RoHS Recast Compliant

USB-Disk Module Ⅱ *Plus*

Product Specifications

June 10th, 2014

Version 2.2

Apacer Technology Inc.
1F, No.32, Zhongcheng Rd., Tucheng Dist., New Taipei City, Taiwan
Tel: +886-2-2267-8000 Fax: +886-2-2267-2261
www.apacer.com

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.

© 2014 Apacer Technology, Inc.

TABLE OF CONTENTS

1. General Description 3

1.1 Performance-optimized Controller 3
1.1.1 Error Correction Code (ECC) 3
1.1.2 Wear-Leveling 3
1.1.3 Write Protection Mode (Optional) 3

2. Functional Block Diagram 4

3. Pin Assignment 5

3.1 Type A, Type B, and Type C 5
3.2 Type D（STD） 6
3.3 Type D（LP） 7
3.4 Type E (LP) 8

4. Performance & Reliability Specifications 9

4.1 Capacity Specifications 9
4.2 Performance Specifications 9
4.3 Environmental Specifications 9
4.4 MTBF 10

5. Electrical Specification 11

5.1 AC Characteristics 11

6. Physical Dimension 12

6.1 Horizontal Design 12
6.1.1 Type A (STD 90D) 12
6.1.2 Type B (STD 90D-MH) 13
6.1.3 Type C (STD 90D-MS) 14
6.2 Vertical Design 15
6.2.1 Type D (STD 180D) 15
6.3 Low Profile Design 16
6.3.1 Type D (LP 180D) 16
6.3.1 Type E (LP 90D) 17

7. Product Ordering Information 18

7.1 Product Code Designation 18
7.2 Valid Combinations 19

© 2014 Apacer Technology, Inc.

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.

© 2014 Apacer Technology, Inc.

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.

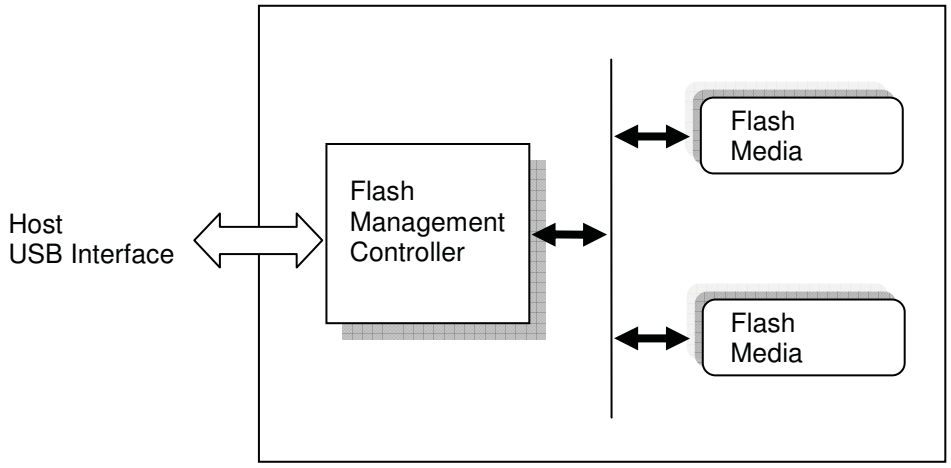


Figure 2-1: Functional block diagram

© 2014 Apacer Technology, Inc.

3. Pin Assignment

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

3.1 Type A, Type B, and Type C

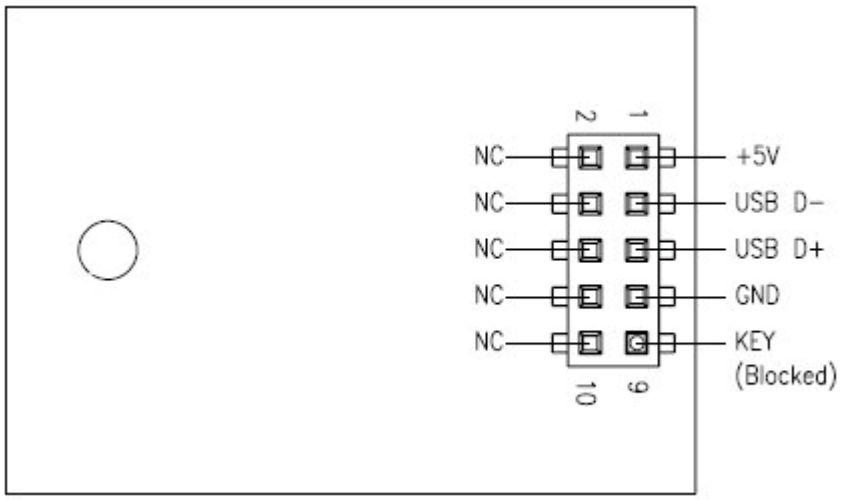


Table 3-1: Pin Assignment of the 10-pin configuration in Type A, Type B, Type C, and Type E

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

© 2014 Apacer Technology, Inc.

