



# SDHC and SDXC UHS-I SD Card

**MTSD032AHC6RG-1WT, MTSD064AHC6RG-1WT, MTSD128AHC6RG-1WT,  
MTSD256AHC6RG-1WT**

## Features

- Micron® 3D TLC NAND Flash
- Form factor: 9-pad Secure Digital (SD) memory card
- Density<sup>1</sup>: 32GB, 64GB, 128GB, 256GB
- SD Physical Layer Specification version 5.10 compliant<sup>2</sup>
  - SD memory card file system specification
  - SD memory card security specification
  - Secure digital music initiative (SDMI)-compliant
  - Supports secure digital interface (SD) and serial peripheral interface (SPI)
  - Copyright protection for recordable media (CPRM)
  - Exterior mechanical write-protect switch
- Endurance: 2K program erase cycles
- Performance
  - Refer to Performance and Capacity (page 5) 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
- Operation voltage: 2.7–3.6V
- Temperature
  - Operating: –25°C to +85°C
  - Storage: –40°C to +85°C
- Form factor
  - Standard SD (24mm x 32mm x 2.1mm)
- Standards compliance
  - RoHS
  - FCC
  - CE
  - BSMI
  - KC RRA
  - W.E.E.E.
  - VCCI
  - IC
- Halogen-free

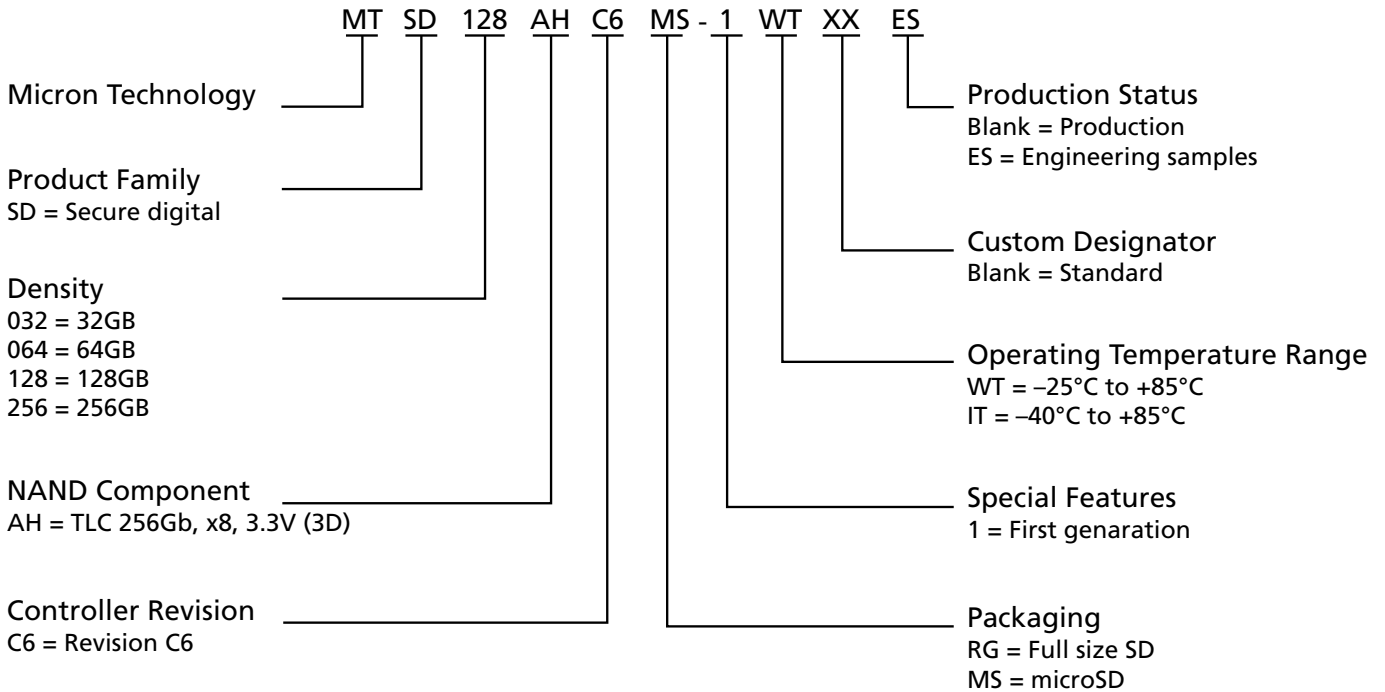
- Notes:
1. Actual usable capacity may vary. 1GB equals 1 billion bytes.
  2. SD Specifications, Part 1, Physical Layer Specification, version 5.10; see <http://www.sdcard.org>.



