*RoHS Compliant*

# Industrial Secure Digital Card

*Specifications*

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*Version 1.0*

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# FEATURES:

- **Fully compatible with SD card standard specification**

  - SD Memory Card Specifications, Part 1, Physical Layer Specification, Version 2.00

  - SD Memory Card Specifications, Part 2, File System Specification, Version 2.00

  - SD Memory Card Specifications, Part 3, Security Specification, Version 2.00

- **Capacity**

  - Standard: 256, 512 MB
    1, 2 GB

  - SDHC: 4, 8 GB

- **Performance**

  - Sustained read: Up to 20 MB/sec

  - Sustained write: Up to 13 MB/sec

- **SD-protocol compatible**

- **Support SPI mode**

- **Support auto standby and sleep mode**

- **NAND Flash Type:** SLC

- **Variable clock rate 0-50MHz**

- **Intelligent endurance design**

  - Built-in BCH-ECC supports correction up to 24 bits data error per 1K bytes data automatically

  - Implements global wear-leveling algorithms to substantially increase longevity of flash media

  - Flash bad-block management

  - S.M.A.R.T feature supported

- **Temperature ranges**

  - Operating temperature

| Standard | 0°C ~ 70°C |
|----------|------------|
| ET[*] | -40°C ~ 85°C |

  - Storage temperature: -40°C ~ 100°C

- **Low power consumption**

- **Operation voltage: 2.7V ~ 3.6V**

- **Physical dimension:** 24㎜ x 32㎜ x 2.1㎜

- **RoHS Compliant**

*Extended Temperature

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# 1. General Description

As the demand of reliable and high-performance data storage in a small form factor increases, Apacer's embedded SD card is designed specifically for rigorous applications by offering maximum endurance, reliability, and agility, where extreme traceability, enhanced data integrity, and exceptionally velocity are required.

## 1.1 Product Function Block

The embedded SD contains a flash controller and flash media with SD standard interface.
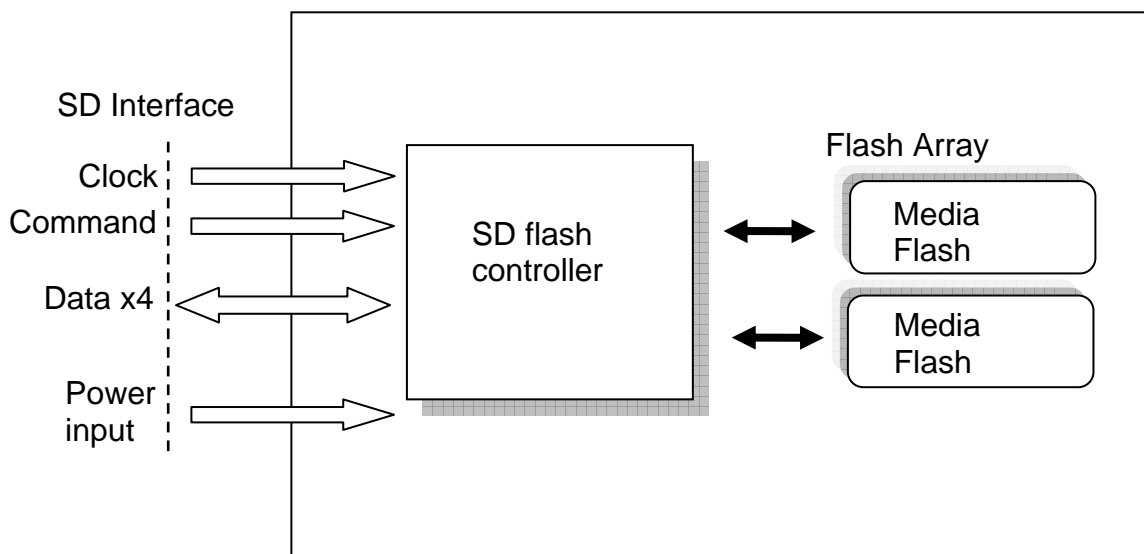


## 1.2 Functional description

The embedded SD device contains a high level, intelligent subsystem that provides many capabilities including:

- Powerful ECC algorithms

- Global wear-leveling algorithms

- Power management for low power operation

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## 1.2.1 Flash Management

The SD controller contains logic/physical flash block mapping and bad block management system. It will manage all flash block include user data space and spare block.

