ambient Operating Temperature | -40  | 85   | °C   |

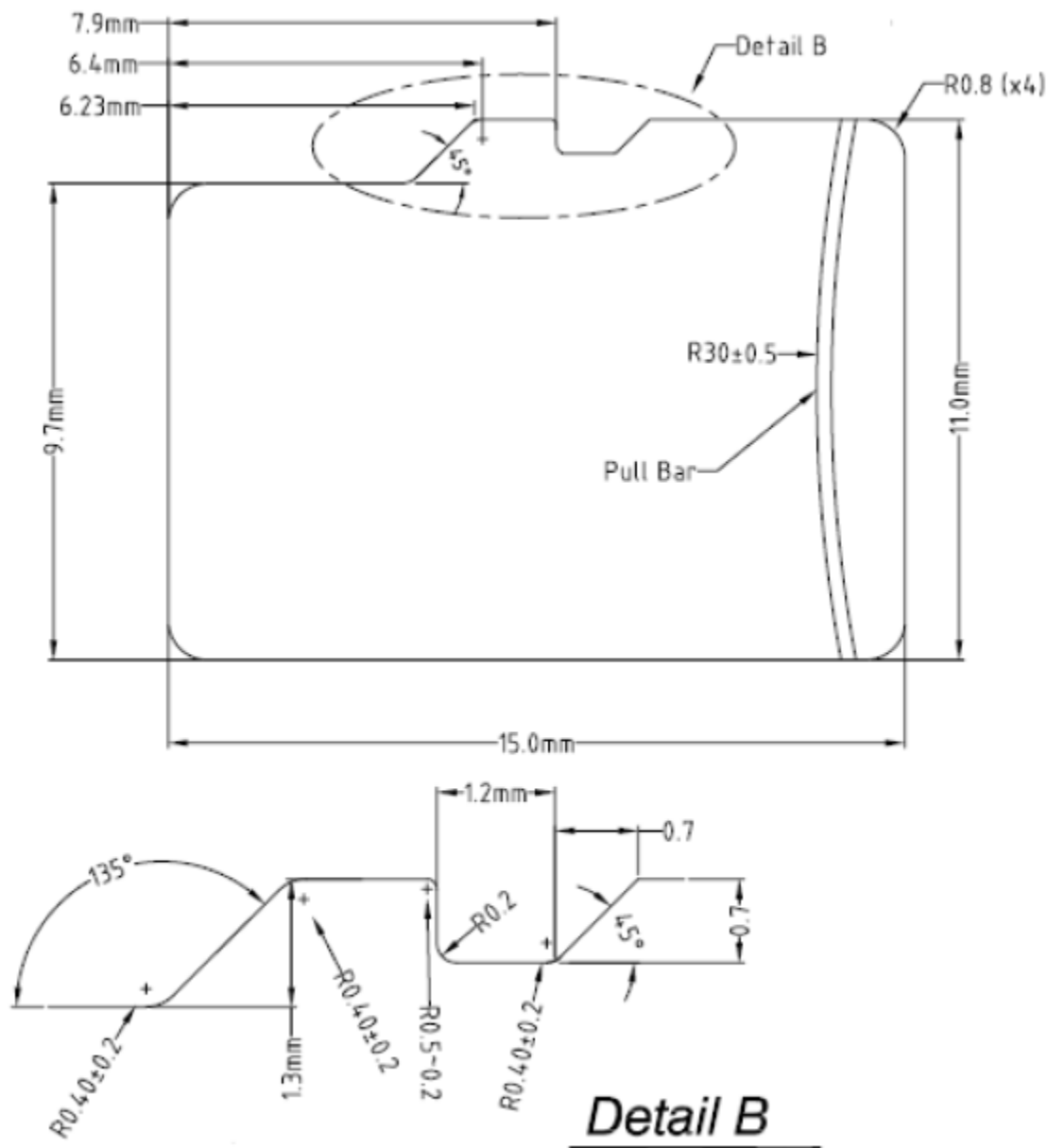
## 2.6 Power consumption (typical)

| Read at 3.3V (mA) | Write at 3.3V (mA) | Stand By (uA) |
|-------------------|--------------------|---------------|
| 40                | 65                 | 150           |

