*RoHS Recast Compliant*

# USB-Disk Module Ⅱ *Plus*

***Product Specifications***

**June 10th, 2014**

*Version 2.2*

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# FEATURES:

- **USB2.0 High-Speed and USB1.1 Full-Speed compatible interface**
- **Capacity**
  - 256, 512 MB
  - 1, 2, 4, 8, 16, 32 GB
- **Performance**
  - Sustained read: up to 34 MB/s
  - Sustained write: up to 22 MB/s
- **Intelligent USB Module**
  - Advanced wear-leveling algorithms to substantially increase longevity of flash media
  - BCH (24 bit) Error Detection Code/Error Correction Code (EDC/ECC)
- **Extended Data Protection (Optional)**
  - Write protection setting by jumper for prevention of data overwrites.
- **MTBF**
  - Approximately greater than 4.20 x $10^6$ hours
- **Support boot-up function for OS**
  - Windows XP Embedded
  - Windows CE
  - Linux
  - Windows 7
- **Temperature ranges**
  - 0℃ to 70℃ for operation (standard)
  - -40℃ to 85℃ for operation (ET[1])
  - -40℃ to 85℃ for storage
- **Power consumption (typical)**
  - Active mode: 181 mA
  - Idle mode: 68 mA
  - Operating voltage: 5V (with a certain percentage of tolerance)
- **Connector**
  - 10-pin (2x5) female header
- **NAND Flash type:** SLC
- **Supports Ready Boost for Vista**
- **RoHS Recast Compliant (2011/65/EU)**
- **Support Non-Removable Setting**

1. Extended Temperature

Notes: the results for performance and power consumption addressed here may vary in real world platforms.



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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 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.

### 1.1.2 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 write/erase cycles for reliable data storage over an extended period.

### 1.1.3 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.


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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.

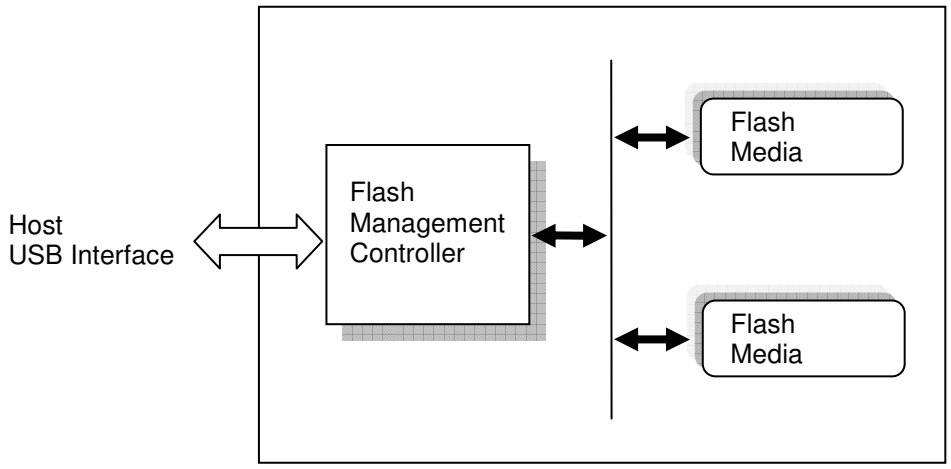



**Figure 2-1:** Functional block diagram


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# 3. Pin Assignment

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

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

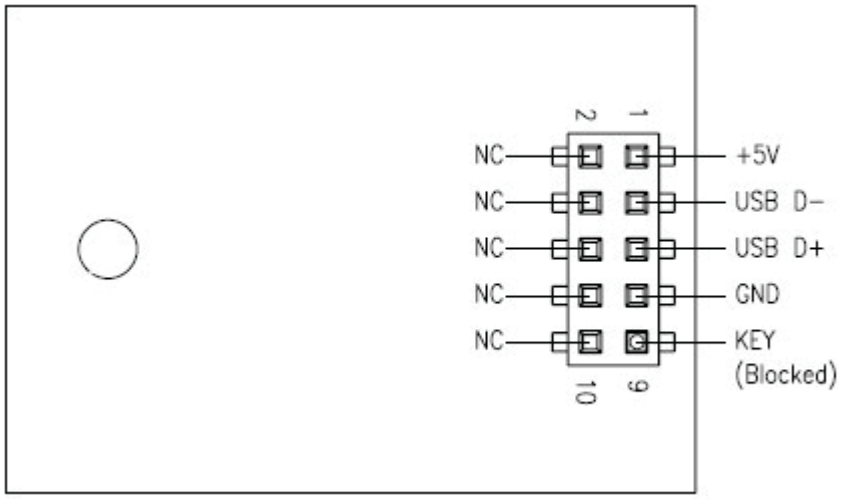



**Table 3-1:** Pin Assignment of the 10-pin configuration in Type A, Type B, Type C, and Type E

| 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 |


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## 3.2 Type D（STD）

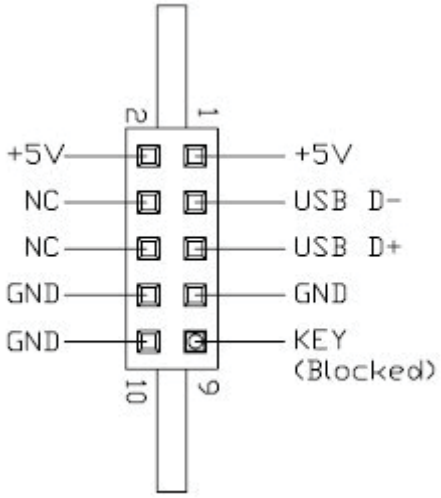



**Table 3-2:** Pin Assignment of the 10-pin configuration in Type D (STD)

| 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 |


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## 3.3 Type D（LP）

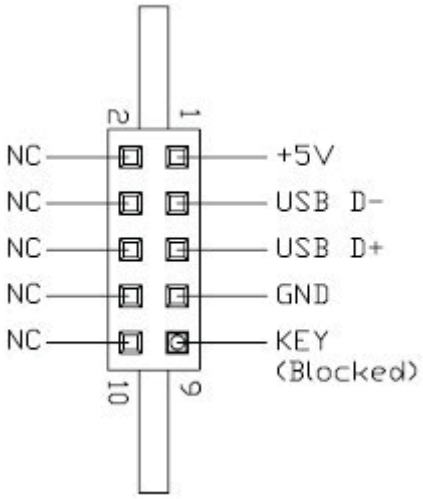



**Table 3-3:** Pin Assignment of the 10-pin configuration in Type D (LP)

| 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 |


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## 3.4 Type E (LP)