The embedded SD also contains a sophisticated defect and error management system. It does a read after write under margin conditions to verify that the data is written correctly (except in the case of write pre-erased sectors). In case that a bit is found to be defective, the embedded SD replaces this bad bit with a spare bit within the sector header. If necessary, the embedded SD will even replace the entire sector with a spare sector. This is completely transparent to the master (host device) and does not consume any user data space.

## 1.2.2 Powerful ECC Algorithms

The powerful ECC algorithms will enhance flash block use rate and whole device life. The SD controller has an innovative algorithm to recover the data. Built-in BCH-ECC supports correction up to 24 bits data error per 1K bytes data automatically

## 1.2.3 Power Management

A power saving feature of the embedded SD is automatic entrance and exit from sleep mode. Upon completion of an operation, the embedded SD will enter the sleep mode to conserve power if no further commands are received within X seconds, where X is programmable by software. The master does not have to take any action for this to occur. The embedded SD is in sleep mode except when the host is accessing it, thus conserving power.

Any command issued by the master to the embedded SD will cause it to exit sleep mode and response to the master.

## 1.2.4 S.M.A.R.T

S.M.A.R.T. (SMART), an acronym stands for Self-Monitoring, Analysis and Reporting Technology, is an open standard allowing an individual disk drive in the ATA/IDE or SCSI interface to automatically monitor its own health and report potential problems in order to prevent data loss. This failure warning technology provides predictions from unscheduled downtime by observing and storing critical drive performance and calibration parameters. Ideally, this should allow taking hands-on actions to keep from impending drive failure.

Failures are divided into two categories: those that can be predicted and those that cannot. Predictable failures occur gradually over time, and the decline in performance can be detected; on the other hand, unpredictable failures happen very sudden without any warning. These failures may be caused by power surges or related to electronic components. The purpose of the SMART implementation is to predict near-term failures of each individual disk drive and generate a warning to prevent unfortunate loss.

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# 2. Electrical characteristics

