*RoHS Compliant*

# USB-Disk Module 3

***Specification***

**January 13, 2011**

*Preliminary*

For Internal Evaluation

Apacer
Access the best

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# FEATURES:

- **USB2.0 High-Speed and USB1.1 Full-Speed compatible interface**
- **Capacity**
  - 512 MB, 1, 2, 4, 8 GB
- **Fast sustained read performance**
  - Sustained read: 35 MB/s
- **Fast sustained write performance**
  - Sustained write: 25 MB/s
- **Intelligent USB Module**
  - BCH (14/28 bit) Error Detection Code/Error Correction Code (EDC/ECC)
  - Intrinsic data integrity after power loss
  - Data Encryption
  - Implements advanced wear-leveling algorithms to substantially increase longevity of flash media
- **Flash Type:** SLC
- **Zero Power Data Retention**
  - Batteries not required for data storage
- **Support Ready Boost for Windows Vista**
- **Support boot-up function for OS**
  - Linux
  - Windows CE
  - Windows XP Embedded
  - Windows 7 Embedded
- **Temperature ranges**
  - 0℃ to 70℃ for operation (standard)
  - -40℃ to 85℃ for operation (ET*)
  - -40℃ to 100℃ for storage
- **Low power consumption (typical)**
  - Active mode: TBD mA
  - Sleep mode: TBD μA
- **Connector**
  - 10-pin (2x5) female header
- **RoHS Compliant**
- **Support Non-Removable Setting****

*Extended Temperature
**Standard Temperature Exclusive

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# TABLE OF CONTENTS

**1. General Description ..... 3**

1.1 Performance-optimized Controller ..... 3
*1.1.1 Error Correction Code (ECC) ..... 3*
*1.1.2 Data Encryption ..... 3*
*1.1.3 Advanced Wear-Leveling ..... 3*

**2. Functional Block Diagram ..... 4**

**3. Pin Assignment ..... 5**

3.1 Type C and Type E ..... 5
3.2 Type D (Low Profile) ..... 6

**4. Capacity Specifications ..... 7**

4.1 Performance Specifications ..... 7
4.2 Environmental Specifications ..... 7

**5. Electrical Specification ..... 8**

5.1 AC Characteristics ..... 9

**6. Physical Dimension ..... 10**

6.1 Horizontal Design ..... 10
*6.1.1 Type C (STD 90D-MS) ..... 10*
6.2 Low Profile Design ..... 11
*6.2.1 Type D (LP 180D) ..... 11*
*6.2.2 Type E (LP 90D-MS) ..... 12*

**7. Product Ordering Information ..... 13**

7.1 Product Code Designations ..... 13
7.2 Valid Combinations ..... 14
*7.2.1 Type C (STD 90D-MS) ..... 14*
*7.2.2 Type D (LP 180D) ..... 14*
*7.2.3 Type E (LP 90D-MS) ..... 14*

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# 1. General Description

Apacer's USB-Disk Module (UDM) is a high performance, embedded solid state drive (SSD) designed to replace a conventional IDE hard disk drive. UDM SSD can be plugged into a standard Embedded USB connector commonly found in desktops, portable PC systems and industrial PC systems. This product is well suited for embedded flash storage applications offering new and expanded functionality as well as more cost-effective designs, better performance and increased reliability.

## 1.1 Performance-optimized Controller

The heart of an UDM is the USB controller, which translates standard USB signals into the data and controls of the flash media. This proprietary USB controller is specifically designed to attain high data throughput from host to flash.

### 1.1.1 Error Correction Code (ECC)

The UDM uses BCH Error Detection Code (EDC) and Error Correction Code (ECC) algorithms which correct up to 14/28 random single-bit errors for each 512/1K byte block of data depending on spare area of flash memory. High performance is achieved through hardware-based error detection and correction.

### 1.1.2 Data Encryption

The UDM comes with 128 bits AES algorithm realized by hardware which makes it unique in protecting data store within.

### 1.1.3 Advanced Wear-Leveling

Flash memory can be erased a limited number of times, This number is called the erase cycle limit, or write endurance limit, The erase cycle limit applies to each individual erase block in the flash device.

In a typical application, and especially if a file system is used, specific pages are constantly updated (e.g., the page that contains the FAT, registry, etc.). Without any special handling, these pages would wear out more rapidly than other pages, reducing the lifetime of the entire flash.

