

*RoHS Compliant*

# **USB-Disk Module II Plus**

*Specification*

**May 24, 2011**

*Version 1.1*



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## FEATURES:

- **USB2.0 High-Speed and USB1.1 Full-Speed compatible interface**
- **Capacity**
  - 256, 512 MB
  - 1, 2, 4, 8 GB
- **Fast sustained read performance**
  - Sustained read: 30 MB/s
- **Fast sustained write performance**
  - Sustained write: 25 MB/s
- **Intelligent USB Module**
  - Implements dynamic wear-leveling algorithms to substantially increase longevity of flash media
  - BCH (24 bit) Error Detection Code/Error Correction Code (EDC/ECC)
  - Intrinsic data integrity after power loss
  - Wear leveling algorithm that provides more reliable data storage over an extended period
- **Extended Data Protection (Optional)**
  - Write protection setting by jumper for prevention of data overwrites.
- **Zero Power Data Retention**
  - Batteries not required for data storage
- **Support Ready Boost for Windows Vista**
- **Support boot-up function for OS**
  - Windows XP Embedded
  - Windows CE
  - Linux
- **Temperature ranges**
  - 0°C to 70°C for operation (standard)
  - -40°C to 85°C for operation (ET <sup>1</sup>)
  - -40°C to 100°C for storage
- **Power consumption (typical)**
  - Active mode: 181 mA
  - Sleep mode: 402  $\mu$  A
- **Connector**
  - 10-pin (2x5) female header
- **RoHS Compliant**
- **Support Non-Removable Setting<sup>2</sup>**

1. Extended Temperature

2. Standard Temperature Exclusive

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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

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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 Power Management Unit (PMU)

The power management unit (PMU) controls the power consumption of the UDM. It can dramatically extend product battery life by leaving the idle part of the circuitry into sleep mode. The PMU has zero wake-up latency.

#### 1.1.2 SRAM Buffer

The SRAM buffer is a key contributor to the USB controller performance. It optimizes data writes to the flash.

#### 1.1.3 Error Correction Code (ECC)

The UDM uses BCH Error Detection Code (EDC) and Error Correction Code (ECC) algorithms which correct up to 24 random single-bit errors for each 1024-byte block of data depending on spare area of flash memory. High performance is achieved through hardware-based error detection and correction.

#### 1.1.4 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.

#### 1.1.5 Write Protection Mode (Optional)

When the device is configured to the Write-Protection mode, it enhances the data security and protection. This feature prevents the stored data from inadvertent system writes or erases, and viruses.

## 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.

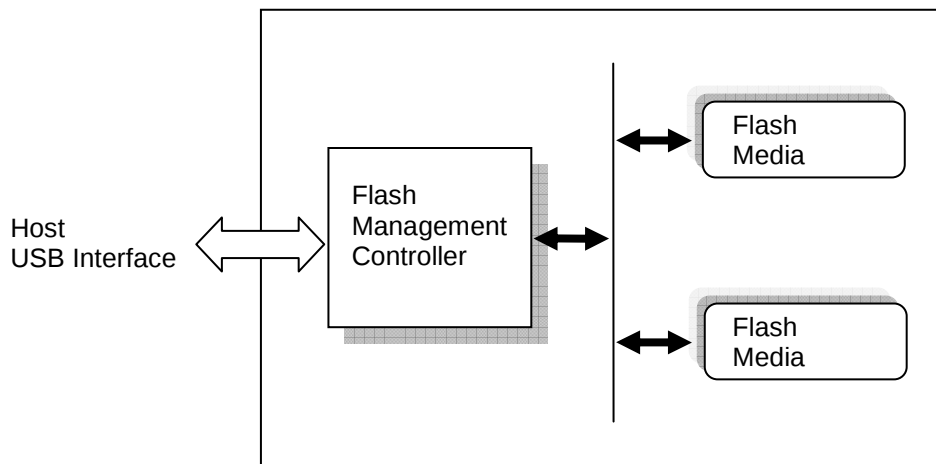
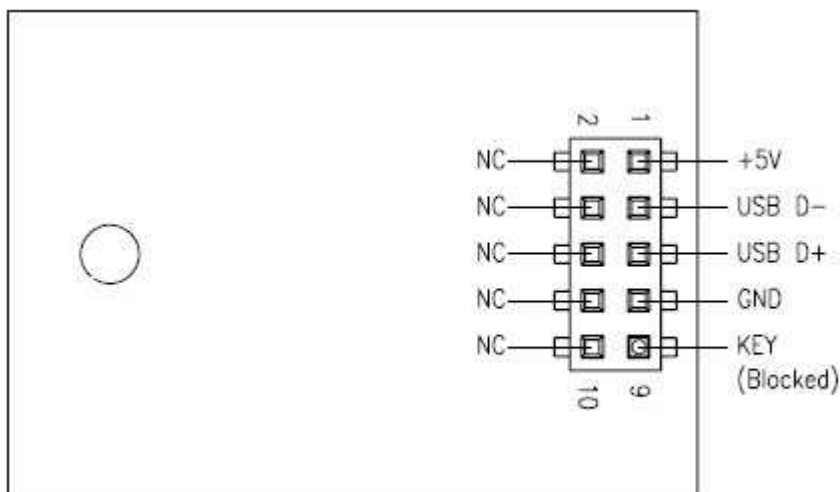