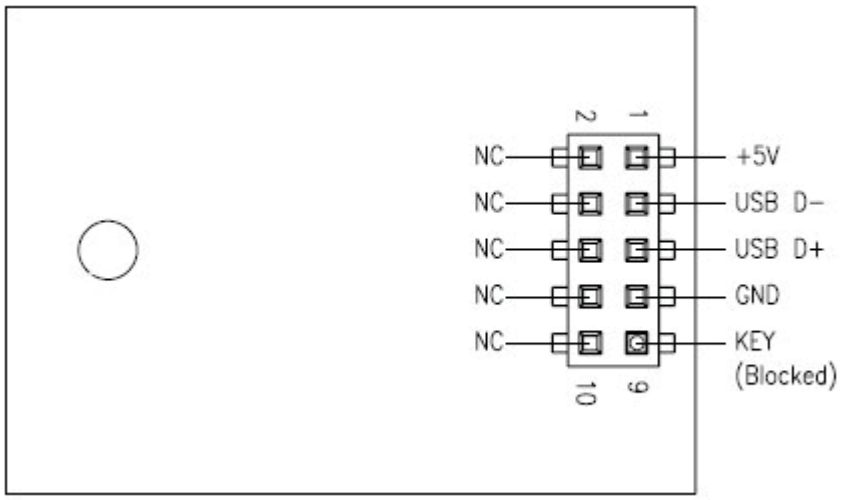



**Table 3-4:** Pin Assignment of the 10-pin configuration in Type A, Type B, Type C, and Type E

| 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 |


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# 4. Performance & Reliability Specifications

## 4.1 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 | 1,029,406,720 |
| 2GB | 2,061,205,504 |
| 4GB | 4,120,920,064 |
| 8GB | 8,248,131,584 |
| 16GB | 16,030,662,656 |
| 32GB | 32,061,292,544 |

Notes: the number of total bytes may vary depending on the file system in use.

## 4.2 Performance Specifications

**Table 4-2:** Performance Specifications

| Capacity / Performance | 256 MB | 512 MB | 1 GB | 2 GB | 4 GB | 8 GB | 16 GB | 32 GB |
|---|---|---|---|---|---|---|---|---|
| **Sustained read (MB/s)** | 31 | 31 | 32 | 34 | 28 | 32 | 34 | 31 |
| **Sustained write (MB/s)** | 10 | 15 | 19 | 19 | 21 | 15 | 22 | 21 |

Note: results may vary in real world platforms or flash configurations.

## 4.3 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

| | | |
|---|---|---|
| **Temperature** | Operation | 0℃ to 70℃ (Std.); -40℃ to 85℃ (Ext. Temp.) |
| | Storage | -40℃ to 85℃ |
| **Vibration** | Sine wave 10 Hz to 500 Hz, 50 $m/s^2$ , 3 axes (IEC 68-2-6, non-operating) | |
| **Shock** | Half sine wave 50G, 6 axes, 18 times (IEC 68-2-27, non-operating) | |
| **EMC** | FCC, CE | |


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## 4.4 MTBF

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in this device. The measurement assumes that device failure rate can be generated by the sum of failure rates in each component and a steady state failure rate can be predicated as equal to or greater than $4.20 \times 10^6$ hours.

Notes about the MTBF:

The MTBF is predicated and calculated based on "Bellcore Analysis Method 1".

$$\lambda_{ss} = \pi_E \sum_{i=1}^{m} (Ni\lambda_{SSi})$$

*m*: number of component types
$\lambda_{SS}$: device failure rate at steady state
*Ni*: quantity of i type component
$\lambda_{SSi}$: failure rate for i type component at steady state
$\pi_E$: device environment factor


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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 |
|---|---|---|---|---|
| Power Supply Input | $V_{DD}$- $V_{SS}$ | -0.3 | 5.5 | V |
| Voltage on any pin except VDD with respect to GND | $V_{IN}$ | $-_{ss}$ – 0.3 | $V_{DD}$ +0.3 | V |