## 2.1 Card Architecture

Write Enabled

Write Protected
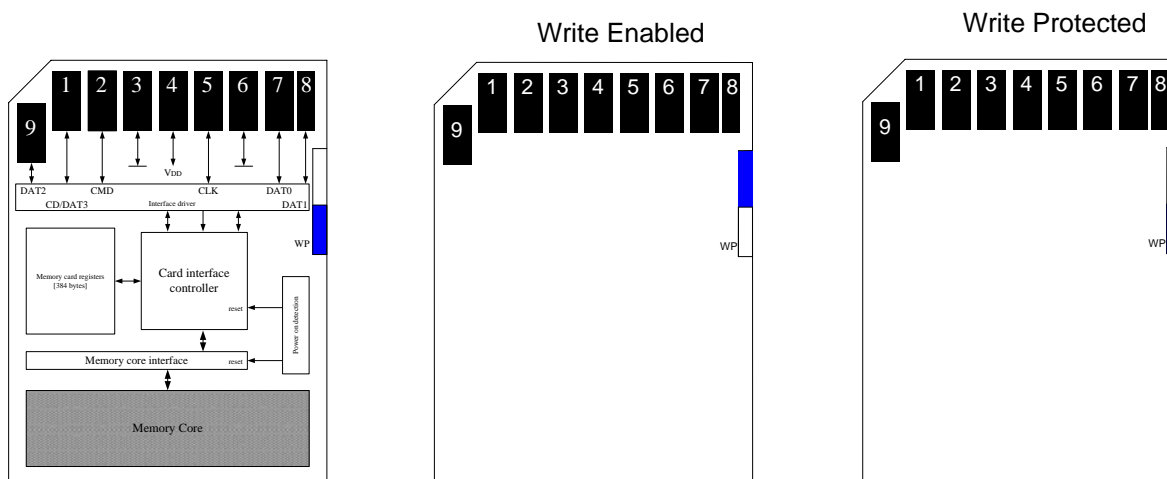
## 2.2 Pin Assignment

| Pin | SD Mode | | SPI Mode | |
|-----|---------|---|----------|---|
| | **Name** | **Description** | **Name** | **Description** |
| 1 | CD/DAT3 | Card detect/Data line[Bit 3] | CS | Chip select |
| 2 | CMD | Command/Response | DI | Data in |
| 3 | VSS1 | Supply voltage ground | VSS | Supply voltage ground |
| 4 | VDD | Supply voltage | VDD | Supply voltage |
| 5 | CLK | Clock | SCLK | Clock |
| 6 | VSS2 | Supply voltage ground | VSS2 | Supply voltage ground |
| 7 | DAT0 | Data line[Bit 0] | DO | Data out |
| 8 | DAT1 | Data line[Bit 1] | Reserved | |
| 9 | DAT2 | Data line[Bit 2] | Reserved | |

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## 2.3 Capacity Specification

The Embedded SD product family is available as the table below. The following table shows the specific capacity. (Follow SDA rule to do format)

| 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 | 1,003,520 | 1,003,287 | 1,003,008 | 513,540,096 |
| 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 |
| 8 GB | 16,039,936 | 16,031,744 | 16,023,552 | 8,204,058,624 |

## 2.4 Performance

Performances of Embedded SD are shown in the table below.

| Performance \ Capacity | 256 MB | 512 MB | 1 GB | 2 GB | 4 GB | 8 GB |
|---|---|---|---|---|---|---|
| Sustained Read (MB/s) | 18 | 19 | 20 | 20 | 20 | 18 |
| Sustained Write (MB/s) | 7 | 7 | 10 | 13 | 12 | 13 |

Note: Performances vary from flash configurations.

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## 2.5 Absolute Maximum Ratings

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|--------|-----------|------|------|------|------|
| Vcc | Power Supply Voltage | 2.7 | 3.3 | 3.6 | V |
| Vss | Power Supply Voltage | 0 | 0 | 0 | V |