3.2 Type D（STD）

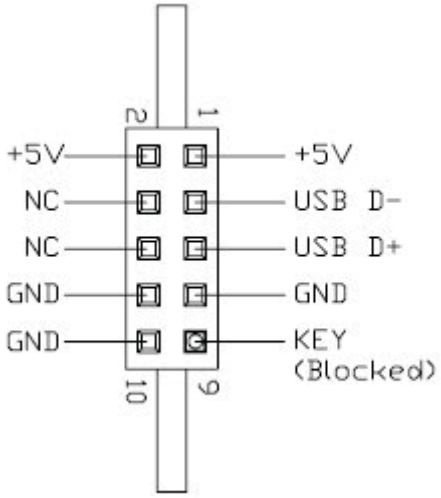


Table 3-2: Pin Assignment of the 10-pin configuration in Type D (STD)

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

© 2014 Apacer Technology, Inc.

3.3 Type D（LP）

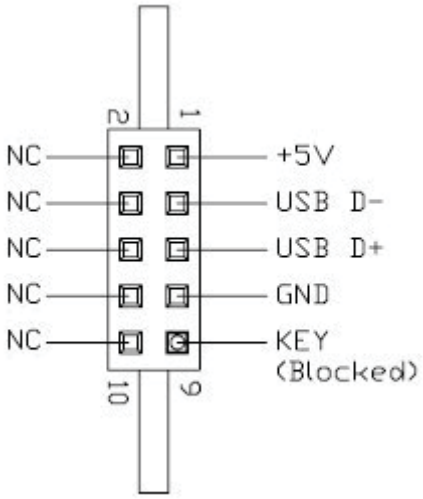


Table 3-3: Pin Assignment of the 10-pin configuration in Type D (LP)

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

© 2014 Apacer Technology, Inc.

3.4 Type E (LP)

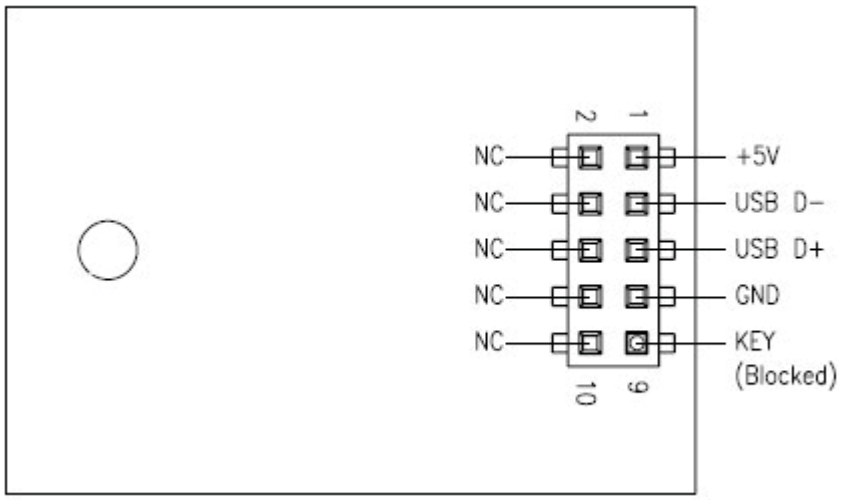


Table 3-4: Pin Assignment of the 10-pin configuration in Type A, Type B, Type C, and Type E

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

© 2014 Apacer Technology, Inc.

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	

© 2014 Apacer Technology, Inc.

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 x 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
λ_{SS}: device failure rate at steady state
Ni: quantity of i type component
λ_{SSi}: failure rate for i type component at steady state
π_E: device environment factor

© 2014 Apacer Technology, Inc.

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

© 2014 Apacer Technology, Inc.