## 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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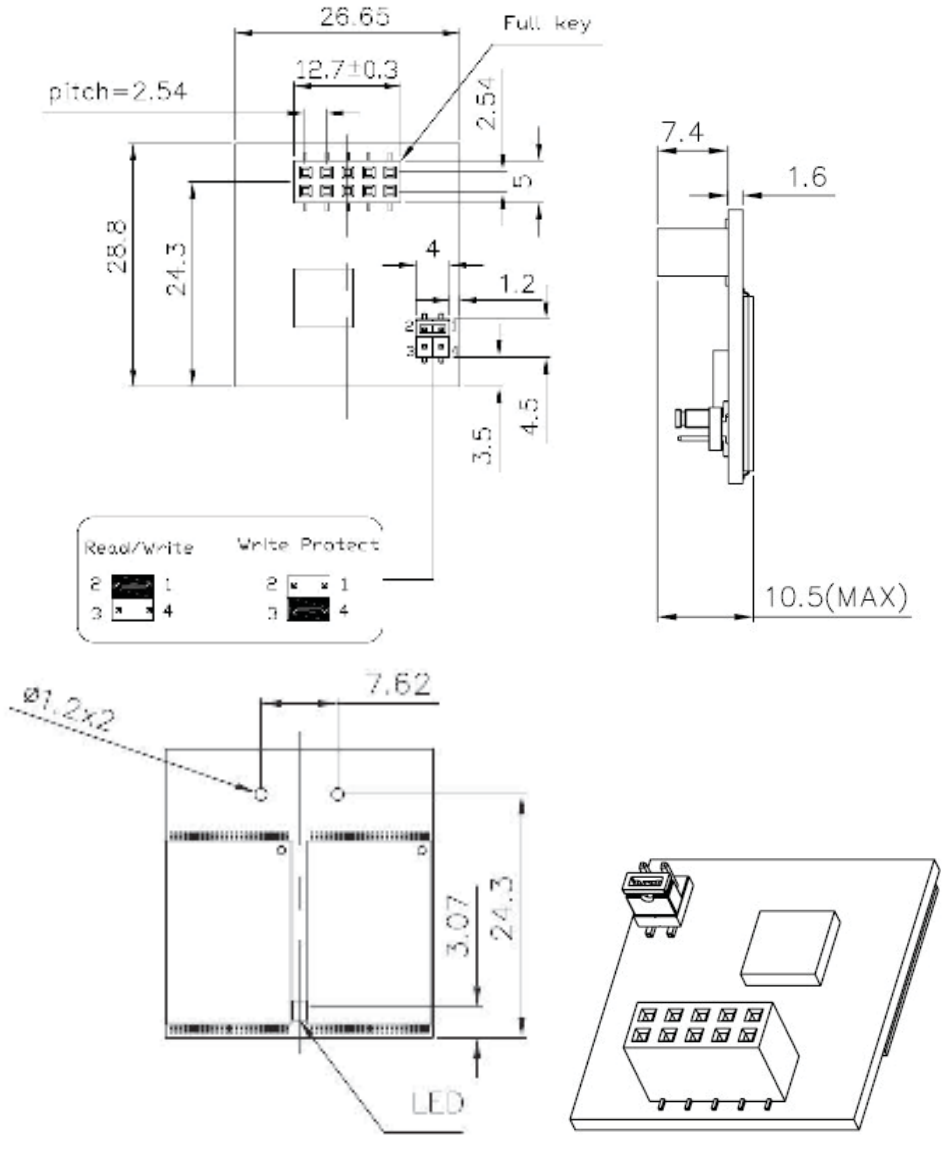
# 6. Physical Dimension