Figure 2-1: Functional block diagram

## 3. Pin Assignment

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

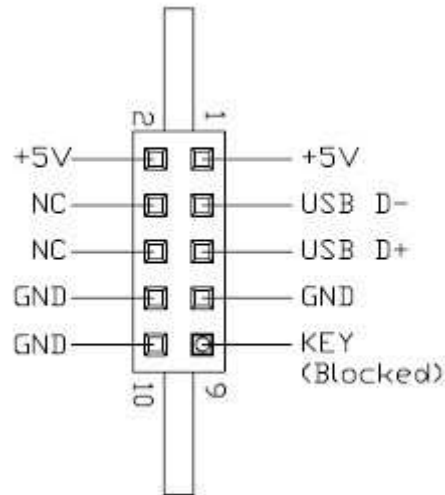
### 3.1 Type A, Type B, Type C, and Type E



**Table 3-1:** Pin Assignment of the 10-pin configuration in Type A, Type B, 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  | N.C    |

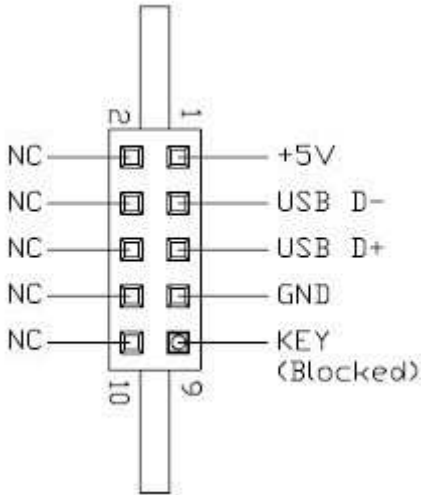
## 3.2 Type D ( STD )



**Table 3-2:** Pin Assignment of the 10-pin configuration in Type D (STD)

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

### 3.3 Type D ( LP )



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

| 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  | N.C    |

## 4. Capacity Specifications

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

**Table 4-1:** Capacity Specification

| Density | Total Bytes   |
|---------|---------------|
| 256MB   | 254,509,056   |
| 512 MB  | 512,458,752   |
| 1GB     | 1,028,358,144 |
| 2GB     | 2,060,156,928 |
| 4GB     | 4,120,920,064 |
| 8GB     | 8,248,131,584 |

### 4.1 Functional Specifications

**Table 4-2:** Performance Specifications

| Capacity               | 256 MB | 512 MB / 1 GB | 2 GB | 4 GB | 8 GB |
|------------------------|--------|---------------|------|------|------|
| Performance            |        |               |      |      |      |
| Sustained read (MB/s)  | 15     | 25            | 25   | 30   | 25   |
| Sustained write (MB/s) | 9      | 10            | 15   | 25   | 20   |

### 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 4-2.

**Table 4-2:** Environmental Specifications

|                    |                                                       |                                                |
|--------------------|-------------------------------------------------------|------------------------------------------------|
| <b>Temperature</b> | Operation                                             | 0°C to 70°C (Std.); -40°C to 85°C (Ext. Temp.) |
|                    | Storage                                               | -40°C to 100°C                                 |
| <b>Vibration</b>   | 10 Hz to 500 Hz, 15G, 3 axes, 30 minutes (IEC 68-2-6) |                                                |
| <b>Shock</b>       | Duration: 11 ms, 50G, 3 axes, 18 times (IEC 68-2-27)  |                                                |
| <b>EMC</b>         | FCC, CE                                               |                                                |

## 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°C to 70°C         | 4.5-5.5V |
| Extended Temperature | -40°C to 85°C       |          |

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

| Parameter                                         | Symbol   | Min       | Max      | Unit |
|---------------------------------------------------|----------|-----------|----------|------|
| Power Supply Input                                | VDD- VSS | -0.3      | 5.5      | V    |
| Voltage on any pin except VDD with respect to GND | VIN      | -SS - 0.3 | VDD +0.3 | V    |

### 5.1 AC Characteristics

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

| Parameter                                | Symbol            | Min | Typ | Max    | Unit |
|------------------------------------------|-------------------|-----|-----|--------|------|
| Rise Time                                | T <sub>FR</sub>   | 4   | —   | 20     | ns   |
| Fall Time                                | T <sub>FF</sub>   | 4   | —   | 20     | ns   |
| Differential Rise and Fall Time Matching | T <sub>FRFM</sub> | 90  |     | 111.11 | %    |
| Driver Output Resistance                 | Z <sub>DRV</sub>  | 28  | —   | 44     | Ω    |

