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EN - For pricing and availability in your local country please visit one of the below links:

DE - Informationen zu Preisen und Verfügbarkeit in Ihrem Land erhalten Sie über die unten aufgeführten Links:

FR - Pour connaître les tarifs et la disponibilité dans votre pays, cliquez sur l'un des liens suivants:

MTSD256AHC6MS-1WT

EN
This Datasheet is presented by
the manufacturer

DE
Dieses Datenblatt wird vom
Hersteller bereitgestellt

FR
Cette fiche technique est
présentée par le fabricant

i200 microSDHC and microSDXC Card

MTSD032AHC6MS-1WT, MTSD064AHC6MS-1WT, MTSD128AHC6MS-1WT, MTSD256AHC6MS-1WT

Features

- Micron® 3D TLC NAND Flash
- Form factor: 8-pad microSD memory card (11mm × 15mm)
- Density[1]: 32GB, 64GB, 128GB, 256GB
- SD Physical Layer Specification version 5.10 compliant[2]
  - microSD Card Specification version 4.20[3]
  - SD memory card file system specification
  - SD memory card security specification
  - Content protection for recordable media (CPRM)
  - Secure digital music initiative (SDMI)-compliant
  - Password protection of cards
  - Supports secure digital interface (SD) and serial peripheral interface (SPI)
- Mean time to failure (MTTF): 2 million hours (targeting)
- Endurance: Total bytes written (TBW)
  - 32GB: up to 22TB
  - 64GB: up to 45TB
  - 128GB: up to 90TB
  - 256GB: up to 180TB
- Surveillance recording capability
  - 32GB: 24/7 recording @2 Mb/s for 3 years
  - 64GB: 24/7 recording @4 Mb/s for 3 years
  - 128GB: 24/7 recording @8 Mb/s for 3 years
  - 256GB: 24/7 recording @16 Mb/s for 3 years
- Health monitoring: Available[4]
- Performance
  - Refer to Performance and Capacity (page 6) for read and write speed
- Bus speed mode (theoretical transfer rate @x4 bits)
  - Default: 3.3V signaling up to 12.5 MB/s @25 MHz
  - High-speed: 3.3V signaling up to 25 MB/s @50 MHz
  - SDR12: UHS-I 1.8V signaling up to 12.5 MB/s @25 MHz
  - SDR25: UHS-I 1.8V signaling up to 25 MB/s @50 MHz
  - SDR50: UHS-I 1.8V signaling up to 50 MB/s @100 MHz
  - SDR104: UHS-I 1.8V signaling up to 104 MB/s @208 MHz
  - DDR50: UHS-I 1.8V signaling up to 50 MB/s @50 MHz (sampled on both clock edges)
- Integrated power-on reset, oscillator, voltage regulation, and voltage detection circuits
- Built-in features for defect and error management
  - Strong error correction code implemented
  - Global wear leveling
  - Bad block management
  - Refresh mechanism for UECC prevention
  - Sudden power-off (SPO) protection
- Operating voltage: 2.7–3.6V
- Temperature
  - Operating: –25°C to +85°C
  - Storage: –40°C to +85°C
- Standards compliance
  - RoHS
  - FCC
  - CE
  - BSMI
  - KC RRA
  - W.E.E.E.
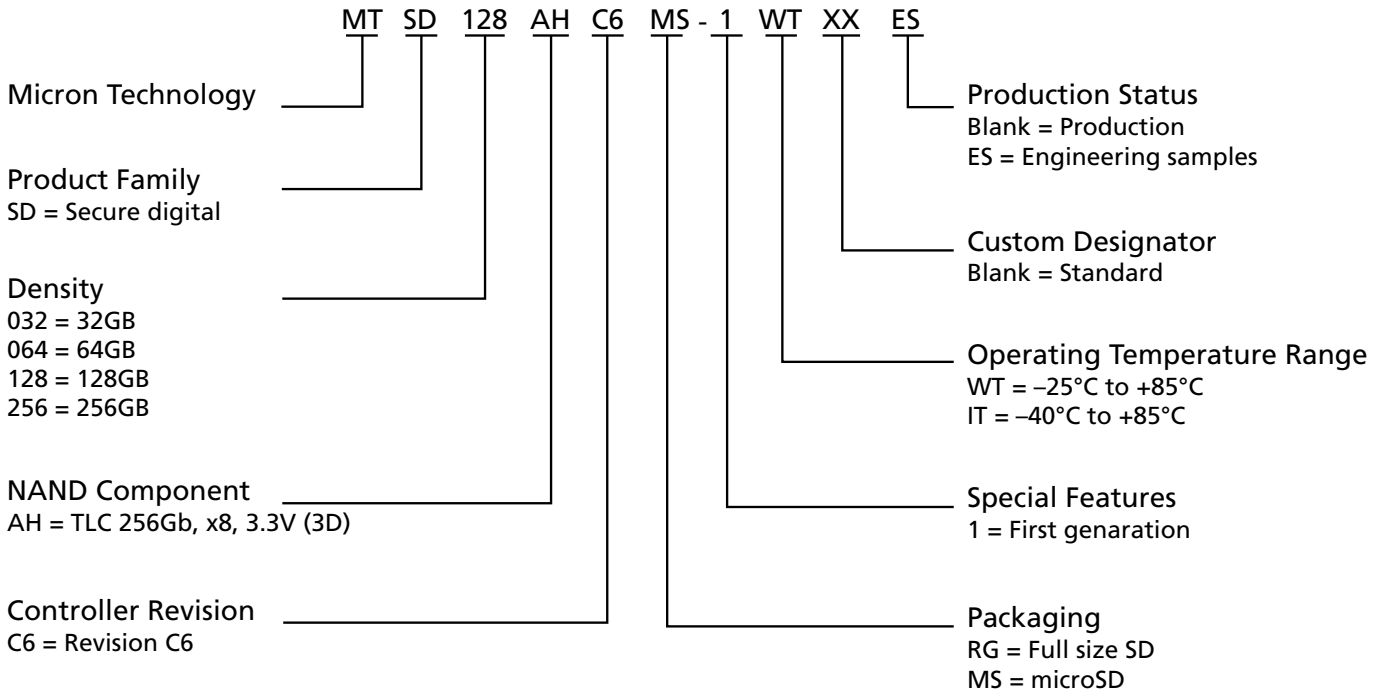 - VCCI
  - IC
- Halogen-free