**Part Number Ordering Information**

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

**Figure 1: Marketing Part Number Chart**



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
MTSD032AHC6RG-1WT	32GB
MTSD064AHC6RG-1WT	64GB
MTSD128AHC6RG-1WT	128GB
MTSD256AHC6RG-1WT	256GB



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**Limited Warranty.** In no event shall Micron be liable for any indirect, incidental, punitive, special or consequential damages (including without limitation lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort, warranty, breach of contract or other legal theory, unless explicitly stated in a written agreement executed by Micron's duly authorized representative.

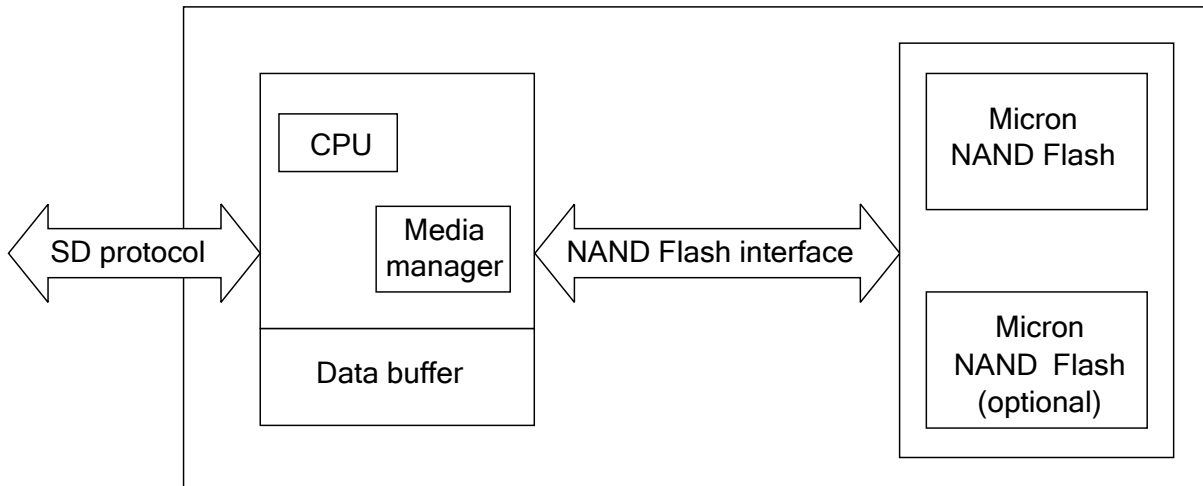


## General Description

The SD 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 mass market devices or systems. In addition to mass storage-specific Flash memory, the SD 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 SD card includes one or more NAND Flash memory components and a SD 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.



## Performance and Capacity

### Performance

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

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

**Table 2: Measured Performance (25°C, V<sub>DD</sub> = 3.3V)**

Density <sup>1</sup>	Sequential Read <sup>2</sup>	Sequential Write <sup>2</sup>
32GB	95 MB/s	25 MB/s
64GB	95 MB/s	45 MB/s
128GB	95 MB/s	45 MB/s
256GB	95 MB/s	45 MB/s

- Notes:
- 1GB = 1 billion bytes.
  - Measurements are based on a 100MB file size in UHS-I mode (SDR104 @208 MHz) 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 3: Bytes Available After Factory Formatting (FAT32 for SDHC card and exFAT for SDXC card)**

Density <sup>1</sup>	Usable Bytes <sup>2</sup>	Speed Class <sup>3</sup>	Application Performance Class
32GB	31,243,370,496	Class10, U1	A1
64GB	59,760,443,392	Class10, U1	A1
128GB	124,668,269,312	Class10, U1	A1
256GB	249,376,538,624	Class10, U1	A1

- Notes:
- 1GB = 1 billion bytes.
  - 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.
  - Class is determined by Testmetrix VTE4100 Compliance Test.