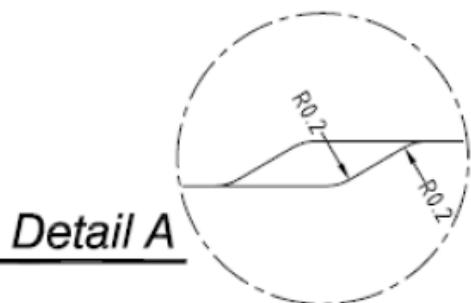
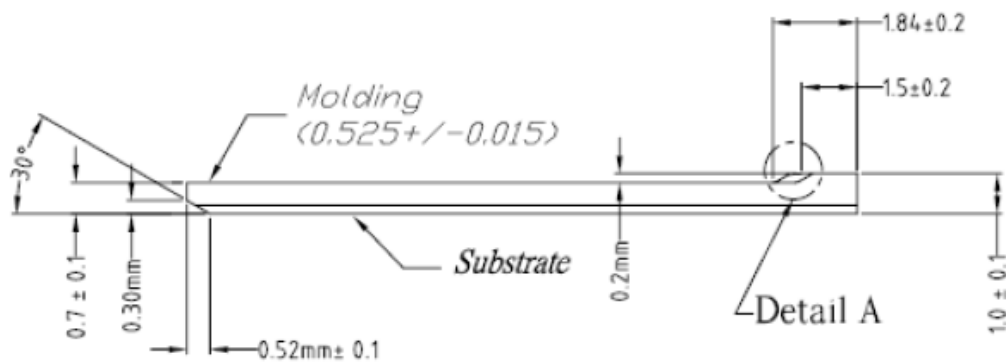
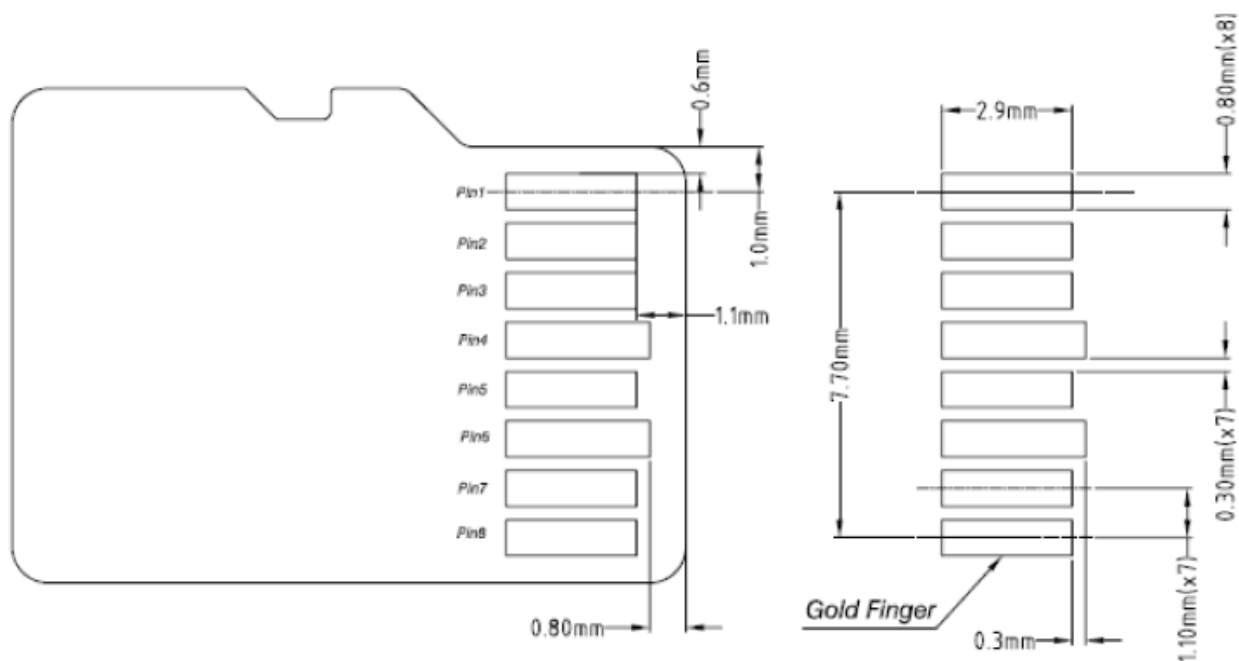
\*Power consumption may differ from host system configurations.