Notes:
1. Actual usable capacity may vary. 1GB equals 1 billion bytes.
2. SD Specifications, Part 1, Physical Layer Specification, version 5.10.
3. SD Specifications, Part 1, microSD Card Specification, version 4.20.
4. Contact Micron factory for details.

Products and specifications discussed herein are subject to change by Micron without notice.

Part Number Ordering Information

Micron microSD memory cards are available in different configurations and densities. Verify valid part numbers by using Micron's part catalog search at www.micron.com. To compare features and specifications by device type, visit www.micron.com/products. Contact the factory for cards not found.

Figure 1: Marketing Part Number Chart

MT SD 128 AH C6 MS - 1 WT XX ES

Micron Technology

Product Family
SD = Secure digital

Density
032 = 32GB
064 = 64GB
128 = 128GB
256 = 256GB

NAND Component
AH = TLC 256Gb, x8, 3.3V (3D)

Controller Revision
C6 = Revision C6

Production Status
Blank = Production
ES = Engineering samples

Custom Designator
Blank = Standard

Operating Temperature Range
WT = −25°C to +85°C
IT = −40°C to +85°C

Special Features
1 = First genaration

Packaging
RG = Full size SD
MS = microSD

Note: 1. Not all combinations are necessarily available. For a list of available devices or for further information on any aspect of these products, please contact your nearest Micron sales office.

Table 1: Ordering Information

Part Number	Capacity
MTSD032AHC6MS-1WT	32GB
MTSD064AHC6MS-1WT	64GB
MTSD128AHC6MS-1WT	128GB
MTSD256AHC6MS-1WT	256GB

Important Notes and Warnings

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General Description

The microSD card is an advanced Micron® 3D NAND Flash memory technology based removable storage device specifically designed to meet the performance, capacity, and quality required for industrial devices or systems. In addition to mass storage-specific Flash memory, the microSD card includes an on-board intelligent controller which manages interface protocols, security algorithms for content protection, data storage and retrieval, as well as error correction code (ECC) algorithms, defect handling, sudden power-off safeguard and wear leveling.

The microSD card includes one or more NAND Flash memory components and a microSD card controller. The density of a card depends on the number of die within the package and the density of each die.