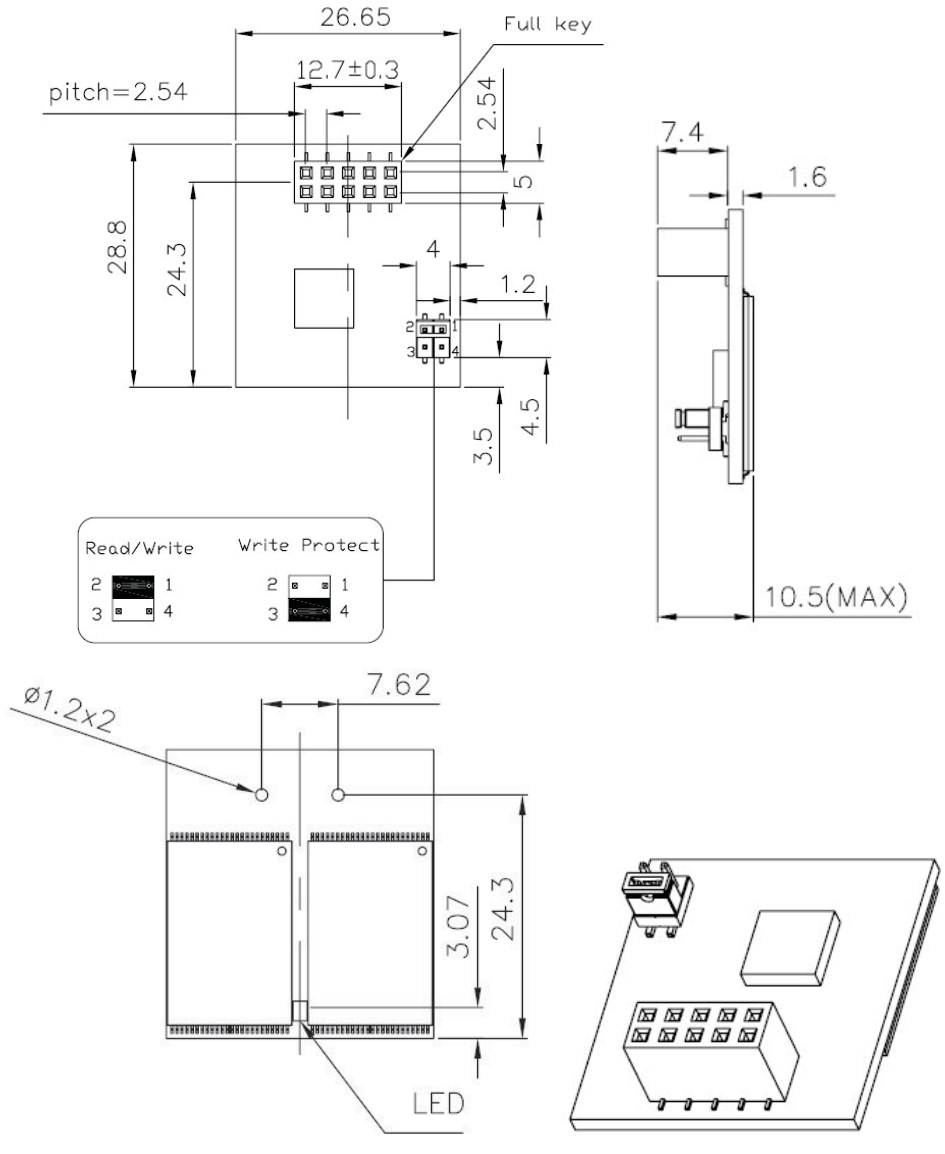
6. Physical Dimension

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



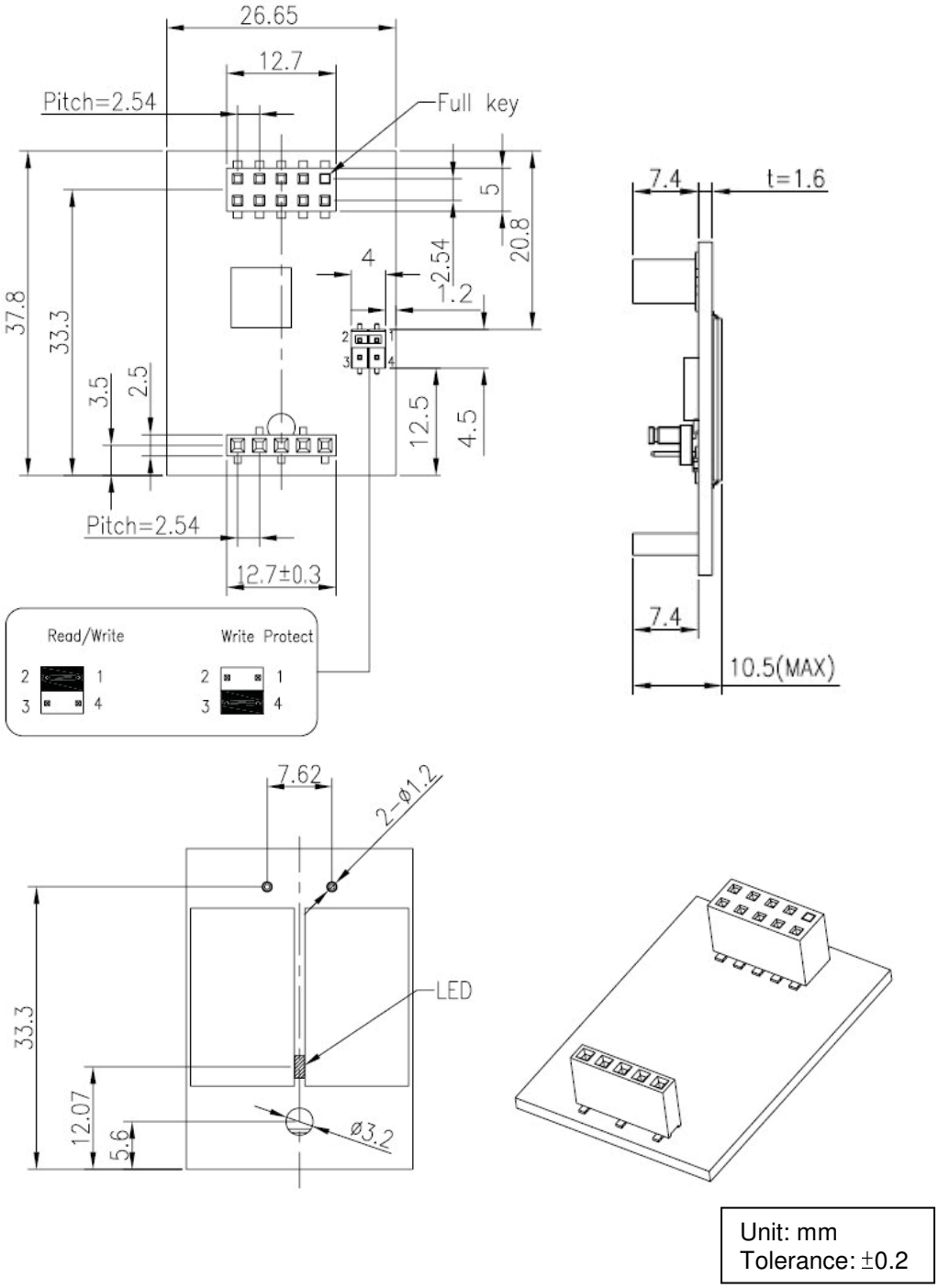
Unit: mm
Tolerance: ±0.2

© 2014 Apacer Technology, Inc.