## 6.1 Horizontal Design

### 6.1.1 Type A (STD 90D)

Standard 90 degree

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



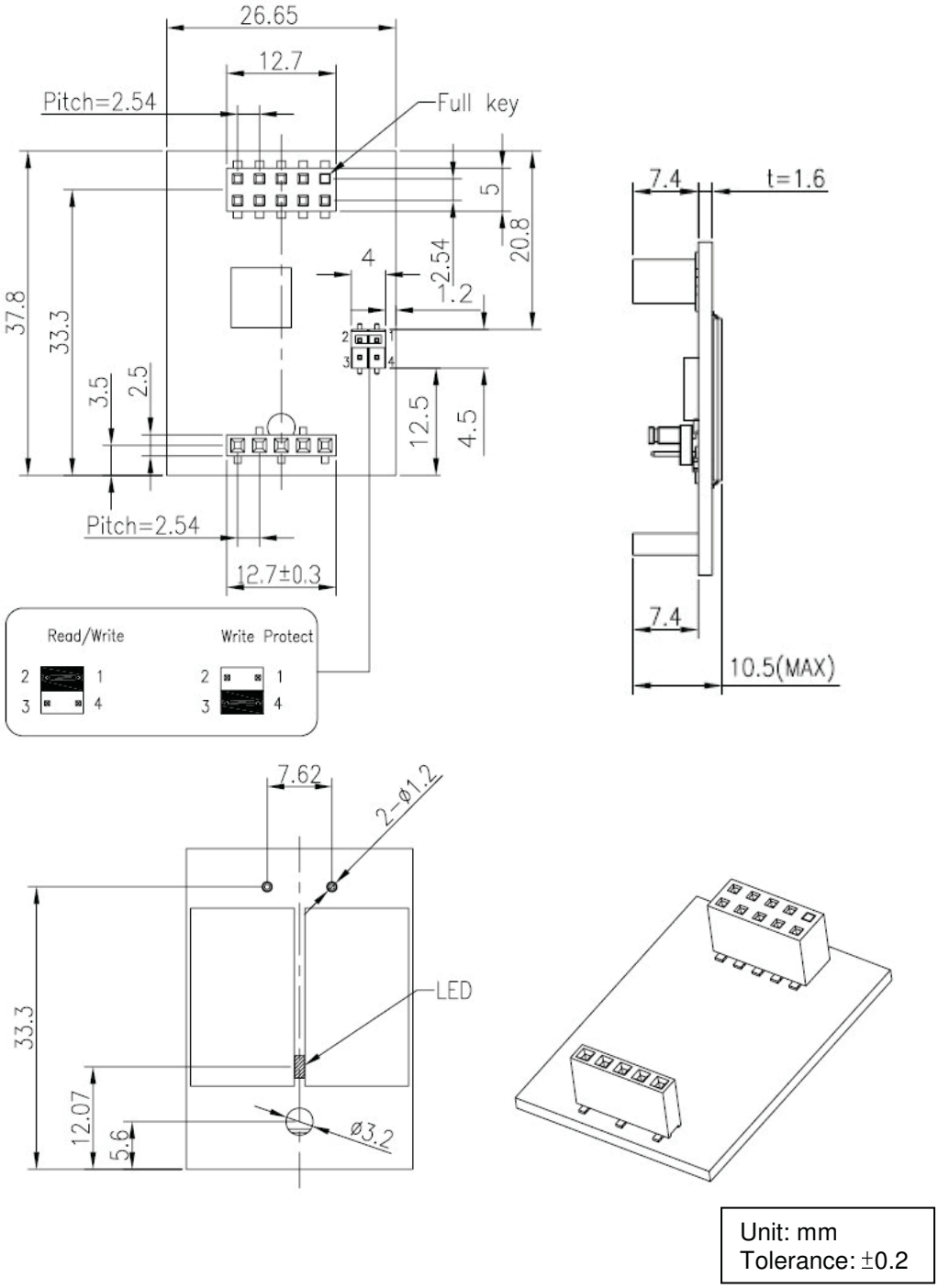

Unit: mm
Tolerance: ±0.2


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

Standard 90 Degree Mounting Header

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




Unit: mm
Tolerance: ±0.2

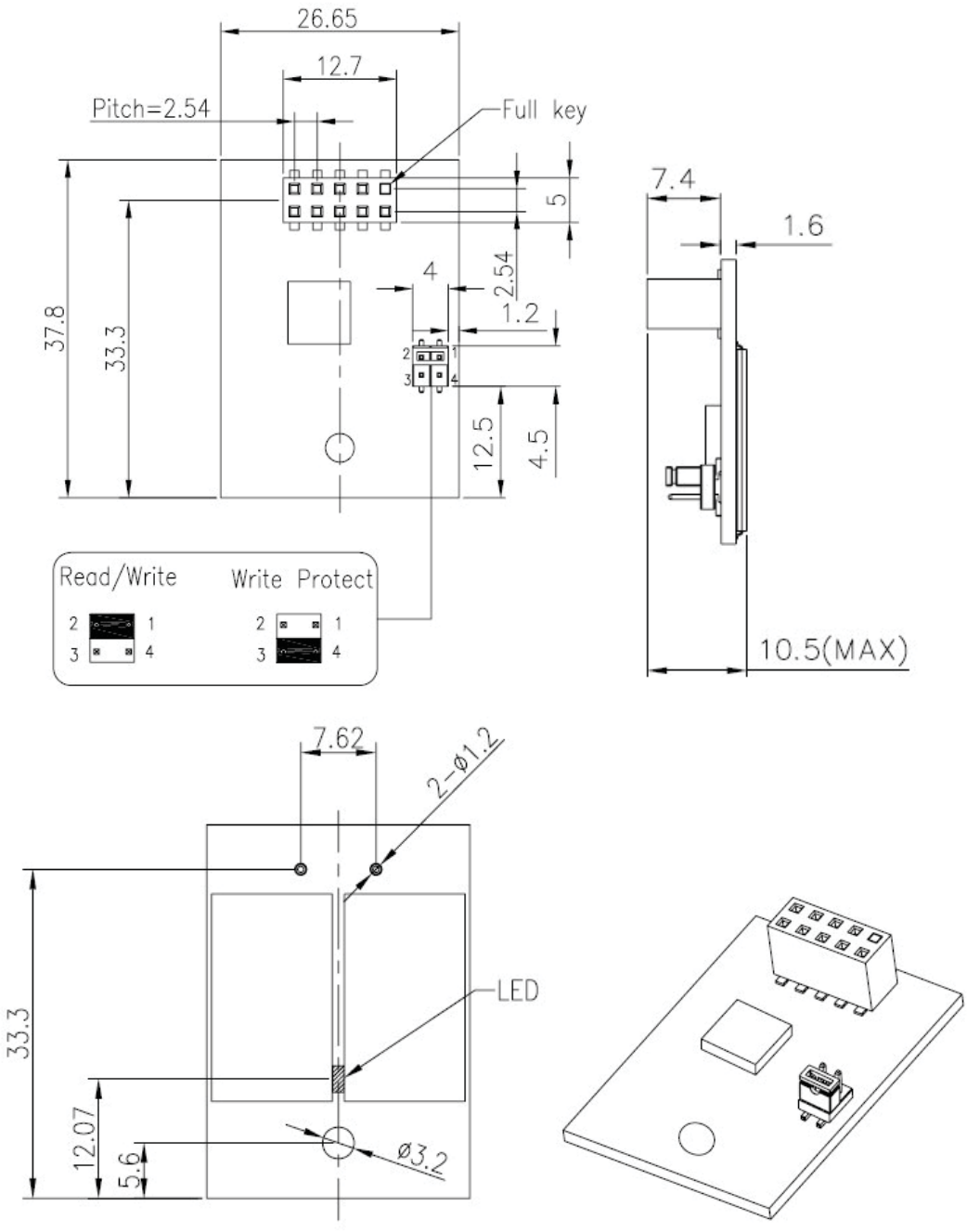


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### 6.1.3 Type C (STD 90D-MS)