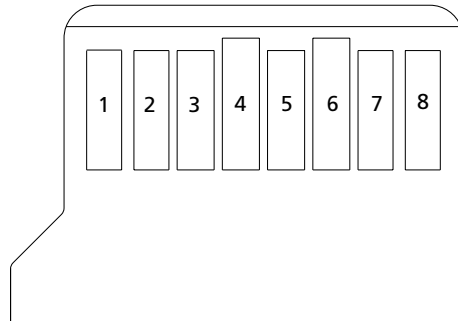**Figure 2: Functional Block Diagram**
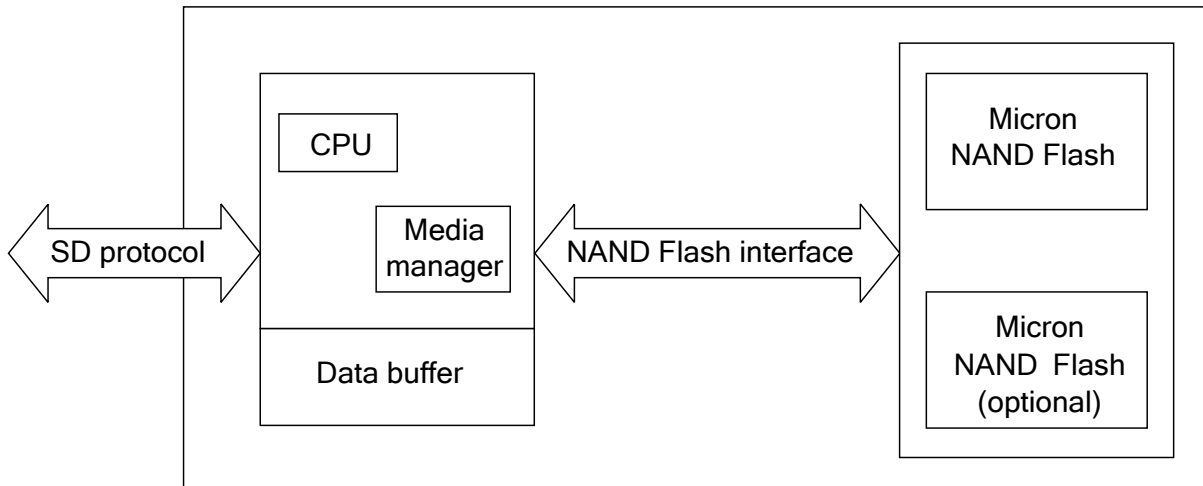
Note: 1. Not drawn to scale.

Pad Assignment and Descriptions

Figure 3: microSD Card Pad Assignment (Bottom View)

Table 2: MicroSD Contact Pad Description

Pad Number	SD Mode			SPI Mode		
	Symbol	Type[1]	Description	Symbol	Type[1]	Description
1	DAT2[2]	I/O/PP	Data line [Bit 2]	RSV	–	Reserved
2	CD/DAT3[2]	I/O/PP[3]	Card detect/data line [Bit 3]	CS	I[3]	Chip select (active low)
3	CMD	PP	Command/response	DI	I	Data in
4	V_{DD}	S	Supply voltage	V_{DD}	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	V_{SS}	S	Supply voltage ground	V_{SS}	S	Supply voltage ground
7	DAT0	I/O/PP	Data line [Bit 0]	DO	O/PP	Data out
8	DAT1[2]	I/O/PP	Data line [Bit 1]	RSV	–	Reserved

Notes: 1. S: Power supply; I: Input; O: Output using push-pull drivers; PP: I/O using push-pull drivers.

2. The extended DAT lines (DAT1-DAT3) are input on power-up. They start to operate as DAT lines after SET_BUS_WIDTH (ACMD6) command. The host should keep its own DAT1-DAT3 lines in input mode, as well, while they are not used.

3. After power-up, pad 2 is configured as an input with an internal 50kΩ pull-up (for card detection and SPI mode selection). The pull-up should be disconnected prior to regular data transfer by issuing the SET_CLR_CARD_DETECT (ACMD42) command.

Performance and Capacity

Performance

Using a striping method across multiple NAND Flash devices the card read and write performance is optimized.

The Industrial microSD cards also use performance features of the underlying NAND Flash to increase speed in streaming applications. By sending larger packets of sequential data, the Industrial microSD card can better utilize NAND Flash features to enhance performance.