## 2.6 Power consumption

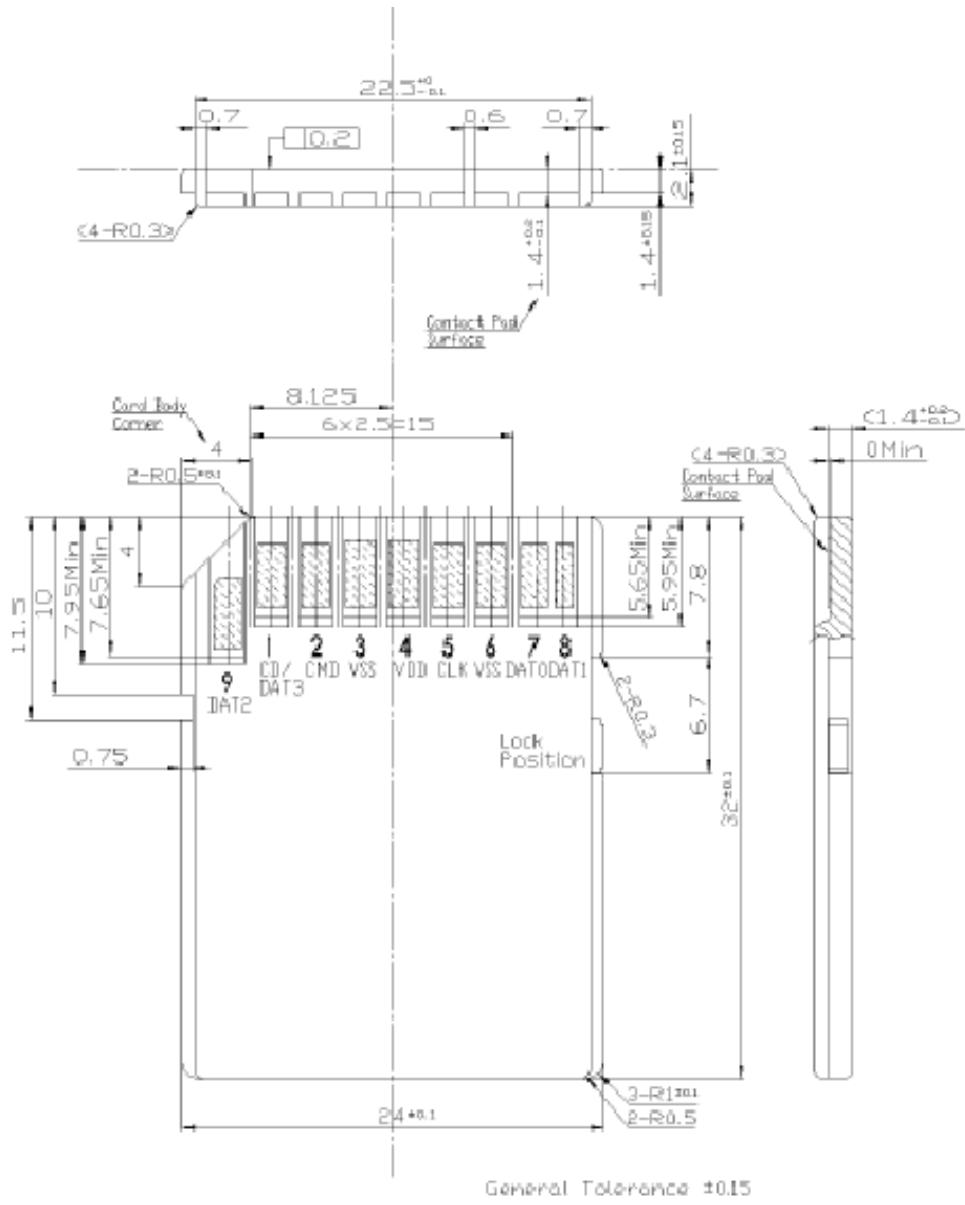| VCC 2.7V – 3.6V | | | |
|-----------------|-------|------|---------|
| Mode | Value | Unit | Average |
| Standby | 94 | $\mu$ A | Max. |
| Read | 10 | mA | Typical |
| Write | 15 | mA | Typical |

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# 3. Physical Characteristics

## 3.1 Physical Dimension

| Dimensions Card Package | 24 mm x 32 mm<br>Min. 23.9 mm x 31.9 mm<br>Max. 24.1 mm x 32.1 mm |
|---|---|
| Thickness | 2.1 mm ± 0.15 mm |
| Surface | Plain (except contact area) |
| Edges | Smooth edges |