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

| Parameter                | Symbol             | Min  | Typ | Max  | Unit |
|--------------------------|--------------------|------|-----|------|------|
| Rise Time (10%~90%)      | T <sub>HSR</sub>   | 500  | —   | —    | ps   |
| Fall Time (10%~90%)      | T <sub>HSF</sub>   | 500  | —   | —    | ps   |
| Driver Output Resistance | Z <sub>HSDRV</sub> | 40.5 | —   | 49.5 | Ω    |

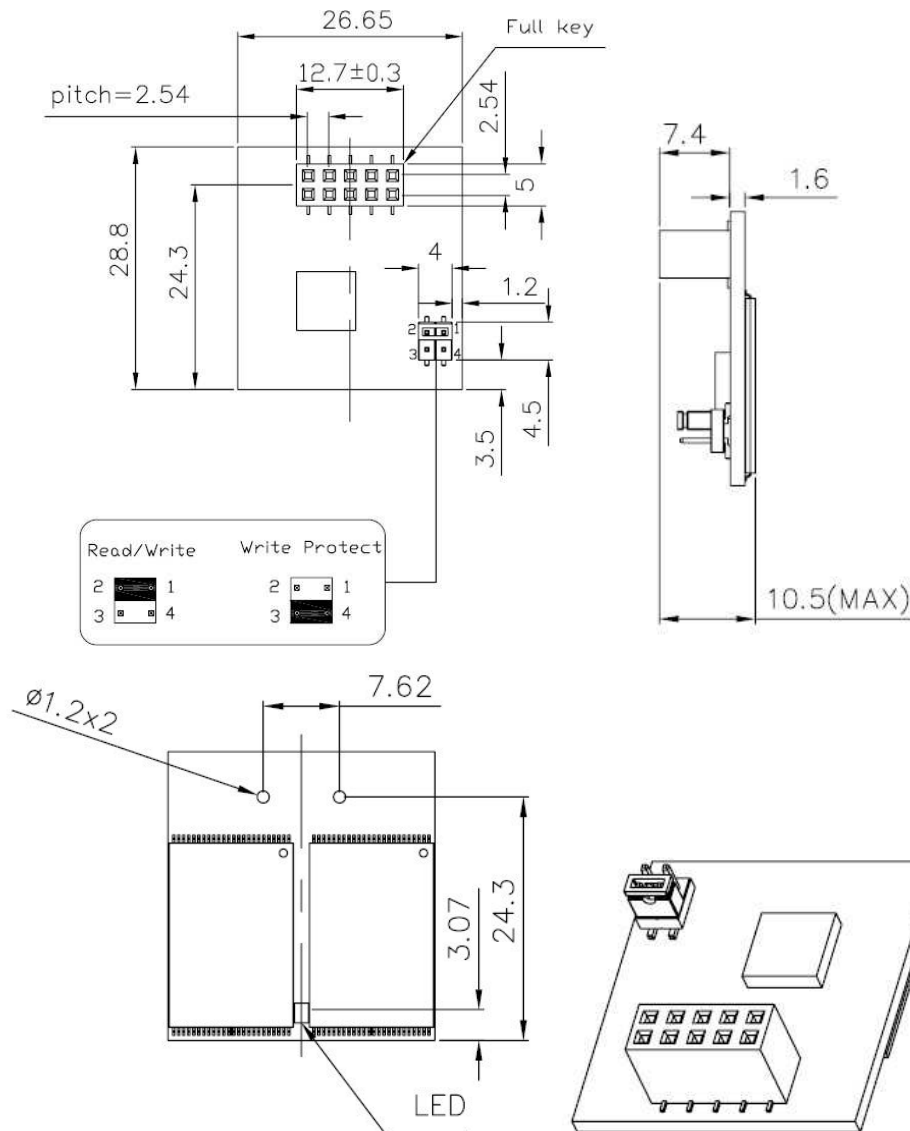
## 6. Physical Dimension

### 6.1 Horizontal Design

#### 6.1.1 Type A (STD 90D)

Standard 90 degree

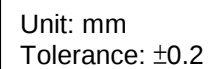
| Length | 28.8mm | Width | 26.65mm | Height (Max) | 10.5 mm |
|--------|--------|-------|---------|--------------|---------|
|--------|--------|-------|---------|--------------|---------|



Unit: mm  
Tolerance: ±0.2

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|               |                    |              |                     |                     |                    |
|---------------|--------------------|--------------|---------------------|---------------------|--------------------|
| <b>Length</b> | 37.8 <sub>mm</sub> | <b>Width</b> | 26.65 <sub>mm</sub> | <b>Height (Max)</b> | 10.5 <sub>mm</sub> |
|---------------|--------------------|--------------|---------------------|---------------------|--------------------|