Standard 90 Degree Mounting Screw

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




Unit: mm
Tolerance: ±0.2



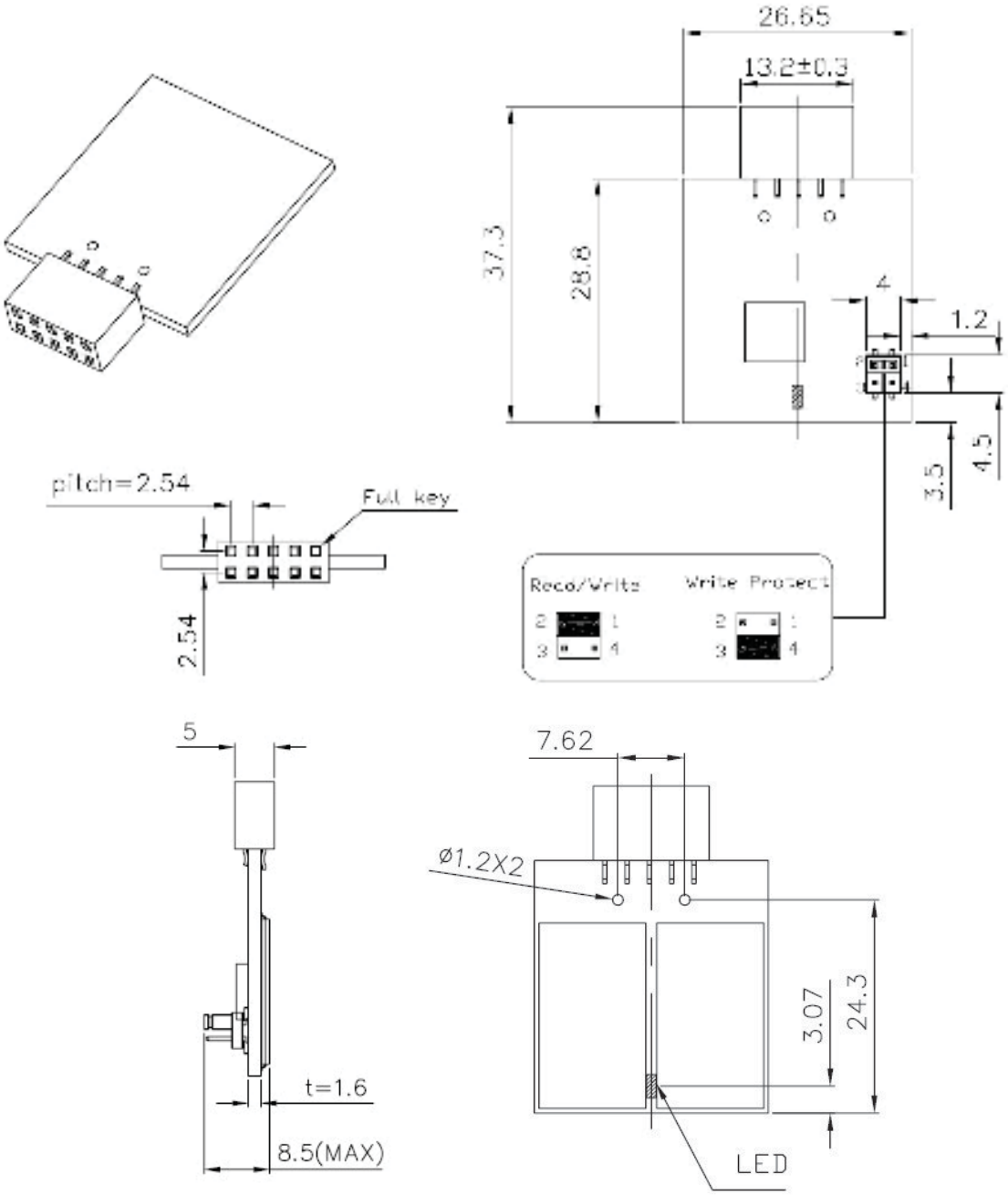
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## 6.2 Vertical Design

### 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



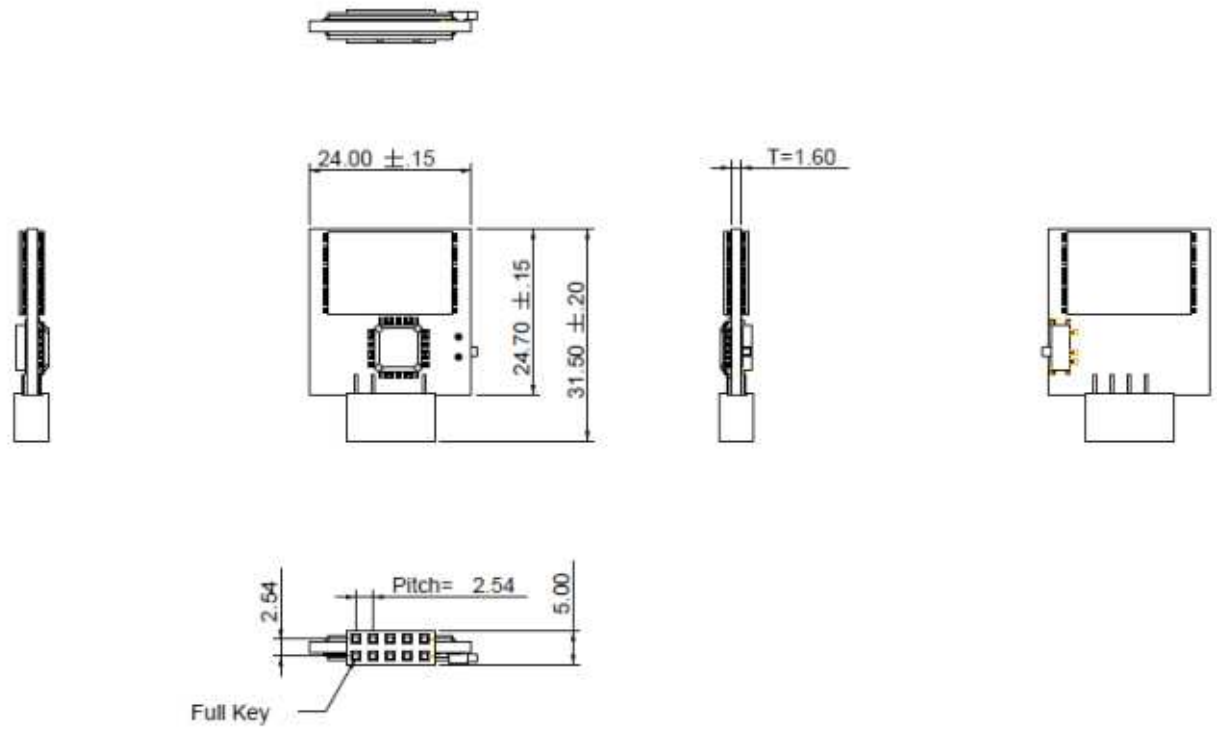
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## 6.3 Low Profile Design

### 6.3.1 Type D (LP 180D)

Low Profile 180 Degree

| Length | 31.50mm | Width | 24mm | Height (Max) | 5 mm |
|---|---|---|---|---|---|