### 3. Physical Characteristics

#### Top View

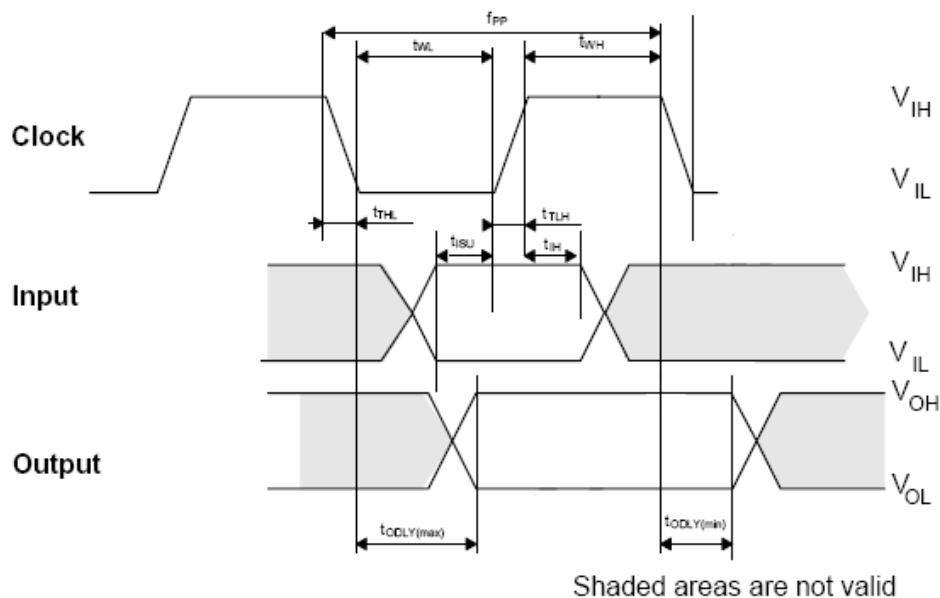


Bottom View



## 4. Electrical Characteristics

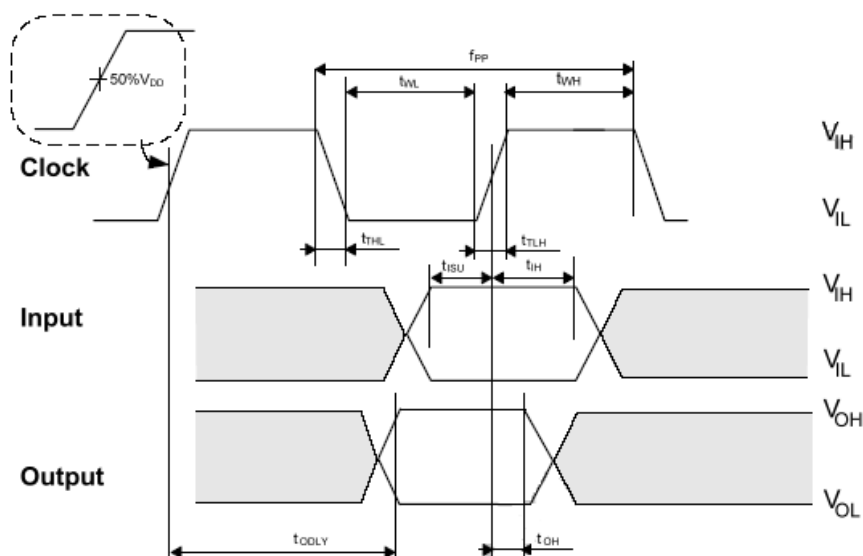
### 4.1 Bus Interface Timing (Standard)