To overcome this inherent deficiency, Apacer's USB-Disk Module (UDM) uses wear-leveling algorithm. This wear-leveling algorithm ensures that consecutive writes of a specific sector are not written physically to the same page in the flash. This spreads flash media usage evenly across all pages, thereby maximizing flash lifetime.

The wear-leveling mechanism provides more than 100,000 write/erase cycles for reliable data storage over an extended period.

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# 2. Functional Block Diagram

The USB-Disk Module (UDM) contains a controller, embedded firmware, and Flash Media with a female connector. The UDM interfaces with the host system allowing data to be written to and read from the Flash Media.

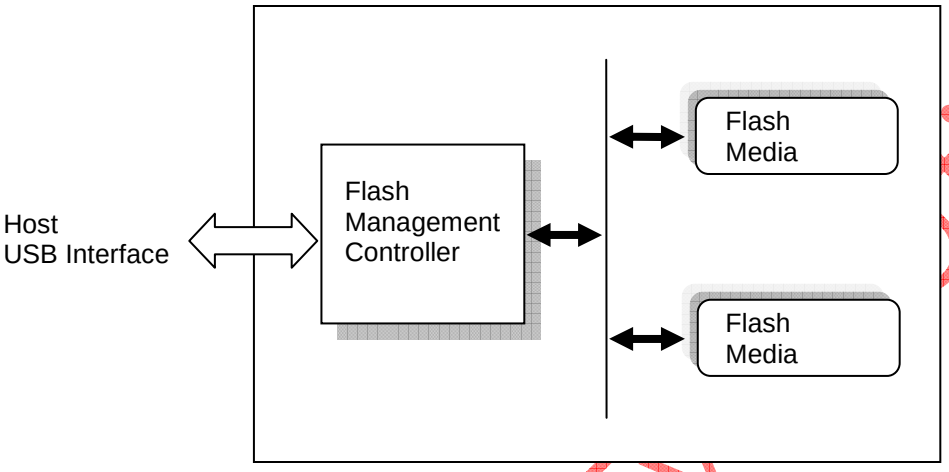


**Figure 2-1:** Functional block diagram

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# 3. Pin Assignment

This chapter provides the information on the pin assignments and signal descriptions.

## 3.1 Type C and Type E

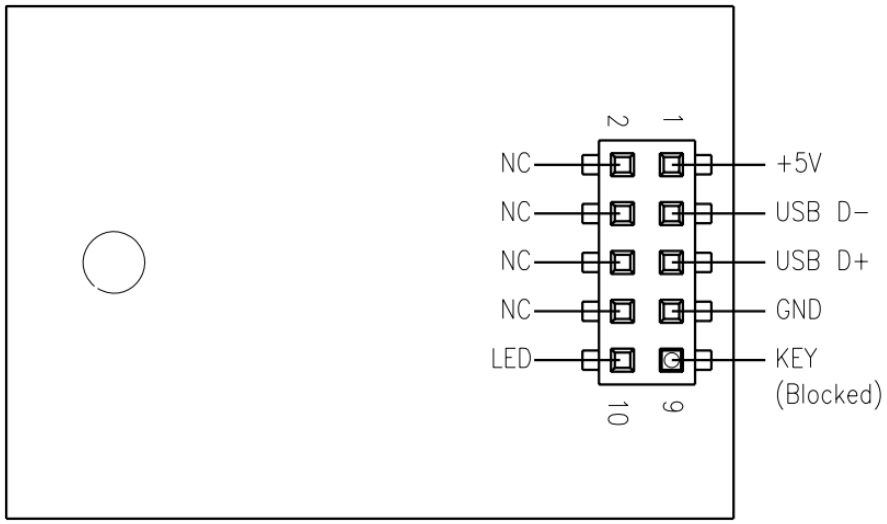


**Table 3-1:** Pin Assignment of the 10-pin configuration in Type C and Type E

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | +5V | 2 | N.C |
| 3 | USB D- | 4 | N.C |
| 5 | USB D+ | 6 | N.C |
| 7 | GND | 8 | N.C |
| 9 | Key (Blocked) | 10 | LED |

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## 3.2 Type D (Low Profile)