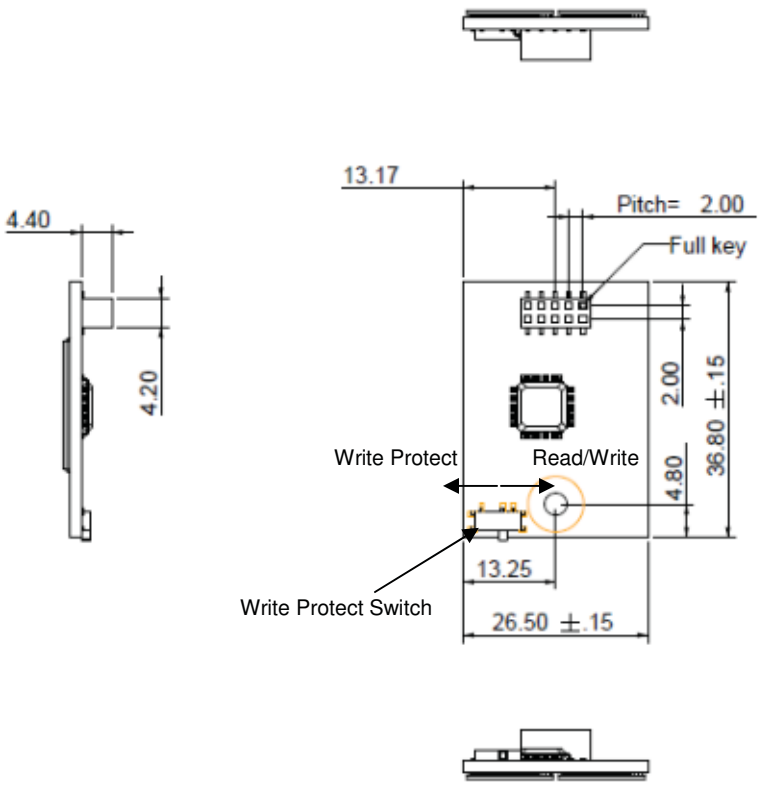
Unit: mm
Tolerance: ±0.2

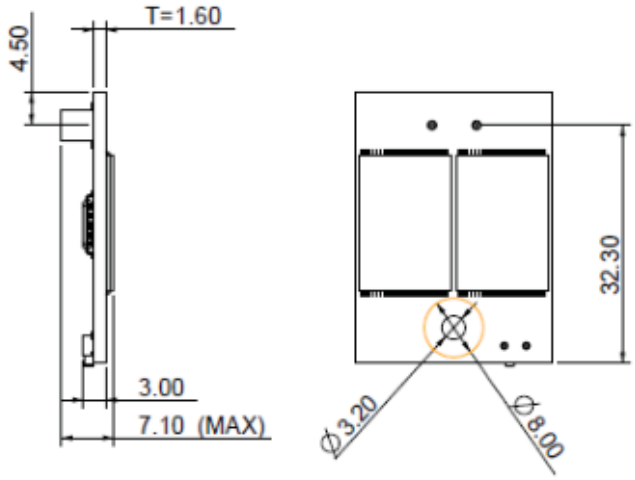

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### 6.3.1 Type E (LP 90D)

Low Profile 90 Degree

| Length | 36.80mm | Width | 26.50mm | Height (Max) | 7.10 mm |
|---|---|---|---|---|---|