| SYMBOL                                                                                    | PARAMETER                                    | MIN                   | MAX | UNIT | Note                                  |
|-------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------|-----|------|---------------------------------------|
| <b>Clock CLK (All values are referred to min(V<sub>IH</sub>) and max(V<sub>IL</sub>))</b> |                                              |                       |     |      |                                       |
| f <sub>PP</sub>                                                                           | Clock frequency Data Transfer Mode           | 0                     | 25  | MHz  | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| f <sub>OD</sub>                                                                           | Clock frequency Identification Mode          | 0 <sub>(1)</sub> /100 | 400 | kHz  | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>WL</sub>                                                                           | Clock low time                               | 10                    | -   | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>WH</sub>                                                                           | Clock high time                              | 10                    | -   | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>TLH</sub>                                                                          | Clock rise time                              | -                     | 10  | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>THL</sub>                                                                          | Clock fall time                              | -                     | 10  | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>ISU</sub>                                                                          | Input setup time                             | 5                     | -   | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>IH</sub>                                                                           | Input hold time                              | 5                     | -   | ns   | C <sub>card</sub> ≤ 10 pF<br>(1 card) |
| t <sub>ODLY</sub>                                                                         | Output delay time                            | 0                     | 14  | ns   | C <sub>L</sub> ≤ 40 pF<br>(1 card)    |
| t <sub>ODLY</sub>                                                                         | Output Delay time during Identification Mode | 0                     | 50  | ns   | C <sub>L</sub> ≤ 40 pF<br>(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  | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{WL}$   | Clock low time                     | 7   | -   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{WH}$   | Clock high time                    | 7   | -   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{TLH}$  | Clock rise time                    | -   | 3   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{THL}$  | Clock fall time                    | -   | 3   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{ISU}$  | Input setup time                   | 6   | -   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{IH}$   | Input hold time                    | 2   | -   | ns   | $C_{card} \leq 10 \text{ pF}$<br>(1 card) |
| $t_{ODLY}$ | Output delay time                  |     | 14  | ns   | $CL \leq 40 \text{ pF}$<br>(1 card)       |
| $T_{OH}$   | Output hold time                   | 2.5 | 50  | ns   | $CL \leq 15 \text{ pF}$<br>(1 card)       |
| $C_L$      | System capacitance of each line*   |     | 40  | pF   | $CL \leq 15 \text{ pF}$<br>(1 card)       |

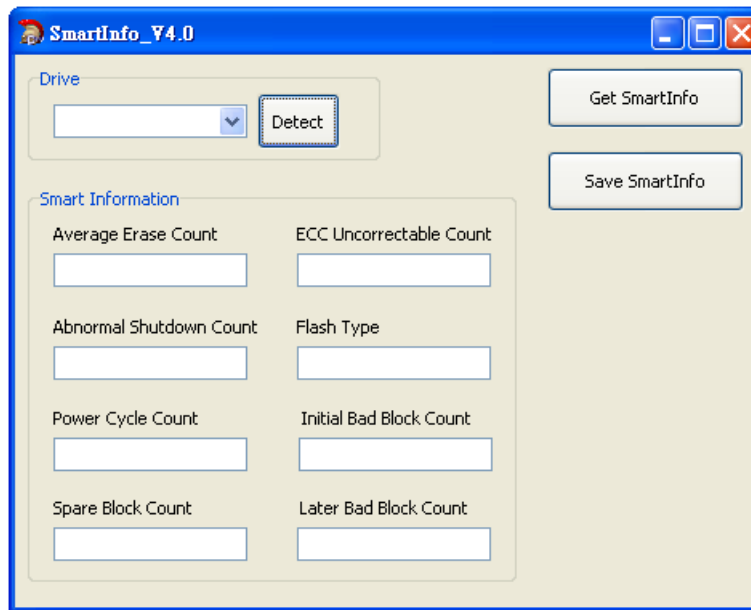
\*In order to satisfy severe timing, host shall run on only one card