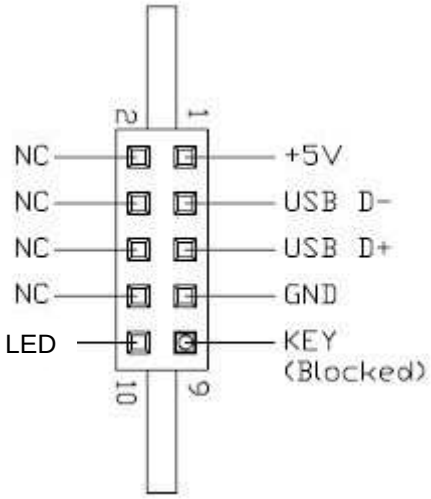


**Table 3-3:** Pin Assignment of the 10-pin configuration in Type D (Low Profile)

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | +5V | 2 | N.C |
| 3 | USB D- | 4 | N.C |
| 5 | USB D+ | 6 | N.C |
| 7 | GND | 8 | N.C |
| 9 | Key (Blocked) | 10 | LED |

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# 4. Capacity Specifications

The USB-Disk Module product family is available as below.

**Table 4-1:** Capacity Specification

| Capacity | Total Bytes |
|---|---|
| 512 MB | TBD |
| 1 GB | TBD |
| 2 GB | TBD |
| 4 GB | TBD |
| 8 GB | TBD |

## 4.1 Performance Specifications

**Table 4-2:** Performance Specifications

| | USB 2.0 High-Speed (Max.) |
|---|---|
| Sustained Read | Up to 35 MB/sec |
| Sustained Write | Up to 25 MB/sec |

## 4.2 Environmental Specifications

Environmental specification of the USB-Disk Module (UDM) product family which follows the MIL-STD-810F standards is available as shown in Table 4-3.

**Table 4-3:** Environmental Specifications

| Item | Specification |
|---|---|
| *Non-Operating temp.* | -40~100(℃) |
| *Operating temp.* | 0~70(℃) |
| *Non-Operating shock* | 1500(G)/0.5(ms), half-sine wave, 3 axis/6 direction |
| *Operating shock* | 50(G)/11(ms), half-sine wave, 3 axis/6 direction |
| *Non-Operating vibration* | 10~2000(Hz), 15(G), sine wave, 3axis |
| *Operating vibration* | 20~2000(Hz), 7.7(Grms), random wave, 3axis |
| *Operating humidity* | 10~95(%) R.H, non-condensing, 35(℃) max. wet bulb temp. |

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# 5. Electrical Specification

***Caution: Absolute Maximum Stress Ratings*** – Applied conditions greater than those listed under "Absolute Maximum Stress Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.

**Table 5-1:** Operating Range

| Range | Ambient Temperature | Voltage |
|---|---|---|
| Standard | 0℃ to 70℃ | 4.5-5.5V |
| Extended Temperature | -40℃ to 85℃ | |

**Table 5-2:** Absolute maximum power pin stress ratings

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Input Voltage | VIN | -0.3 | 5.25 | V |
| Storage Temperature | TSTG | -40 | 100 | ℃ |

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## 5.1 AC Characteristics

**Table 5-3:** AC Characteristics Full Speed

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Rise Time | $T_{FR}$ | 4 | – | 20 | ns |
| Fall Time | $T_{FF}$ | 4 | – | 20 | ns |
| Differential Rise and Fall Time Matching | $T_{FRFM}$ | 90 | | 111.11 | % |
| Driver Output Resistance | $Z_{DRV}$ | 28 | – | 44 | Ω |

**Table 5-4:** AC Characteristics High Speed

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Rise Time (10%~90%) | $T_{HSR}$ | 500 | – | – | ps |
| Fall Time (10%~90%) | $T_{HSF}$ | 500 | – | – | ps |
| Driver Output Resistance | $Z_{HSDRV}$ | 40.5 | – | 49.5 | Ω |