6.1.2 Type B (STD 90D-MH)

Standard 90 Degree Mounting Header

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



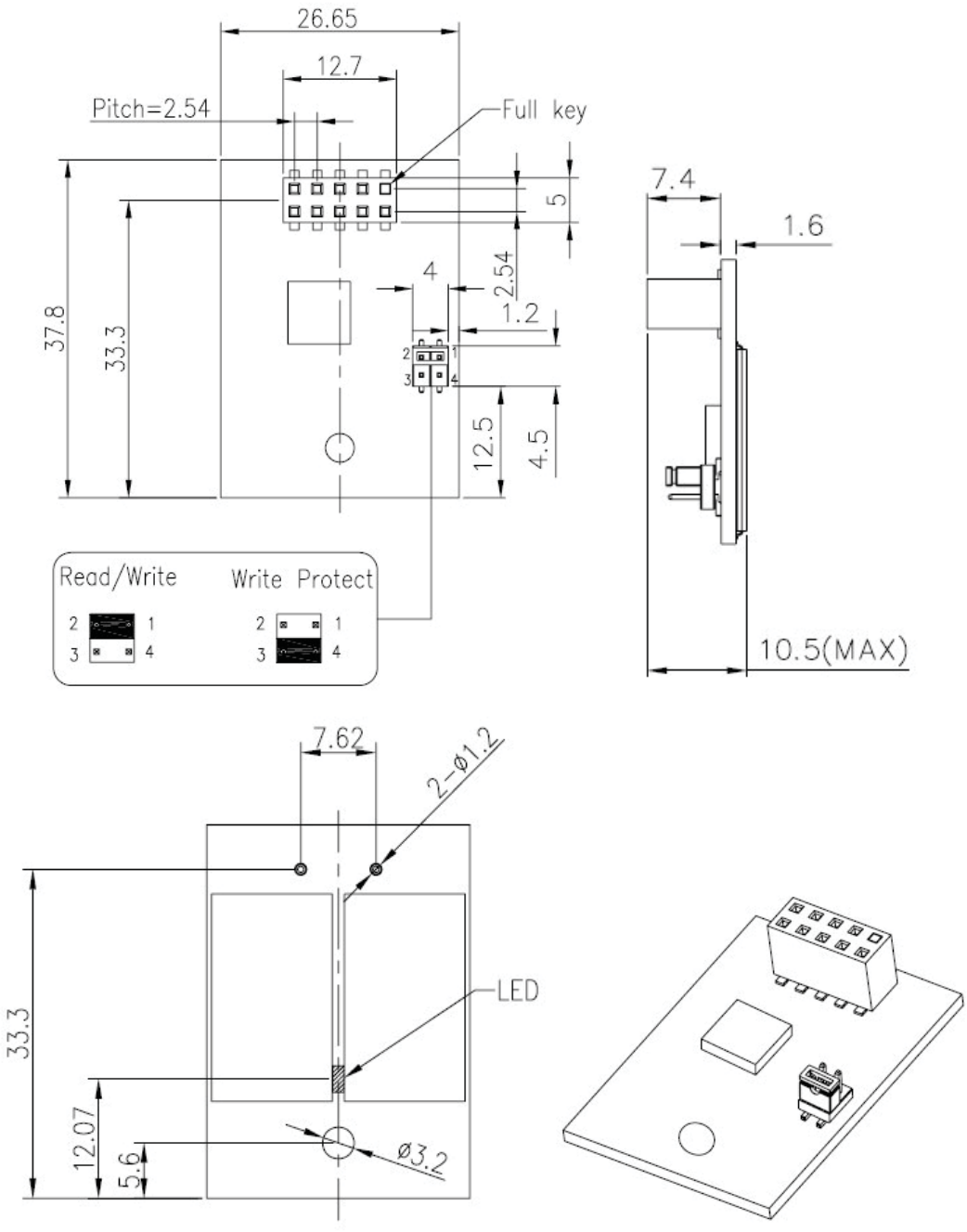
Unit: mm