Table 3: Measured Performance (25°C, V_{DD} = 3.3V)

Density[1]	Sequential Read[2]	Sequential Write[2]
32GB	90 MB/s	25 MB/s
64GB	90 MB/s	45 MB/s
128GB	90 MB/s	45 MB/s
256GB	90 MB/s	45 MB/s

Notes: 1. 1GB = 1 billion bytes.
         2. Measurements are based on a 100MB file size in UHS-I mode and depend on the host configuration used to run the test.

Capacity

When quoting device capacity, Micron uses the formatted capacity, not the raw number of bytes available.

Table 4: Bytes Available After Factory Formatting (FAT32 for SDHC card and exFAT for SDXC card)

Density[1]	Usable Bytes[2]	Speed Class[3]	Application Performance Class[3, 4]
32GB	29,884,416,000	Class10, U1	Class1 (A1)
64GB	59,760,443,392	Class10, U1	Class1 (A1)
128GB	124,688,269,312	Class10, U1	Class1 (A1)
256GB	249,376,538,624	Class10, U1	Class1 (A1)

Notes: 1. 1GB = 1 billion bytes.
         2. Actual user usable capacity. When cloning disk partitions, the master disk should always be formatted to no more than the minimum guaranteed usable bytes available for that card capacity.
         3. Class is determined by Testmetrix VTE4100 Compliance Test.
         4. Enable users to run their smartphone apps from the installed memory card.

OCR Register

The 32-bit operation conditions register defines the supported operating voltage ranges for the power supply and supported access modes of the microSD card. Additionally, this register includes status information bits.

Table 5: OCR Field Parameters

OCR-Slice	OCR Value	Description
[31]	1b (ready)/0b (busy)	Card power-up status bit (busy)[1]
[30]	1b	Card Capacity Status (CCS)[2]
[29:25]	0 0000b	Reserved
[24]	1b (switching)/0b (maintained)	Switching to 1.8V Accepted (S18A)
[23:15]	1 1111 1111b	V_{DD}: 2.7–3.6V range
[14:0]	000 0000 0000 0000b	Reserved

Notes: 1. This bit is set to LOW if the card has not finished the power-up routine.
2. This bit is valid only when the card power-up status bit is set.

CID Register

The card identification (CID) register is 128 bits wide. It contains the device identification information used during the card identification phase as required by SD protocol. Each card is created with a unique identification number.

Table 6: CID Register Field Parameters

Name	Field	Width	CID-Slice	CID Value
Manufacturer ID	MID	8	[127:120]	09h
OEM/Application ID	OID	16	[119:104]	41 50h
Product name	PNM	40	[103:64]	32GB: MB33A 64GB: MB43A 128GB: MB53A 256GB: MB63A
Product revision	PRV	8	[63:56]	–
Product serial number	PSN	32	[55:24]	–
Reserved	–	4	[23:20]	–
Manufacturing date	MDT	12	[19:8]	–
CRC7 checksum	CRC	7	[7:1]	–
Not used, always 1	–	1	[0]	1

CSD Register

The card-specific data (CSD) register provides information about accessing the card contents. The CSD register defines the data format, error correction type, maximum data access time, as well as whether the DSR register can be used, and so forth. The programmable part of the register (entries marked with W in the following table) can be changed by the PROGRAM_CSD (CMD27) command. The types of the entries in the table below are coded as follows: R = readable, W(1) = writable once, W = multiple writable.