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General Tolerance ±0.15

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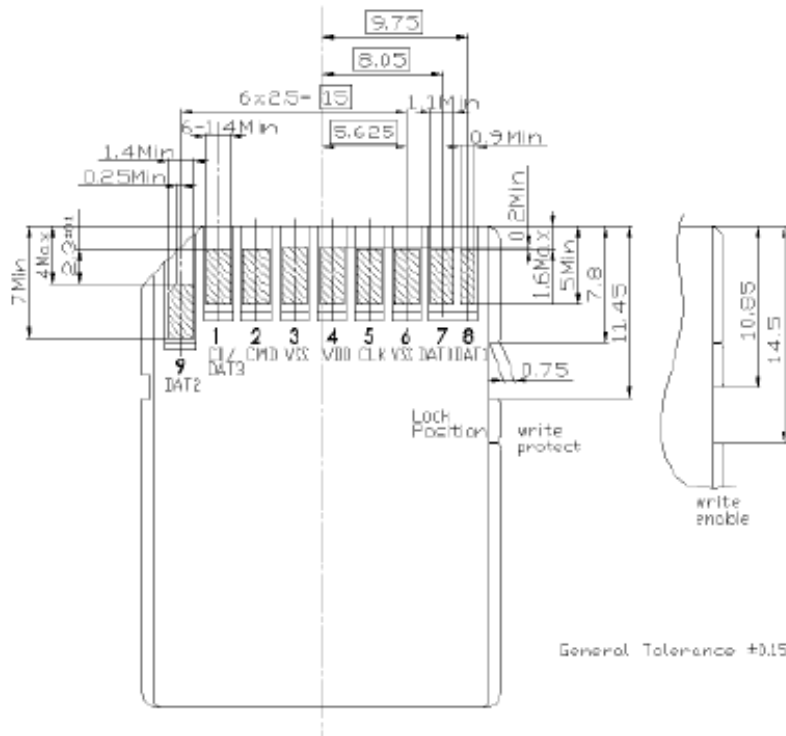
## 3.2 System Reliability

| Durability | 10,000 mating cycles |
|---|---|
| Data reliability | <1 non-recoverable error $10^{14}$ bits read |

## 3.3 Environmental Specifications

**Environmental Specification**

| Temperature | Operating | Standard: 0℃ to 70℃ / ET[*]: -40℃ to 85℃ |
|---|---|---|
| | Storage | -40℃ to 100℃ |
| Humidity | Operating | 25℃ - 95%RH non-condensing |
| | Non-operating | 40℃ - 93%RH non-condensing |
| Minimum moving force of WP switch | Non-operating | Moving Force:40gf.(Ensures that the WP switch will not slide while it is inserted to the connector) |
| WP Switch cycles | Non-operating | Minimum 1,000 Cycles (@ Slideforce:0.4N~5N) |

*Extended Temperature

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# 4. Product Ordering Information