Tolerance: ±0.2

© 2014 Apacer Technology, Inc.

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

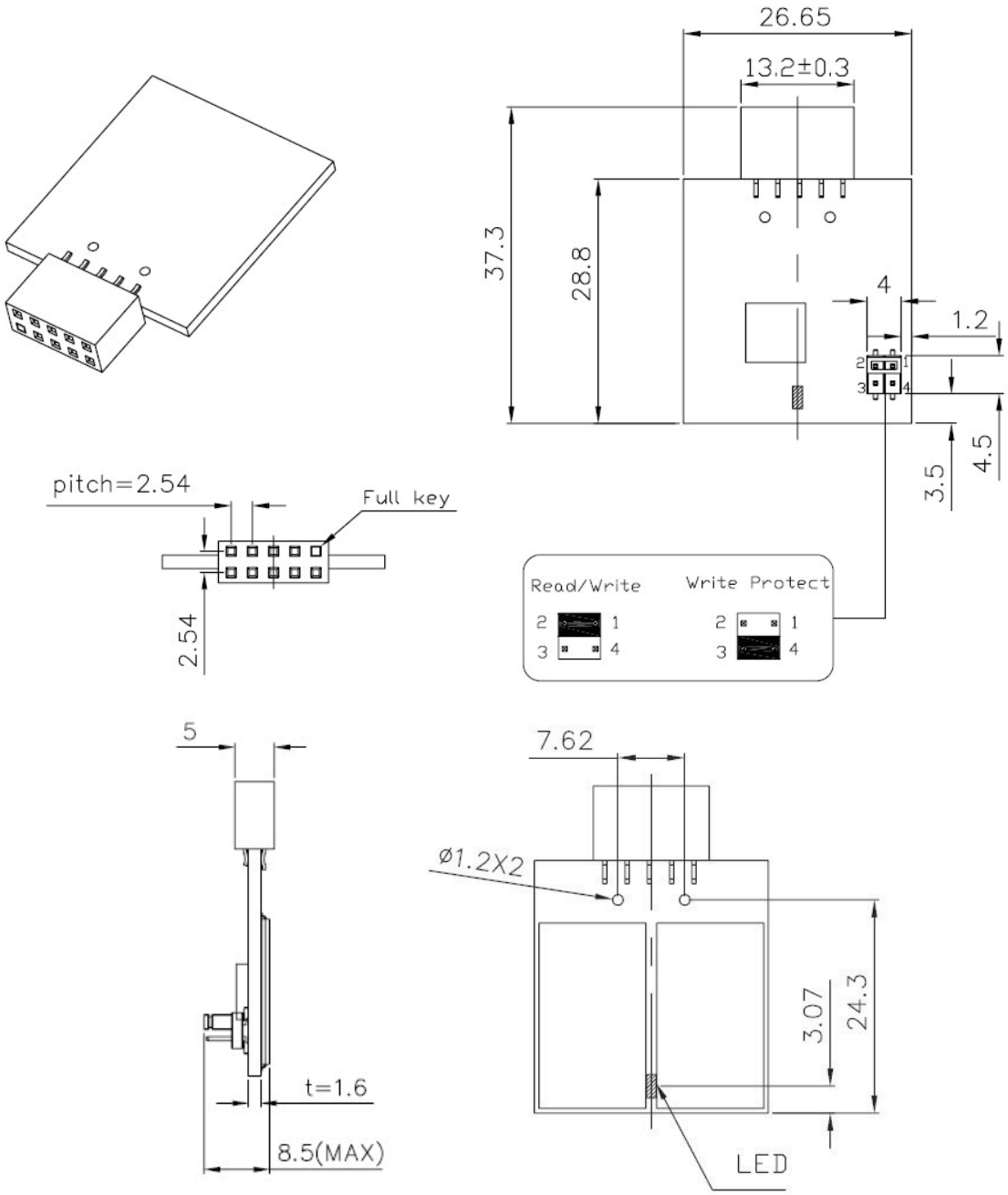
© 2014 Apacer Technology, Inc.