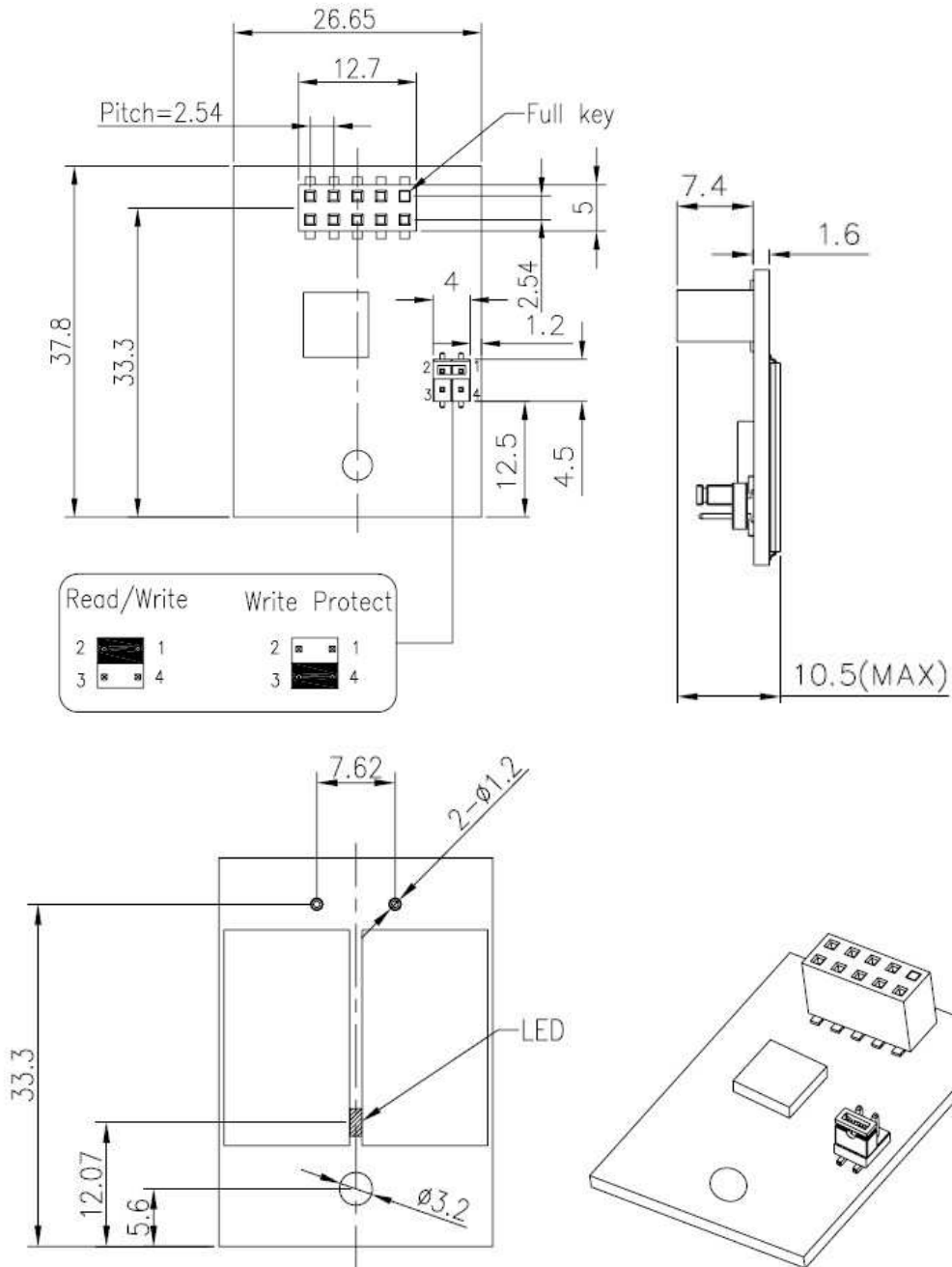
# USB-Disk Module II Plus AP-UMxxxxXXXXX-XXXXX



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

Standard 90 Degree Mounting Screw

| Length | 37.8mm | Width | 26.65mm | Height (Max) | 10.5 mm |
|--------|--------|-------|---------|--------------|---------|
|--------|--------|-------|---------|--------------|---------|