## 4.1 Product Code Designations

A P – ISD x x x  X  X  X  X – X  X

**Flash Type:**
    T: Toshiba SLC

**F/W**
    Blank: N/A
    1: S.M.A.R.T. feature supported

**CTL Solution**

**2: Standard SD**
**4: SDHC**

**Configuration**

    S: Single Channel
    D: Dual Channel

**Temperature:**
    C: Commercial Temperature
    I: Extended Temperature

**Capacities:**

| | |
|---|---|
| 256: | 256MB |
| 512: | 512MB |
| 01G: | 1GB |
| 02G: | 2GB |
| 04G: | 4GB |
| 08G: | 8GB |

**Model Name**

**Apacer Product Code**

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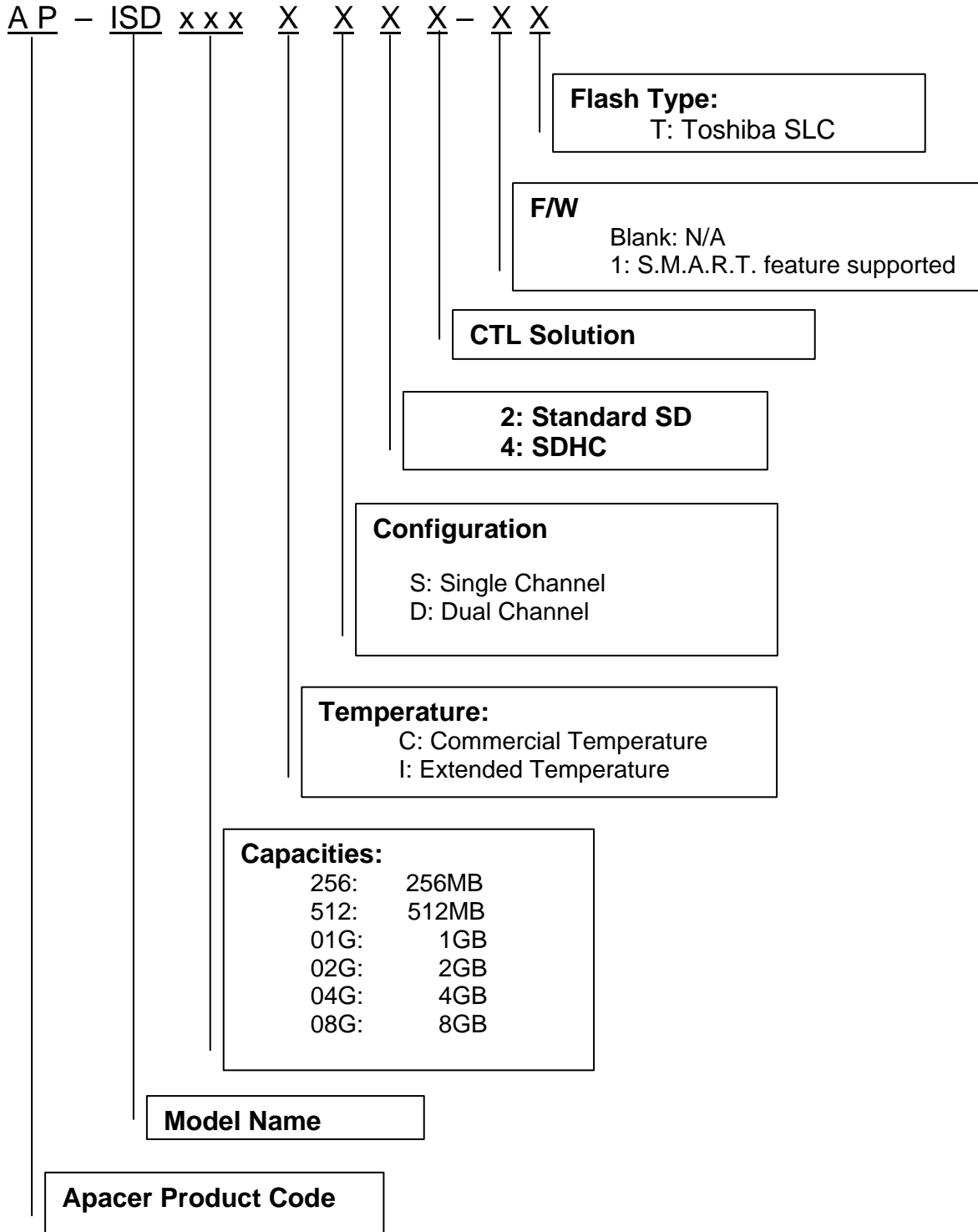
## 4.2 Valid Combinations

### 4.2.1 Standard Temperature

| Capacity | AP/N |
|----------|------|
| 256 MB | AP-ISD256CS2A-1T |
| 512 MB | AP-ISD512CS2A-1T |
| 1 GB | AP-ISD01GCS2A-1T |
| 2 GB | AP-ISD02GCS2A-1T |
| 4 GB | AP-ISD04GCS4A-1T |
| 8 GB | AP-ISD08GCD4A-1T |

### 4.2.2 Extended Temperature

| Capacity | AP/N |
|----------|------|
| 256 MB | AP-ISD256IS2B-1T |
| 512 MB | AP-ISD512IS2B-1T |
| 1 GB | AP-ISD01GIS2B-1T |
| 2 GB | AP-ISD02GIS2B-1T |
| 4 GB | AP-ISD04GIS4B-1T |
| 8 GB | AP-ISD08GID4B-1T |

**Note:** Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

# Revision History

| Revision | Description | Date |
|----------|-------------|------|
| 1.0 | Official release | 1/3/2012 |

# Global Presence

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