Table 7: CSD Register Field Parameters

Name	Field	Width	Cell Type	CSD-Slice	CSD Value[1]
CSD structure	CSD_STRUCTURE	2	R	[127:126]	01b
Reserved	–	6	R	[125:120]	00 0000b
Data read access time	TAAC	8	R	[119:112]	0Eh
Data read access time in CLK cycles (NSAC × 100)	NSAC	8	R	[111:104]	00h
Maximum data transfer rate	TRAN_SPEED	8	R	[103:96]	-
Card command classes	CCC	12	R	[95:84]	010110110101b
Maximum read data block length	READ_BL_LEN	4	R	[83:80]	9
Partial blocks for read allowed	READ_BL_PARTIAL	1	R	[79:79]	0
Write block misalignment	WRITE_BLK_MISALIGN	1	R	[78:78]	0
Read block misalignment	READ_BLK_MISALIGN	1	R	[77:77]	0
DSR implemented	DSR_IMP	1	R	[76:76]	0
Reserved	–	6	R	[75:70]	00 0000b
Device size	C_SIZE	22	R	[69:48]	32GB - 0x00F0BF 64GB - 0x01BD7F 128GB - 0x03A13F 256GB - 0x07427F
Reserved	–	1	R	[47:47]	0
Erase single block enable	ERASE_BLK_EN	1	R	[46:46]	1
Erase sector size	SECTOR_SIZE	7	R	[45:39]	7Fh
Write protect group size	WP_GRP_SIZE	7	R	[38:32]	000 0000b
Write protect group enable	WP_GRP_ENABLE	1	R	[31:31]	0
Reserved	–	2	R	[30:29]	00b
Write speed factor	R2W_FACTOR	3	R	[28:26]	010b
Maximum write data block length	WRITE_BL_LEN	4	R	[25:22]	9
Partial blocks for write allowed	WRITE_BL_PARTIAL	1	R	[21:21]	0
Reserved	–	5	R	[20:16]	0 0000b
File format group	FILE_FORMAT_GRP	1	R	[15:15]	0
Copy flag	COPY	1	R/W(1)	[14:14]	0
Permanent write protection	PERM_WRITE_PROTECT	1	R/W(1)	[13:13]	0

Table 7: CSD Register Field Parameters (Continued)

Name	Field	Width	Cell Type	CSD-Slice	CSD Value[1]
Temporary write protection	TMP_WRITE_PROTECT	1	R/W	[12:12]	0
File format	FILE_FORMAT	2	R	[11:10]	0
Reserved	–	2	R	[9:8]	00b
CRC	CRC	7	R/W	[7:1]	xxxxxxxb
Not used, always 1	–	1	–	[0:0]	1

Note: 1. All register table values reflect their expected state after card initialization and prior to host issuing CMD6.

SCR Register

In addition to the CSD register, there is another configuration register named SD card configuration register (SCR). SCR provides information on the SD Memory Card's special features that were configured into the given card. The size of SCR register is 64 bits. The types of all bits of SCR are R = readable.

Table 8: CSD Register Field Parameters

Description	Field	Width	Cell Type	CSD-Slice	CSD Value
SCR structure	SCR_STRUCTURE	4	R	[63:60]	0000b
SD memory card – Specification version	SD_SPEC	4	R	[59:56]	0010b
Data status after erases	DATA_STAT_AFTER_ERASE	1	R	[55:55]	0
CPRM security support	SD_SECURITY	3	R	[54:52]	100b
DAT bus widths supported	SD_BUS_WIDTHS	4	R	[51:48]	0101b
Specification version 3.00 or later	SD_SPEC3	1	R	[47:47]	1b
Extended security support	EX_SECURITY	4	R	[46:43]	0000b
Specification version 4.00 or later	SD_SPEC4	1	R	[42:42]	0
Specification version 5.00 or later	SD_SPECX	4	R	[41:38]	0001b
Reserved	–	2	R	[37:36]	0
Command support bits	CMD_SUPPORT	4	R	[35:32]	0011b
Reserved for manufacturer usage	–	32	R	[31:0]	01 00 00 00h

Command Set

The SD specification categorizes commands into classes. Table 9 shows commands supported by the industrial microSD card.

Table 9: Supported Commands

Command Type	Card Command Class (CCC)	Supported Commands
Basic commands	Class 0	CMD0, CMD2, CMD3, CMD7, CMD8, CMD9, CMD10, CMD11, CMD12, CMD13, CMD15
Block-oriented read commands	Class 2	CMD16, CMD17, CMD18, CMD19, CMD20, CMD23
Block-oriented write commands	Class 4	CMD16, CMD20, CMD23, CMD24, CMD25, CMD27
Erase commands	Class 5	CMD32, CMD33, CMD38
Lock card	Class 7	CMD16, CMD42
Application-specific commands[1]	Class 8	CMD55, CMD56, ACMD6, ACMD13, ACMD18[2], ACMD22, ACMD23, ACMD25[2], ACMD26[2], ACMD38[2], ACMD41, ACMD42, ACMD43[2], ACMD44[2], ACMD45[2], ACMD46[2], ACMD47[2], ACMD48[2], ACMD49[2], ACMD51
Switch commands	Class 10	CMD6

Notes:
1. Each application-specific (ACMD) command is a 2-sequence command. First, a CMD55 is sent, followed by a CMDx, where x is the ACMDx value.
2. Refer to SD Specifications, Part 3, Security Specification, version 3.00 for a detailed explanation about the SD Security Features.