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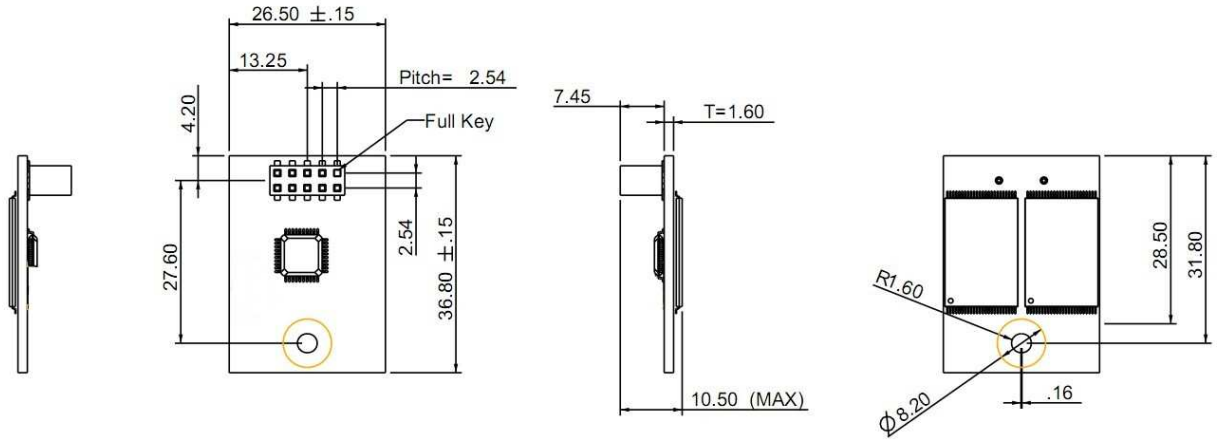
# 6. Physical Dimension

## 6.1 Horizontal Design

### 6.1.1 Type C (STD 90D-MS)

Standard 90 Degree Mounting Screw

| Length | 36.8 mm | Width | 26.5 mm | Height (Max) | 10.5 mm |
|---|---|---|---|---|---|




Unit: mm
Tolerance: ±0.15

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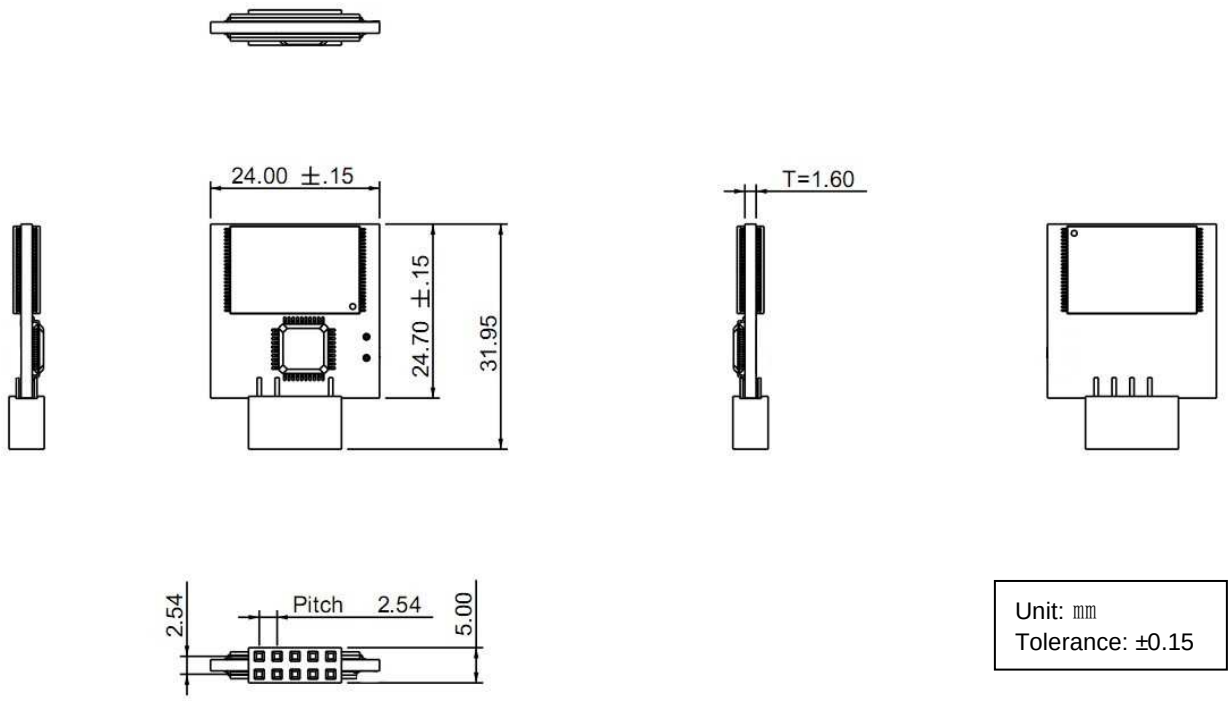
## 6.2 Low Profile Design