## Register

The SD card supports six standard registers: OCR, CID, CSD, RCA, DSR, and SCR. The following sections provide the register values which will be observed in Micron-defined content when read by a host. Many bits have variable content (device status bits or operating mode bits for example; or bits that are undefined in the standard).

### Card Identification Register

The card identification (CID) register is a 128-bit register that contains identifying strings and manufacturing data.

### Card-Specific Data Register

The card-specific data (CSD) register is 128 bits wide. It reports information to the host about the card, including timing, block size, and current requirements.

### Operating Conditions Register

The operating conditions register (OCR) is a 32-bit register that reports to the host the supported operating voltages for the SD UHS-I card.

### SD Card Configuration Register

The SD card configuration register (SCR) is a 64-bit register that reports to the host the configuration of the card including supported operating modes such as security features and bus width options.

### Relative Card Address Register

The relative card address (RCA) register is a 16-bit register that contains the card address for the bus. There is no uniquely reported content in this register.

### Driver Stage Register

The driver stage register (DSR) is an optional 16-bit register that is not supported in SD UHS-I cards.



## Command Set

The SD specification categorizes commands into classes. Table 4 shows commands supported by the SD UHS-I card.

**Table 4: 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 <sup>1</sup>	Class 8	CMD55, CMD56, ACMD6, ACMD13, ACMD18 <sup>2</sup> , ACMD22, ACMD23, ACMD25 <sup>2</sup> , ACMD26 <sup>2</sup> , ACMD38 <sup>2</sup> , ACMD41, ACMD42, ACMD43 <sup>2</sup> , ACMD44 <sup>2</sup> , ACMD44 <sup>2</sup> , ACMD45 <sup>2</sup> , ACMD46 <sup>2</sup> , ACMD47 <sup>2</sup> , ACMD48 <sup>2</sup> , ACMD49 <sup>2</sup> , 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 5 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 5: Absolute Maximum Ratings**

Parameter/Condition	Min	Max	Unit
V <sub>DD</sub> supply voltage	2.7	3.6	V
Storage temperature	-40	+85	°C

**Table 6: Recommended Operating Conditions**

Parameter/Condition	Symbol	Min	Typ	Max	Unit
Operating temperature	T <sub>A</sub>	-25	-	+85	°C
Supply voltage	V <sub>DD</sub>	2.7	3.3	3.6	V
Regulator supply voltage for 1.8V signaling	V <sub>DDIO</sub>	1.7	1.8	1.95	V
Ground supply voltage	V <sub>SS</sub>	0	0	0	V

## DC Characteristics

**Table 7: DC Voltage Characteristics for 3.3V signaling**

Parameter	Symbol	Min	Max	Unit	Comments
Input low voltage	V <sub>IL</sub>	V <sub>SS</sub> - 0.30	0.25 × V <sub>DD</sub>	V	
Input high voltage	V <sub>IH</sub>	0.625 × V <sub>DD</sub>	V <sub>DD</sub> + 0.30	V	
Output low voltage	V <sub>OL</sub>	-	0.125 × V <sub>DD</sub>	V	I <sub>OL</sub> = 2mA @ V <sub>DD</sub> (MIN)
Output high voltage	V <sub>OH</sub>	0.75 × V <sub>DD</sub>	-	V	I <sub>OH</sub> = -2mA @ V <sub>DD</sub> (MIN)

**Table 8: DC Voltage Characteristics for 1.8V signaling**

Parameter	Symbol	Min <sup>1</sup>	Max <sup>1</sup>	Unit	Comments
Input low voltage	V <sub>IL</sub>	V <sub>SS</sub> - 0.30	0.58	V	
Input high voltage	V <sub>IH</sub>	1.27	2.00	V	
Output low voltage	V <sub>OL</sub>	-	0.45	V	I <sub>OL</sub> = 2mA
Output high voltage	V <sub>OH</sub>	1.40	-	V	I <sub>OH</sub> = -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<sub>DD</sub>.