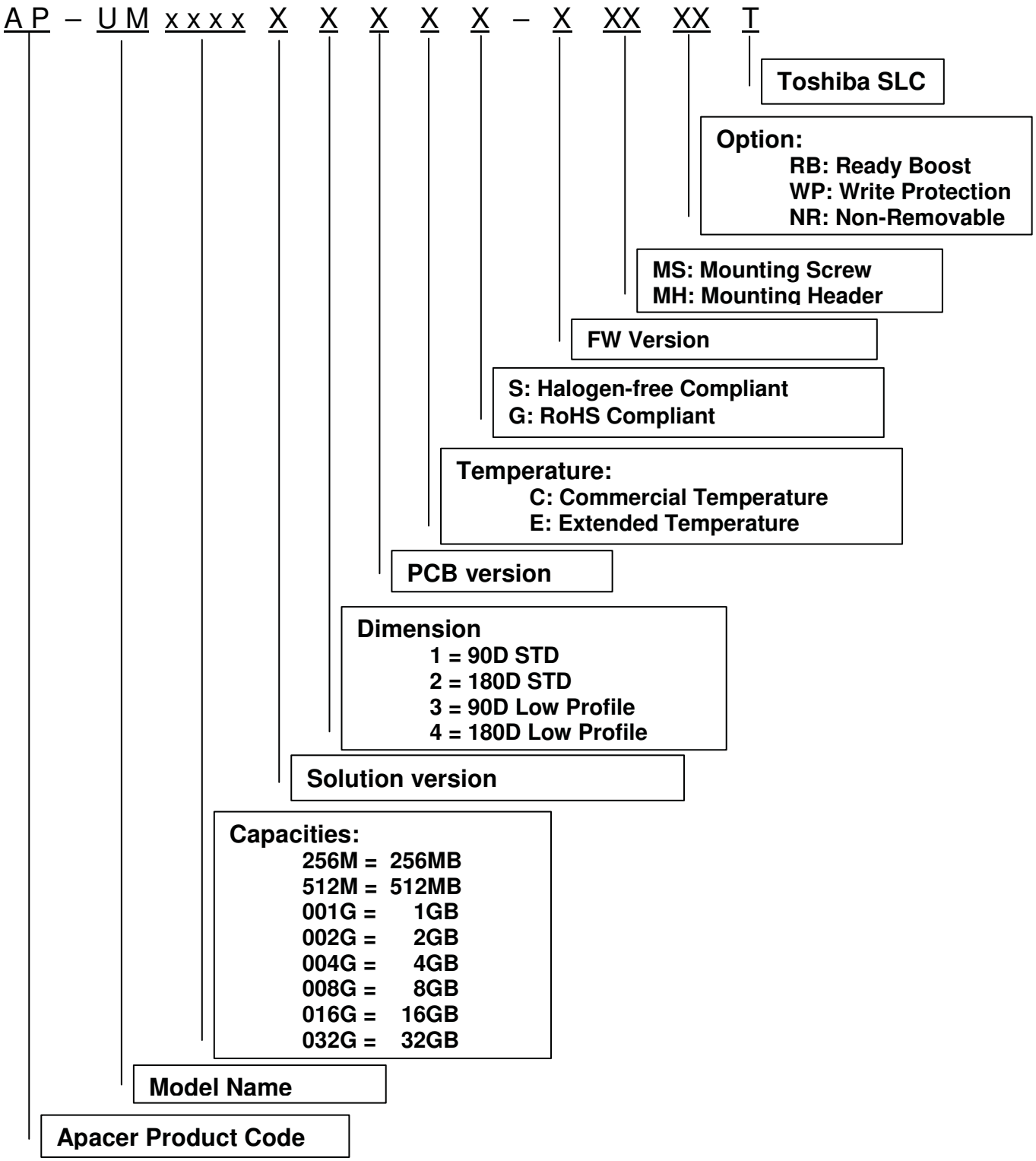

Unit: mm
Tolerance: ±0.2



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# 7. Product Ordering Information

## 7.1 Product Code Designation





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## 7.2 Valid Combinations

### 7.2.1 Type A (STD 90D)

Standard 90 degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2T | AP-UM256MT13ES-2T |
| 512MB | AP-UM512MR13CS-2T | AP-UM512MT13ES-2T |
| 1GB | AP-UM001GR13CS-2T | AP-UM001GT13ES-2T |
| 2GB | AP-UM002GR13CS-2T | AP-UM002GT13ES-2T |
| 4GB | AP-UM004GR13CS-2T | AP-UM004GT13ES-2T |
| 8GB | AP-UM008GR13CS-2T | AP-UM008GT13ES-2T |
| 16GB | AP-UM016GR13CS-2T | AP-UM016GT13ES-2T |
| 32GB | AP-UM032GR13CS-2T | AP-UM032GT13ES-2T |

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

Standard 90 degree Mounting Header

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2MHT | AP-UM256MT13ES-2MHT |
| 512MB | AP-UM512MR13CS-2MHT | AP-UM512MT13ES-2MHT |
| 1GB | AP-UM001GR13CS-2MHT | AP-UM001GT13ES-2MHT |
| 2GB | AP-UM002GR13CS-2MHT | AP-UM002GT13ES-2MHT |
| 4GB | AP-UM004GR13CS-2MHT | AP-UM004GT13ES-2MHT |
| 8GB | AP-UM008GR13CS-2MHT | AP-UM008GT13ES-2MHT |
| 16GB | AP-UM016GR13CS-2MHT | AP-UM016GT13ES-2MHT |
| 32GB | AP-UM032GR13CS-2MHT | AP-UM032GT13ES-2MHT |

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

Standard 90 degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2MST | AP-UM256MT13ES-2MST |
| 512MB | AP-UM512MR13CS-2MST | AP-UM512MT13ES-2MST |
| 1GB | AP-UM001GR13CS-2MST | AP-UM001GT13ES-2MST |
| 2GB | AP-UM002GR13CS-2MST | AP-UM002GT13ES-2MST |
| 4GB | AP-UM004GR13CS-2MST | AP-UM004GT13ES-2MST |
| 8GB | AP-UM008GR13CS-2MST | AP-UM008GT13ES-2MST |
| 16GB | AP-UM016GR13CS-2MST | AP-UM016GT13ES-2MST |
| 32GB | AP-UM032GR13CS-2MST | AP-UM032GT13ES-2MST |


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### 7.2.4 Type D (STD 180D)
Standard 180 degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR23CS-2T | AP-UM256MT23ES-2T |
| 512MB | AP-UM512MR23CS-2T | AP-UM512MT23ES-2T |
| 1GB | AP-UM001GR23CS-2T | AP-UM001GT23ES-2T |
| 2GB | AP-UM002GR23CS-2T | AP-UM002GT23ES-2T |
| 4GB | AP-UM004GR23CS-2T | AP-UM004GT23ES-2T |
| 8GB | AP-UM008GR23CS-2T | AP-UM008GT23ES-2T |
| 16GB | AP-UM016GR23CS-2T | AP-UM016GT23ES-2T |
| 32GB | AP-UM032GR23CS-2T | AP-UM032GT23ES-2T |

### 7.2.5 Type D (LP 180D)
Low Profile 180 Degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR40CG-2T | AP-UM256MT40EG-2T |
| 512MB | AP-UM512MR40CG-2T | AP-UM512MT40EG-2T |
| 1GB | AP-UM001GR40CG-2T | AP-UM001GT40EG-2T |
| 2GB | AP-UM002GR40CG-2T | AP-UM002GT40EG-2T |
| 4GB | AP-UM004GR40CG-2T | AP-UM004GT40EG-2T |
| 8GB | AP-UM008GR40CG-2T | AP-UM008GT40EG-2T |

### 7.2.6 Type E (LP 90D-MS)
Low Profile 90 Degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR31CG-2MST | AP-UM256MT31EG-2MST |
| 512MB | AP-UM512MR31CG-2MST | AP-UM512MT31EG-2MST |
| 1GB | AP-UM001GR31CG-2MST | AP-UM001GT31EG-2MST |
| 2GB | AP-UM002GR31CG-2MST | AP-UM002GT31EG-2MST |
| 4GB | AP-UM004GR31CG-2MST | AP-UM004GT31EG-2MST |
| 8GB | AP-UM008GR31CG-2MST | AP-UM008GT31EG-2MST |


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### 7.2.7 Type A (STD 90D) - NR
Standard 90 degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2NRT | AP-UM256MT13ES-2NRT |
| 512MB | AP-UM512MR13CS-2NRT | AP-UM512MT13ES-2NRT |
| 1GB | AP-UM001GR13CS-2NRT | AP-UM001GT13ES-2NRT |
| 2GB | AP-UM002GR13CS-2NRT | AP-UM002GT13ES-2NRT |
| 4GB | AP-UM004GR13CS-2NRT | AP-UM004GT13ES-2NRT |
| 8GB | AP-UM008GR13CS-2NRT | AP-UM008GT13ES-2NRT |
| 16GB | AP-UM016GR13CS-2NRT | AP-UM016GT13ES-2NRT |
| 32GB | AP-UM032GR13CS-2NRT | AP-UM032GT13ES-2NRT |