### 6.2.1 Type D (LP 180D)

Low Profile 180 Degree

| Length | 31.95 mm | Width | 24 mm | Height (Max) | 5 mm |
|---|---|---|---|---|---|




Unit: mm
Tolerance: ±0.15

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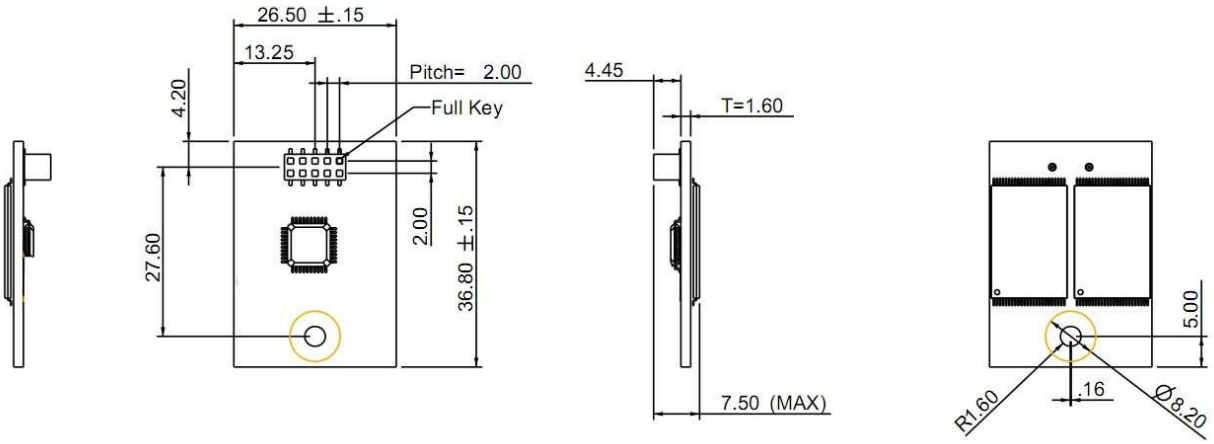
### 6.2.2 Type E (LP 90D-MS)

Low Profile 90 Degree Mounting Screw

| Length | 36.8 mm | Width | 26.5 mm | Height (Max) | 7.5 mm |
|---|---|---|---|---|---|