## 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.

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

Initial value = 00.00%

Maximum value = 100.00%

**Detect**

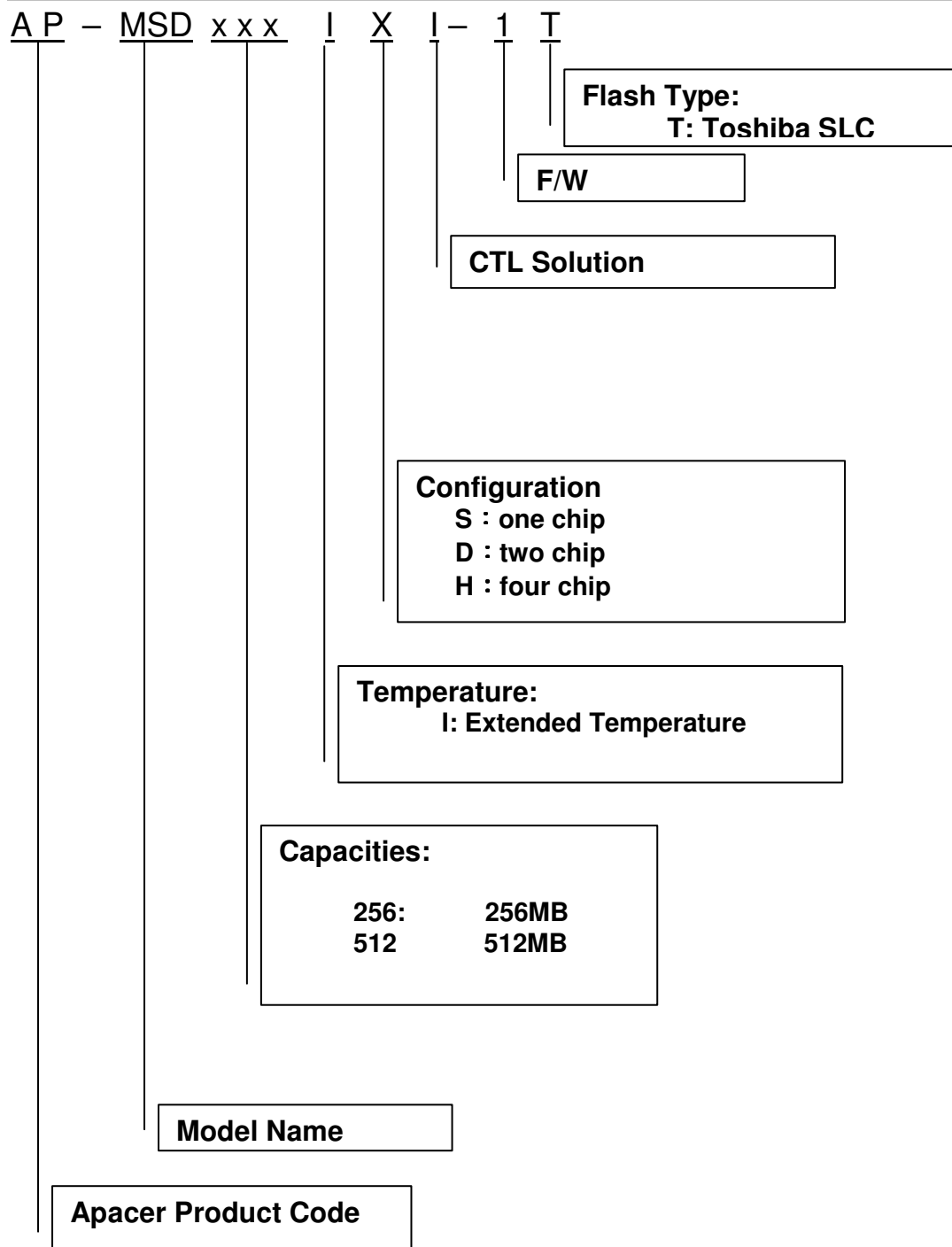
Detect the available drive for S.M.A.R.T. monitoring.

**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



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## 6.2 Valid Combinations

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| <i><b>Capacity</b></i> | <i><b>AP/N</b></i> |
|------------------------|--------------------|
| 256MB                  | AP-MSD256ISI-1T    |
| 512MB                  | AP-MSD512IDI-1T    |

**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.

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## Revision History

| Revision | Description      | Date       |
|----------|------------------|------------|
| 1.0      | Official release | 03/21/2014 |

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## Global Presence

|                              |                                                                                                                                                                                                                                   |
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