## **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  $\pm 4\text{kV}$  according to IEC61000-4-2.

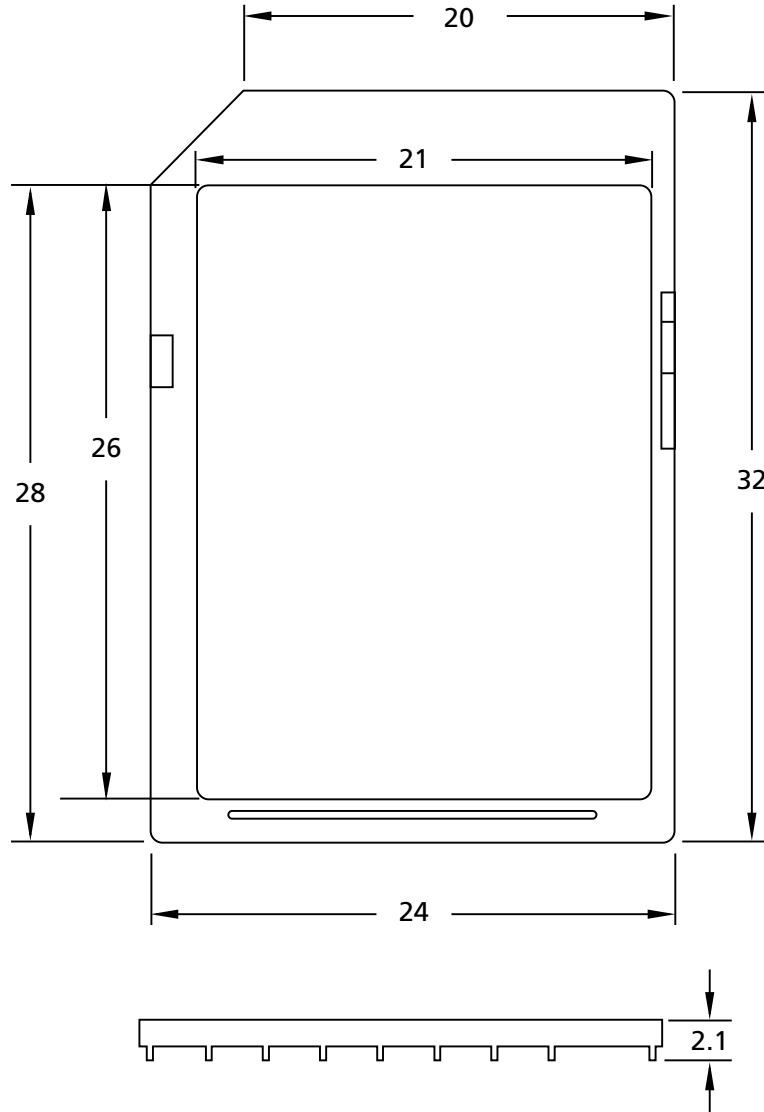
Non contacts pad area:

- Coupling plane discharge of  $\pm 8\text{kV}$ .
- Air discharge of  $\pm 15\text{kV}$ .
- Human body model according to IEC61000-4-2.



## Package Dimensions

Figure 3: SD Card - 24mm x 32mm x 2.1mm



Note: 1. Dimensions are in millimeters.



## 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



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

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R-REM-MU2-MTSDXXXAHC6RG

- 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

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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.



## SDHC and SDXC UHS-I SD Card Compliance

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- 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. B – 07/18**

- Updated legal status to Production
- Added 64GB, 128GB, and 256GB support

### **Rev. A – 05/18**

- Preliminary version

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