### 7.2.8 Type B (STD 90D-MH) - NR
Standard 90 degree Mounting Header

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2MHNRT | AP-UM256MT13ES-2MHNRT |
| 512MB | AP-UM512MR13CS-2MHNRT | AP-UM512MT13ES-2MHNRT |
| 1GB | AP-UM001GR13CS-2MHNRT | AP-UM001GT13ES-2MHNRT |
| 2GB | AP-UM002GR13CS-2MHNRT | AP-UM002GT13ES-2MHNRT |
| 4GB | AP-UM004GR13CS-2MHNRT | AP-UM004GT13ES-2MHNRT |
| 8GB | AP-UM008GR13CS-2MHNRT | AP-UM008GT13ES-2MHNRT |
| 16GB | AP-UM016GR13CS-2MHNRT | AP-UM016GT13ES-2MHNRT |
| 32GB | AP-UM032GR13CS-2MHNRT | AP-UM032GT13ES-2MHNRT |

### 7.2.9 Type C (STD 90D-MS) - NR
Standard 90 degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR13CS-2MSNRT | AP-UM256MT13ES-2MSNRT |
| 512MB | AP-UM512MR13CS-2MSNRT | AP-UM512MT13ES-2MSNRT |
| 1GB | AP-UM001GR13CS-2MSNRT | AP-UM001GT13ES-2MSNRT |
| 2GB | AP-UM002GR13CS-2MSNRT | AP-UM002GT13ES-2MSNRT |
| 4GB | AP-UM004GR13CS-2MSNRT | AP-UM004GT13ES-2MSNRT |
| 8GB | AP-UM008GR13CS-2MSNRT | AP-UM008GT13ES-2MSNRT |
| 16GB | AP-UM016GR13CS-2MSNRT | AP-UM016GT13ES-2MSNRT |
| 32GB | AP-UM032GR13CS-2MSNRT | AP-UM032GT13ES-2MSNRT |


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### 7.2.10 Type D (STD 180D) - NR
Standard 180 degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR23CS-2NRT | AP-UM256MT23ES-2NRT |
| 512MB | AP-UM512MR23CS-2NRT | AP-UM512MT23ES-2NRT |
| 1GB | AP-UM001GR23CS-2NRT | AP-UM001GT23ES-2NRT |
| 2GB | AP-UM002GR23CS-2NRT | AP-UM002GT23ES-2NRT |
| 4GB | AP-UM004GR23CS-2NRT | AP-UM004GT23ES-2NRT |
| 8GB | AP-UM008GR23CS-2NRT | AP-UM008GT23ES-2NRT |
| 16GB | AP-UM016GR23CS-2NRT | AP-UM016GT23ES-2NRT |
| 32GB | AP-UM032GR23CS-2NRT | AP-UM032GT23ES-2NRT |

### 7.2.11 Type D (LP 180D) - NR
Low Profile 180 Degree

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR40CG-2NRT | AP-UM256MT40EG-2NRT |
| 512MB | AP-UM512MR40CG-2NRT | AP-UM512MT40EG-2NRT |
| 1GB | AP-UM001GR40CG-2NRT | AP-UM001GT40EG-2NRT |
| 2GB | AP-UM002GR40CG-2NRT | AP-UM002GT40EG-2NRT |
| 4GB | AP-UM004GR40CG-2NRT | AP-UM004GT40EG-2NRT |
| 8GB | AP-UM008GR40CG-2NRT | AP-UM008GT40EG-2NRT |

### 7.2.12 Type E (LP 90D-MS) - NR
Low Profile 90 Degree Mounting Screw

| Capacity | Standard | Extended Temperature |
|---|---|---|
| 256MB | AP-UM256MR31CG-2MSNRT | AP-UM256MT31EG-2MSNRT |
| 512MB | AP-UM512MR31CG-2MSNRT | AP-UM512MT31EG-2MSNRT |
| 1GB | AP-UM001GR31CG-2MSNRT | AP-UM001GT31EG-2MSNRT |
| 2GB | AP-UM002GR31CG-2MSNRT | AP-UM002GT31EG-2MSNRT |
| 4GB | AP-UM004GR31CG-2MSNRT | AP-UM004GT31EG-2MSNRT |
| 8GB | AP-UM008GR31CG-2MSNRT | AP-UM008GT31EG-2MSNRT |

**Note:** Please consult with our sales representatives for availabilities.


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# Revision History

| Revision | Description | Date |
|---|---|---|
| 1.0 | Official Release | May 16, 2011 |
| 1.1 | Revised Capacity Specifications | May 24, 2011 |
| 1.2 | Revised Product Ordering Information<br>Updated address for our branch in Europe | April 10th, 2012 |
| 1.3 | Added MTBF section | May 10th, 2012 |
| 1.4 | Added Non-removable model types into Product Ordering Information | June 20th, 2012 |
| 1.5 | Added 16GB & 32GB models | June 29th, 2012 |
| 1.6 | Updated Type-E mechanical diagram | July 18th, 2012 |
| 1.7 | Updated contact phone number of Apacer office in America | August 30th, 2012 |
| 1.8 | Added Write Protect switch to Type E mechanical drawing | February 20th, 2013 |
| 1.9 | Added Write Protect for 180D low profile and non-removable type in Product Ordering Information | March 4th, 2013 |
| 2.0 | Revised wear-leveling contents: from dynamic to advanced due to firmware upgrade | April 11th, 2013 |
| 2.1 | Updated performance due to change of NAND flash use | July 26th, 2013 |
| 2.2 | Revised Type D –LP mechanical drawing | June 10th, 2014 |


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