Unit: mm
Tolerance: ±0.15

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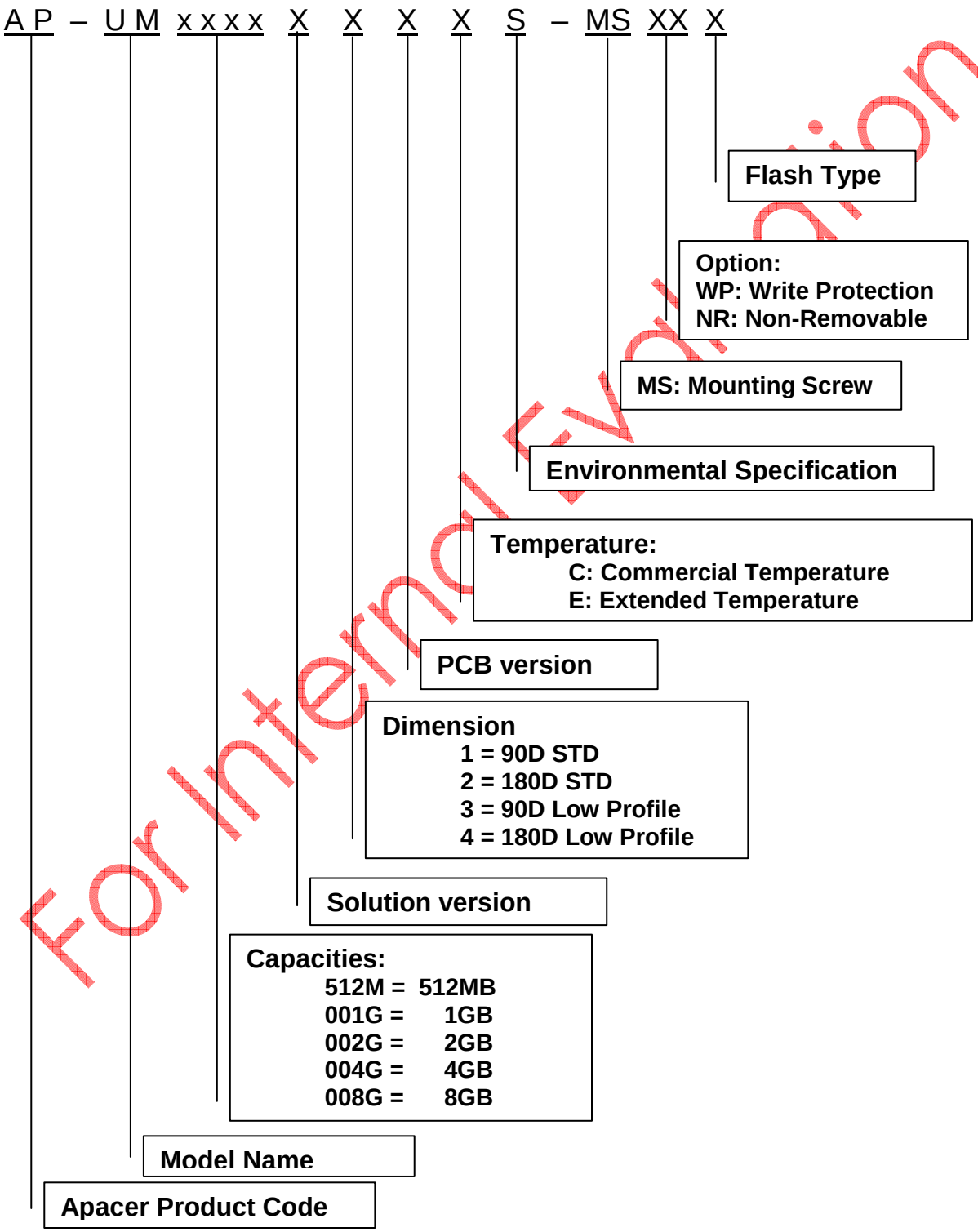
# 7. Product Ordering Information

## 7.1 Product Code Designations

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## 7.2 Valid Combinations

### 7.2.1 Type C (STD 90D-MS)

Standard 90 Degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 512 MB | AP-UM512MK10CS-MSS | AP-UM512ML10ES-MSS |
| 1 GB | AP-UM001GK10CS-MSS | AP-UM001GL10ES-MSS |
| 2 GB | AP-UM002GK10CS-MSS | AP-UM002GL10ES-MSS |
| 4 GB | AP-UM004GK10CS-MSS | AP-UM004GL10ES-MSS |
| 8 GB | AP-UM008GK10CS-MST | AP-UM008GL10ES-MST |

### 7.2.2 Type D (LP 180D)

Low Profile 180 Degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 512 MB | AP-UM512MK42CS-S | AP-UM512ML42ES-S |
| 1 GB | AP-UM001GK42CS-S | AP-UM001GL42ES-S |
| 2 GB | AP-UM002GK42CS-S | AP-UM002GL42ES-S |
| 4 GB | AP-UM004GK42CS-S | AP-UM004GL42ES-S |
| 8 GB | AP-UM008GK42CS-T | AP-UM008GL42ES-T |

### 7.2.3 Type E (LP 90D-MS)

Low Profile 90 Degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 512 MB | AP-UM512MK31CS-MSS | AP-UM512ML31ES-MSS |
| 1 GB | AP-UM001GK31CS-MSS | AP-UM001GL31ES-MSS |
| 2 GB | AP-UM002GK31CS-MSS | AP-UM002GL31ES-MSS |
| 4 GB | AP-UM004GK31CS-MSS | AP-UM004GL31ES-MSS |
| 8 GB | AP-UM008GK31CS-MST | AP-UM008GL31ES-MST |

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# Revision History

| Revision | Description | Date |
|---|---|---|
| 0.1 | Preliminary release | 01/07/2011 |
| 0.2 | Context refined | 01/10/2011 |
| 0.3 | Updated feature details & pin assignments drawings | 01/11/2011 |
| 0.4 | Updated environment specifications | 01/14/2011 |

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