Electrical Specifications

Absolute Ratings and Operating Conditions

Stresses greater than those listed in Table 10 may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may adversely affect reliability.

Table 10: Absolute Maximum Ratings

Parameter/Condition	Min	Max	Unit
V_{DD} supply voltage	2.7	3.6	V
Storage temperature	−40	+85	°C

Table 11: Recommended Operating Conditions

Parameter/Condition	Symbol	Min	Typ	Max	Unit
Operating temperature	T_A	−25	–	+85	°C
Supply voltage	V_{DD}	2.7	3.3	3.6	V
Regulator supply voltage for 1.8V signaling	V_{DDIO}	1.7	1.8	1.95	V
Ground supply voltage	V_{SS}	0	0	0	V

DC Characteristics

Table 12: DC Voltage Characteristics for 3.3V signaling

Parameter	Symbol	Min	Max	Unit	Comments
Input low voltage	V_{IL}	V_{ss} - 0.30	$0.25 \times V_{DD}$	V	
Input high voltage	V_{IH}	$0.625 \times V_{DD}$	$V_{DD} + 0.30$	V	
Output low voltage	V_{OL}	–	$0.125 \times V_{DD}$	V	I_{OL} = 2mA @ V_{DD} (MIN)
Output high voltage	V_{OH}	$0.75 \times V_{DD}$	–	V	I_{OH} = −2mA @ V_{DD} (MIN)

Table 13: DC Voltage Characteristics for 1.8V signaling

Parameter	Symbol	Min[1]	Max[1]	Unit	Comments
Input low voltage	V_{IL}	V_{ss} - 0.30	0.58	V	
Input high voltage	V_{IH}	1.27	2.00	V	
Output low voltage	V_{OL}	–	0.45	V	I_{OL} = 2mA
Output high voltage	V_{OH}	1.40	–	V	I_{OH} = −2mA

Note: 1. As signaling level is generated by regulator in host and card, some of the values are defined by fixed value rather than based on V_{DD}.

Table 14: DC Current Characteristics

Parameter	Density	Symbol	Min	Max[1]	Unit
Operating current (read)	32GB	I_{CC1}	–	226	mA
	64GB		–	240	mA
	128GB		–	256	mA
	256GB		–	274	mA
Operating current (write)	32GB	I_{CC2}	–	171	mA
	64GB		–	250	mA
	128GB		–	253	mA
	256GB		–	263	mA

Note: 1. Peak Current: RMS value with Testmetrix VTE4100.

AC Characteristics

Timing specifications including clock timing, input and output timings for all bus modes are defined in SD Specifications. Refer to Section 6.6 and 6.7 of Part 1, Physical Layer Specification, version 5.10 for detail information.

Electrostatic Discharge (ESD)

Contacts pads:

- Human body model of ±4kV according to IEC61000-4-2.

Non contacts pad area:

- Coupling plane discharge of ±8kV.
- Air discharge of ±15kV.
- Human body model according to IEC61000-4-2.

Package Dimensions

Figure 4 provides the physical dimensions of Micron microSD card. For detail dimensions and tolerances, refer to SDA microSD Card Addendum, Section 3.0 Mechanical Specification for microSD Memory Card.