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

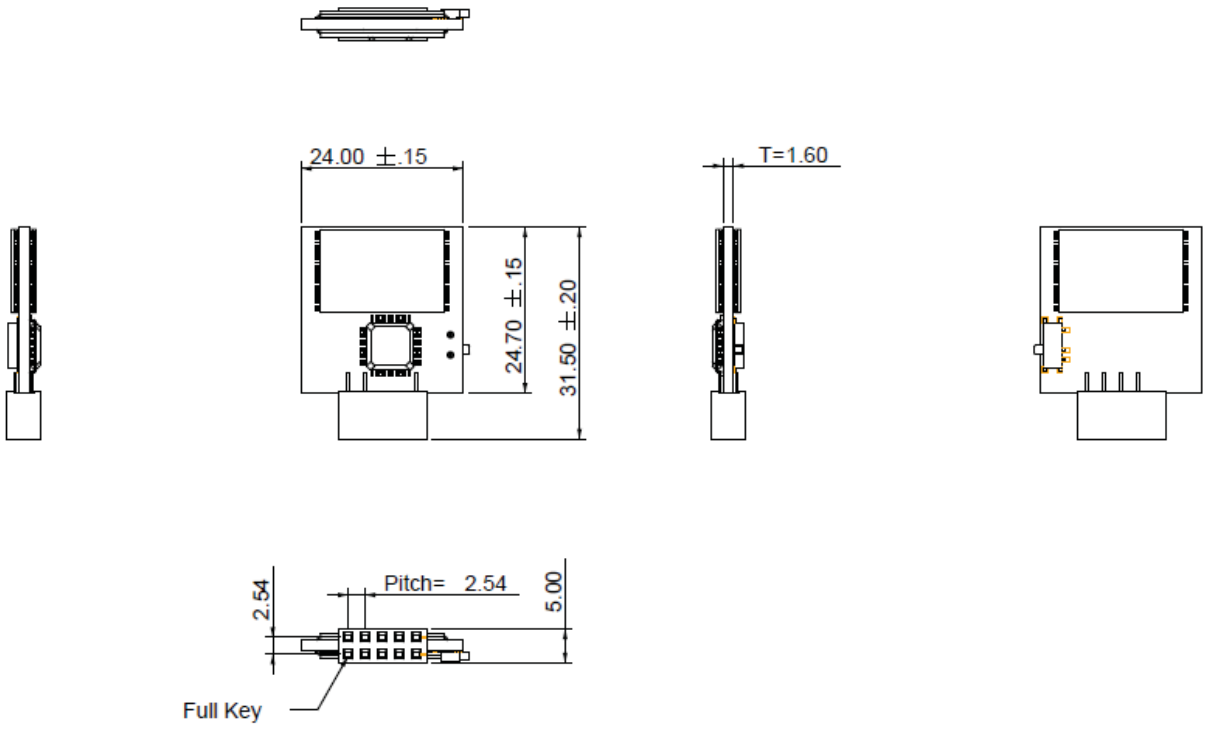
© 2014 Apacer Technology, Inc.