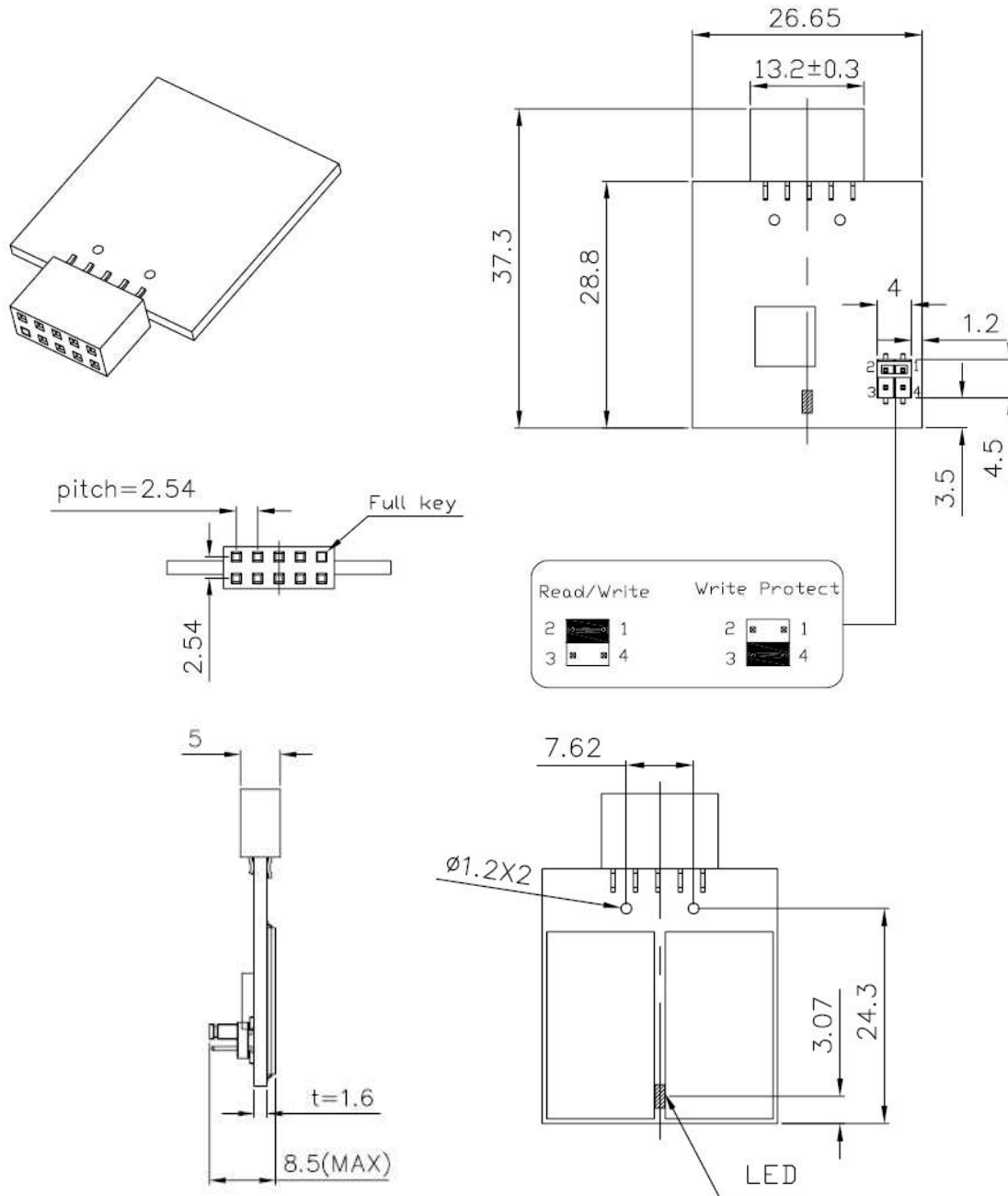
Unit: mm  
Tolerance:  $\pm 0.2$

## 6.2 Vertical Design

### 6.2.1 Type D (STD 180D)

Standard 180 Degree

| Length | 37.3mm | Width | 26.65mm | Height (Max) | 8.5 mm |
|--------|--------|-------|---------|--------------|--------|
|--------|--------|-------|---------|--------------|--------|



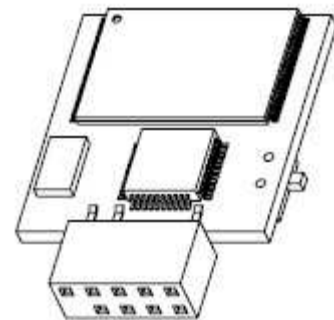
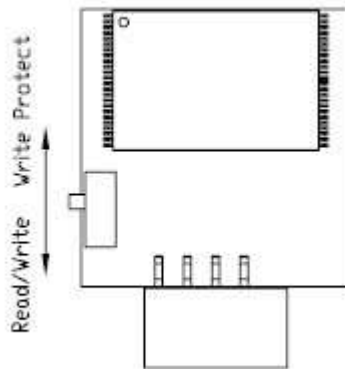
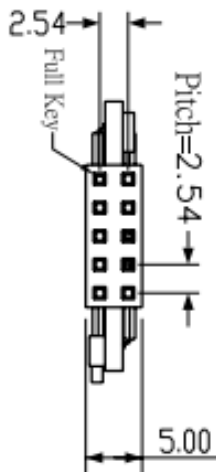
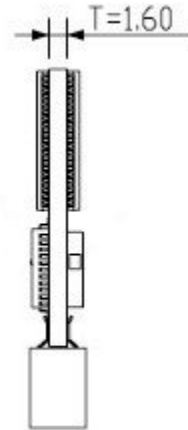
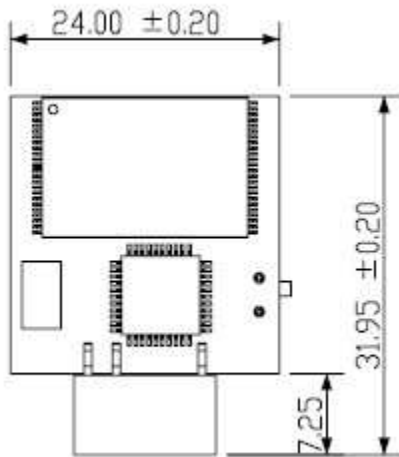
Unit: mm  
Tolerance: ±0.2