Figure 4: microSD Card – 11mm × 15mm
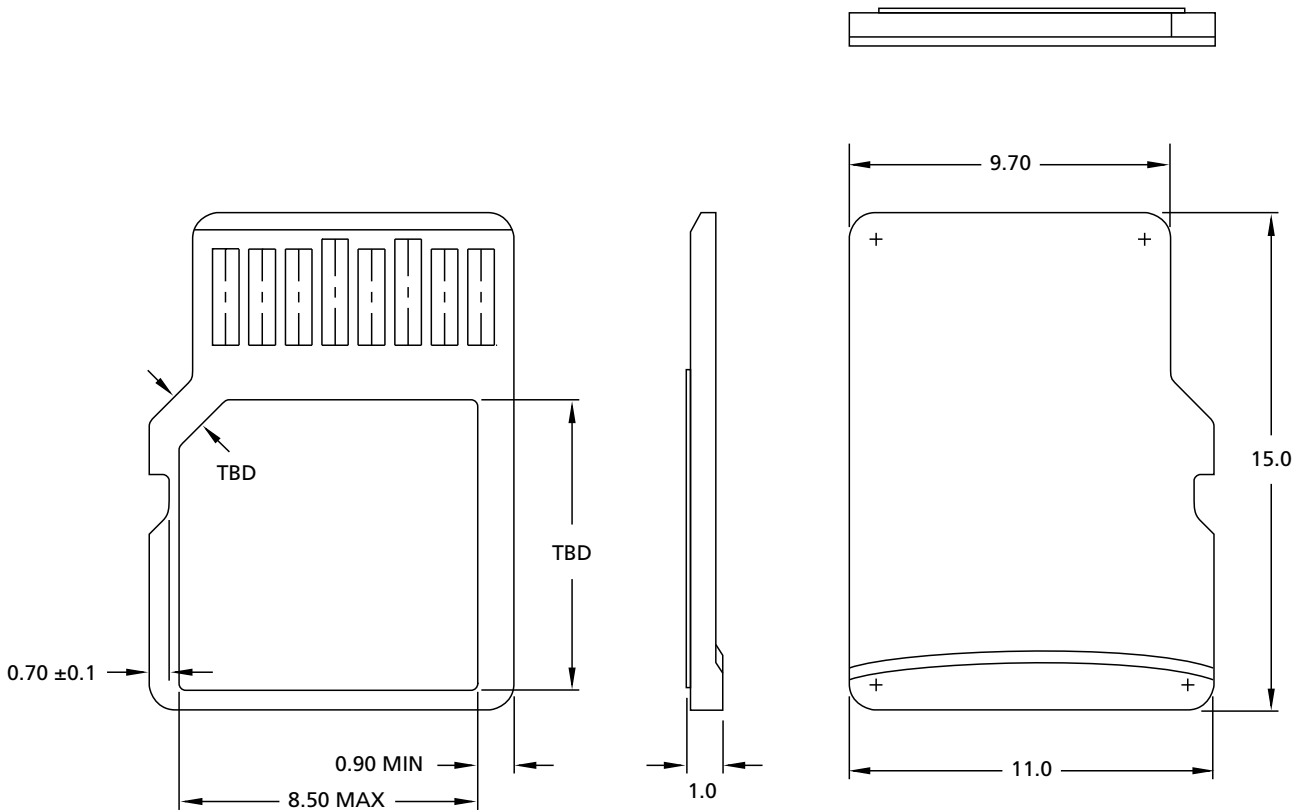
Note: 1. Dimensions are in millimeters.

Table 15: Package Specifications

Parameter	Descriptions
Surface	Plain (except contact area)
Edges	Smooth edges
Weight	0.25gm

Compliance

Micron microSD card comply with the following:

- Micron Green Standard
- CE (Europe): EN 55032 Class B, RoHS
- FCC: CFR Title 47, Part 15 Class B
- BSMI (Taiwan): approval to CNS 13438 Class B and CNS 15663

D33F63
RoHS

- KC RRA (Korea): approval to KN32 Class B, KN 35 Class B

B 급 기기   이 기기는 가정용으로 전자파적합등록을한 기기로서 주거

(가정용 정보통신기기)   지역에서는 물론 모든지역에서 사용할 수 있습니다.

R-REM-MU2-MTSDXXXAHC6MS

- W.E.E.E.: compliance with EU WEEE directive 2012/19/EC. Additional obligations may apply to customers who place these products in the markets where WEEE is enforced.
- VCCI (Japan): 2015-04 Class B

この装置は、クラス B 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。
VCCI－B

- IC (Canada): ICES-003 Class B
  - This Class B digital apparatus complies with Canadian ICES-003.
  - Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.
  - CAN ICES-3 (B)/NMB-3(B).

FCC Rules

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Revision History

Rev. E – 06/19

- Added DC Current Characteristics table.
- Added product name i200.

Rev. D – 05/18

- Updated Compliance section for Canada and Taiwan

Rev. C – 05/18

- Updated legal status to Production
- Added MTSD032AHC6MS-1WT (32GB) and MTSD064AHC6MS-1WT (64GB)
- Added Endurance: Total bytes written (TBW) values
- Updated Product name (PNM) in CID Register Field Parameters table
- Added Compliance section

Rev. B – 02/18

- Updated the endurance for 128GB

Rev. A – 01/18

- Preliminary version