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



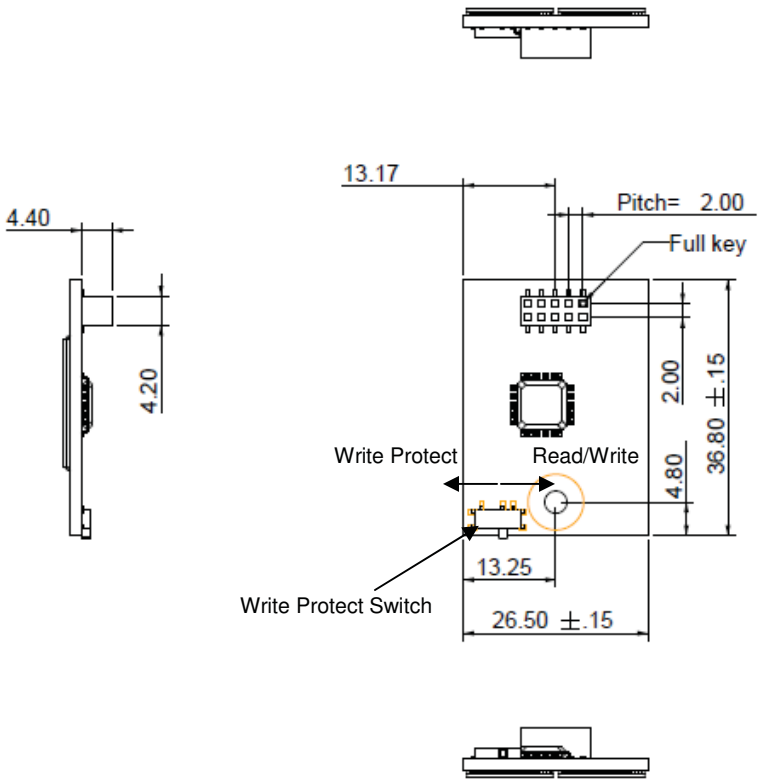
Unit: mm
Tolerance: ±0.2

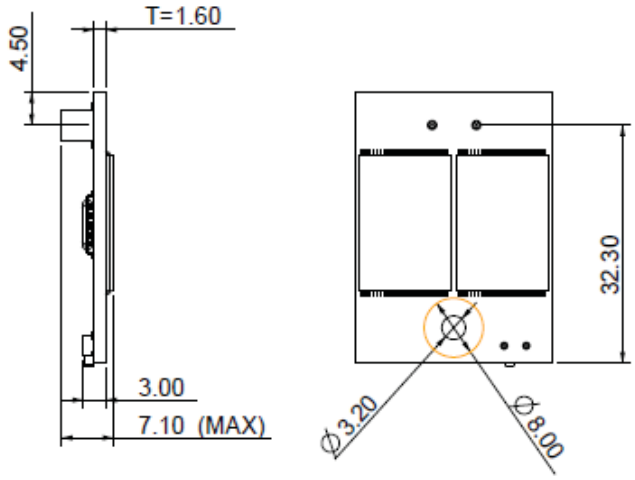
© 2014 Apacer Technology, Inc.