## 6.3 Low Profile Design

### 6.3.1 Type D (LP 180D)

Low Profile 180 Degree

| Length | 31.95 <sub>mm</sub> | Width | 24 <sub>mm</sub> | Height (Max) | 5 <sub>mm</sub> |
|--------|---------------------|-------|------------------|--------------|-----------------|
|--------|---------------------|-------|------------------|--------------|-----------------|



Unit: mm  
Tolerance: ±0.2

# USB-Disk Module II Plus

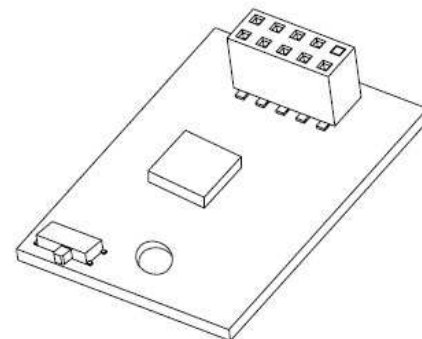
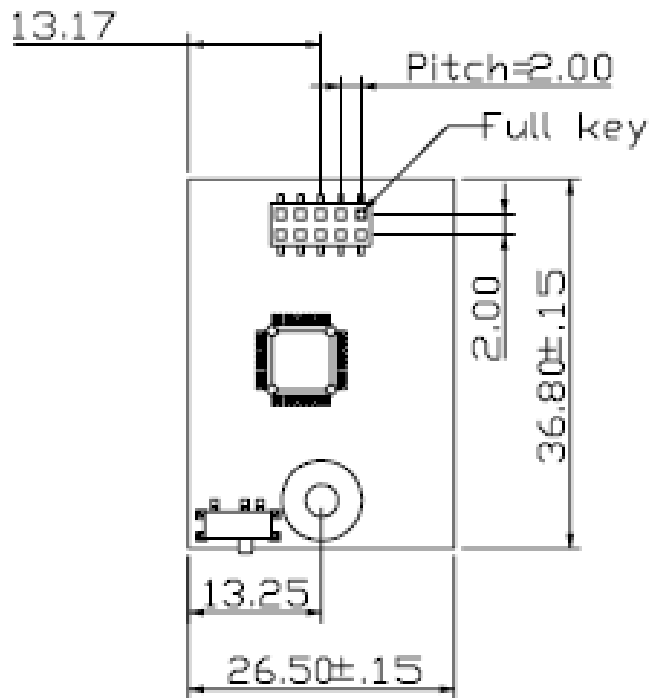
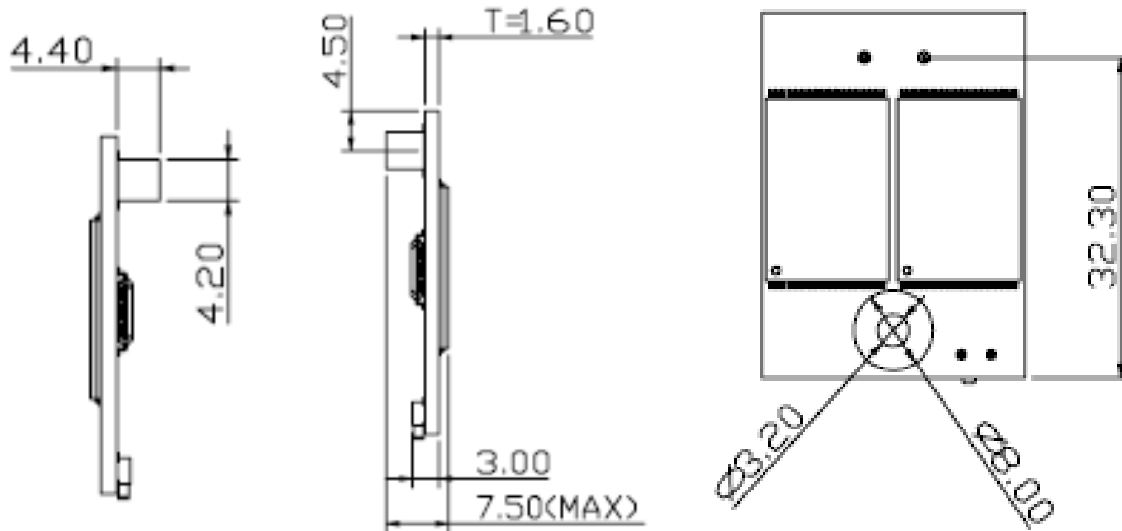
## AP-UMxxxxXXXXX-XXXXX