6.3.1 Type E (LP 90D)

Low Profile 90 Degree

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



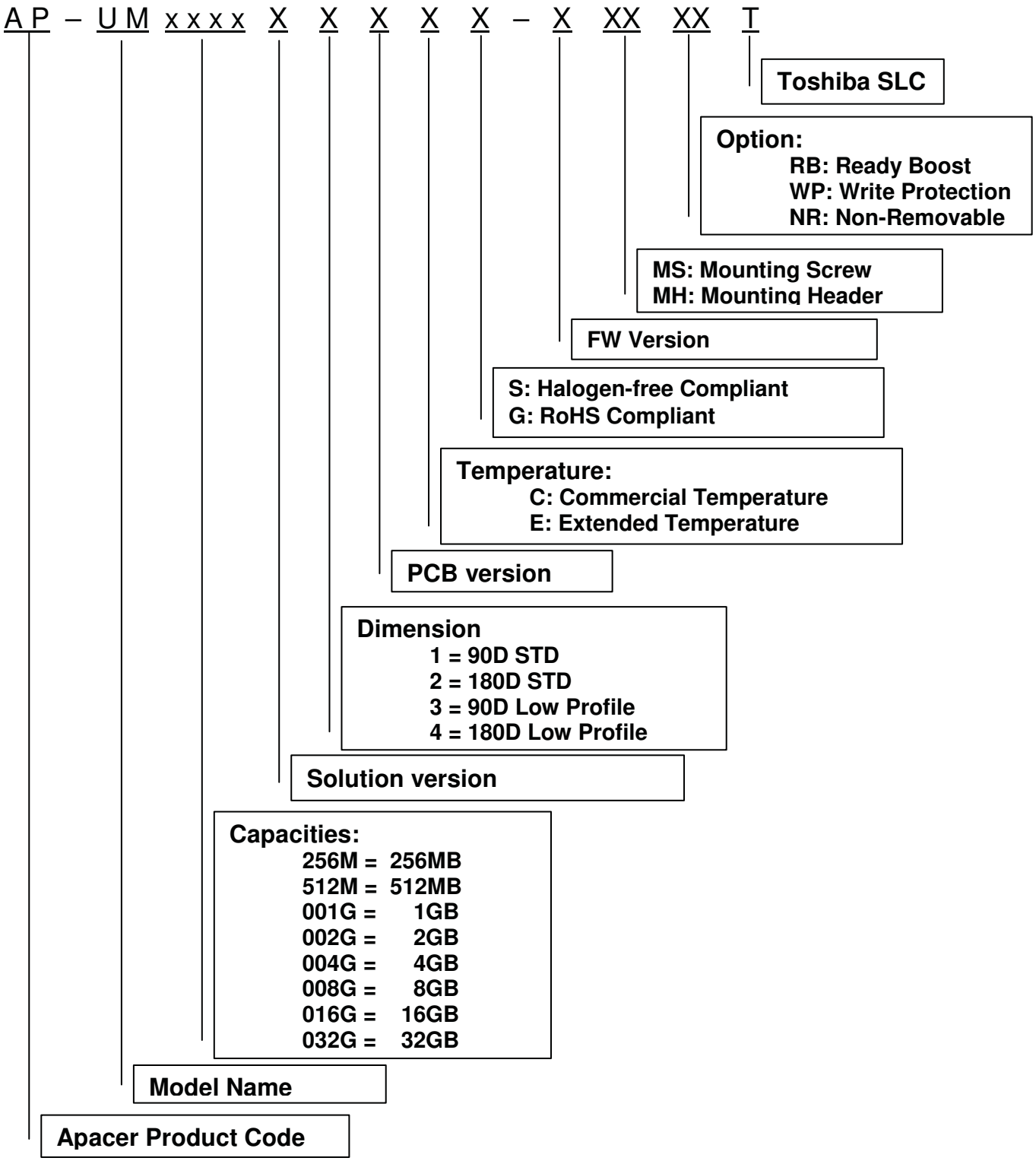


Unit: mm
Tolerance: ±0.2

© 2014 Apacer Technology, Inc.

7. Product Ordering Information

7.1 Product Code Designation



© 2014 Apacer Technology, Inc.

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

© 2014 Apacer Technology, Inc.

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

© 2014 Apacer Technology, Inc.

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

© 2014 Apacer Technology, Inc.

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.

© 2014 Apacer Technology, Inc.

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 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

© 2014 Apacer Technology, Inc.

Global Presence

Taiwan (Headquarters)

Apacer Technology Inc.
Apacer Technology Inc.
1F., No.32, Zhongcheng Rd., Tucheng Dist.,
New Taipei City 236, Taiwan R.O.C.
Tel: 886-2-2267-8000
Fax: 886-2-2267-2261
amtsales@apacer.com

U.S.A.

Apacer Memory America, Inc.
386 Fairview Way, Suite102,
Milpitas, CA 95035
Tel: 1-408-518-8699
Fax: 1-408-935-9611
sa@apacerus.com

Japan

Apacer Technology Corp.
5F, Matsura Bldg., Shiba, Minato-Ku
Tokyo, 105-0014, Japan
Tel: 81-3-5419-2668
Fax: 81-3-5419-0018
jpservices@apacer.com

Europe

Apacer Technology B.V.
Science Park Eindhoven 5051 5692 EB Son,
The Netherlands
Tel: 31-40-267-0000
Fax: 31-40-267-0000#6199
sales@apacer.nl

China

Apacer Electronic (Shanghai) Co., Ltd
1301, No.251,Xiaomuqiao Road, Shanghai,
200032, China
Tel: 86-21-5529-0222
Fax: 86-21-5206-6939
sales@apacer.com.cn

India

Apacer Technologies Pvt. Ltd.
535, 1st Floor, 8th cross, JP Nagar 3rd Phase,
Bangalore – 560078, India
Tel: 91-80-4152-9061
sales_india@apacer.com

© 2014 Apacer Technology, Inc.