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

Low Profile 90 Degree Mounting Screw

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

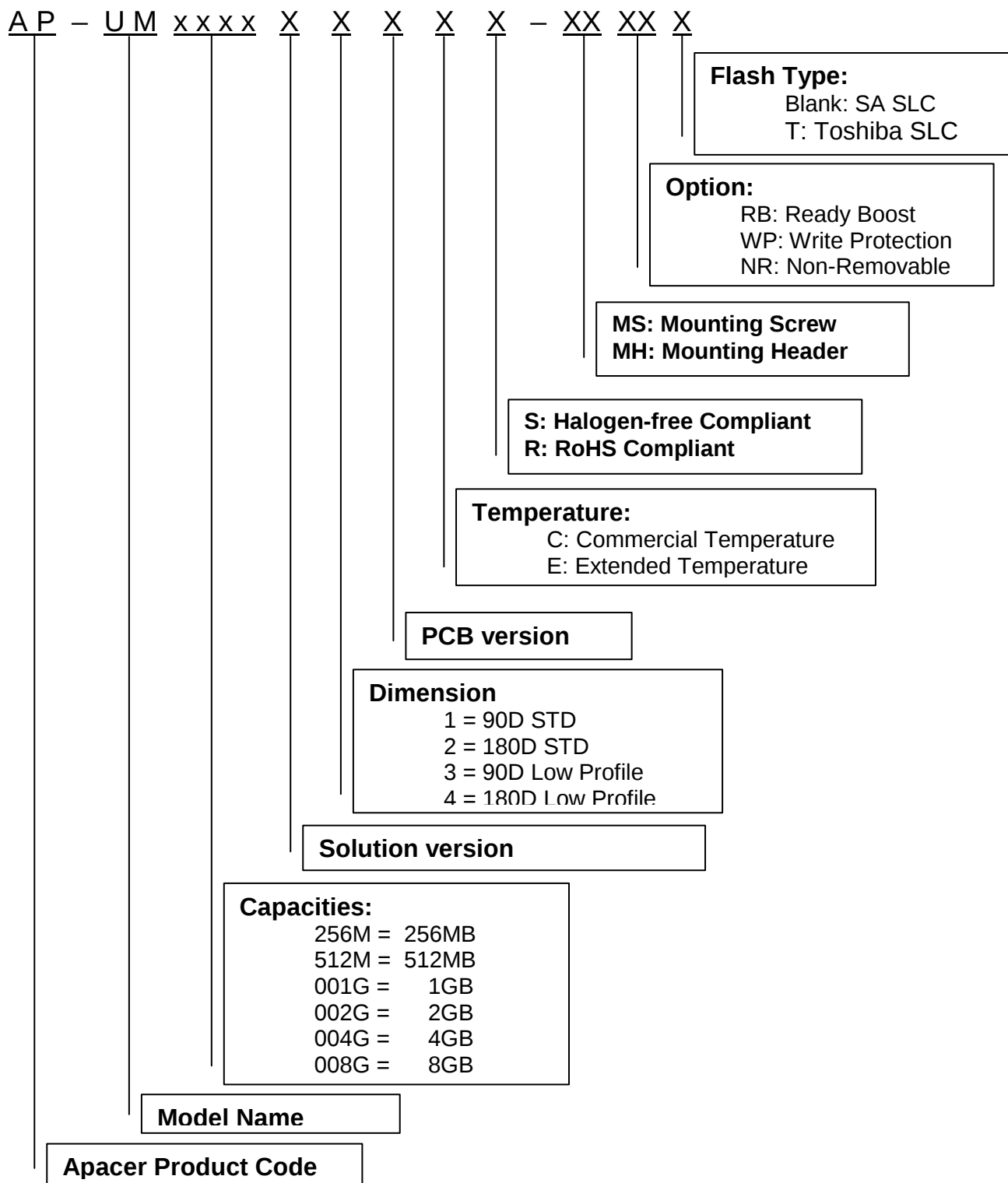


Write Protect    Read/Write

Unit: mm  
Tolerance:  $\pm 0.2$

## 7. Product Ordering Information

### 7.1 Product Code Designation



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## 7.2 Valid Combinations

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### 7.2.1 Type A (STD 90D)

Standard 90 degree

| Capacity | Standard         | Extended Temperature |
|----------|------------------|----------------------|
| 256MB    | AP-UM256MN10CS   | AP-UM256MQ10ES       |
| 512MB    | AP-UM512MN10CS   | AP-UM512MQ10ES       |
| 1GB      | AP-UM001GN10CS   | AP-UM001GQ10ES       |
| 2GB      | AP-UM002GN10CS   | AP-UM002GQ10ES       |
| 4GB      | AP-UM004GN10CS   | AP-UM004GQ10ES       |
| 8GB      | AP-UM008GN10CS-T | AP-UM008GQ10ES-T     |

### 7.2.2 Type B (STD 90D-MH)

Standard 90 Degree Mounting Header

| Capacity | Standard           | Extended Temperature |
|----------|--------------------|----------------------|
| 256MB    | AP-UM256MN10CS-MH  | AP-UM256MQ10ES-MH    |
| 512MB    | AP-UM512MN10CS-MH  | AP-UM512MQ10ES-MH    |
| 1GB      | AP-UM001GN10CS-MH  | AP-UM001GQ10ES-MH    |
| 2GB      | AP-UM002GN10CS-MH  | AP-UM002GQ10ES-MH    |
| 4GB      | AP-UM004GN10CS-MH  | AP-UM004GQ10ES-MH    |
| 8GB      | AP-UM008GN10CS-MHT | AP-UM008GQ10ES-MHT   |

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

Standard 90 Degree Mounting Screw

| Capacity | Standard           | Extended Temperature |
|----------|--------------------|----------------------|
| 256MB    | AP-UM256MN10CS-MS  | AP-UM256MQ10ES-MS    |
| 512MB    | AP-UM512MN10CS-MS  | AP-UM512MQ10ES-MS    |
| 1GB      | AP-UM001GN10CS-MS  | AP-UM001GQ10ES-MS    |
| 2GB      | AP-UM002GN10CS-MS  | AP-UM002GQ10ES-MS    |
| 4GB      | AP-UM004GN10CS-MS  | AP-UM004GQ10ES-MS    |
| 8GB      | AP-UM008GN10CS-MST | AP-UM008GQ10ES-MST   |

### 7.2.4 Type D (STD 180D)

Standard 180 Degree

| Capacity | Standard         | Extended Temperature |
|----------|------------------|----------------------|
| 256MB    | AP-UM256MN20CS   | AP-UM256MQ20ES       |
| 512MB    | AP-UM512MN20CS   | AP-UM512MQ20ES       |
| 1GB      | AP-UM001GN20CS   | AP-UM001GQ20ES       |
| 2GB      | AP-UM002GN20CS   | AP-UM002GQ20ES       |
| 4GB      | AP-UM004GN20CS   | AP-UM004GQ20ES       |
| 8GB      | AP-UM008GN20CS-T | AP-UM008GQ20ES-T     |

### 7.2.5 Type D (LP 180D)

Low Profile 180 Degree

| Capacity | Standard         | Extended Temperature |
|----------|------------------|----------------------|
| 256MB    | AP-UM256MN40CG   | AP-UM256MQ40EG       |
| 512MB    | AP-UM512MN40CG   | AP-UM512MQ40EG       |
| 1GB      | AP-UM001GN40CG   | AP-UM001GQ40EG       |
| 2GB      | AP-UM002GN40CG   | AP-UM002GQ40EG       |
| 4GB      | AP-UM004GN40CG   | AP-UM004GQ40EG       |
| 8GB      | AP-UM008GN40CG-T | AP-UM008GQ40EG-T     |

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

Low Profile 90 Degree Mounting Screw

| Capacity | Standard           | Extended Temperature |
|----------|--------------------|----------------------|
| 256MB    | AP-UM256MN31CG-MS  | AP-UM256MQ31EG-MS    |
| 512MB    | AP-UM512MN31CG-MS  | AP-UM512MQ31EG-MS    |
| 1GB      | AP-UM001GN31CG-MS  | AP-UM001GQ31EG-MS    |
| 2GB      | AP-UM002GN31CG-MS  | AP-UM002GQ31EG-MS    |
| 4GB      | AP-UM004GN31CG-MS  | AP-UM004GQ31EG-MS    |
| 8GB      | AP-UM008GN31CG-MST | AP-UM008GQ31EG-MST   |

**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.

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## Revision History

| Revision | Description                     | Date         |
|----------|---------------------------------|--------------|
| 1.0      | Official Release                | May 16, 2011 |
| 1.1      | Revised Capacity Specifications | May 24, 2011 |

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## Global Presence

|                              |                                                                                                                                                                                                                                                                  |
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| <b>Europe</b>                | <b>Apacer Technology B.V.</b><br>Europalaan 89<br>5232 BC 'S-Hertogenbosch<br>The Netherlands<br>Tel: 31-73-645-9620<br>Fax: 31-73-645-9629<br><a href="mailto:sales@apacer.nl">sales@apacer.nl</a>                                                              |
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