SD Specifications

Part 1

microSD Card Specification

Version 2.01

March 27, 2008

Addendum to:

SD Specifications
Part 1 Physical Layer Specifications

Technical Committee
SD Card Association

CONFIDENTIAL

Revision History

Date	Version	Changes compared to previous issue
May 18, 2005	1.00	Initial Release
June 7, 2006	1.10	Optional two RF Antenna pins are newly added.
January 30,2007	2.00	Support SDHC microSD card. Two figures are added that indicate Nonconductive Area. Change reference to the Physical Layer Specification.
March 27, 2008	2.01	Mechanical Specification described in Application Notes is merged. Test methods are described in Appendix.

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Conventions Used in This Document

Naming Conventions

- Some terms are capitalized to distinguish their definition from their common English meaning. Words not capitalized have their common English meaning.

Numbers and Number Bases

- Hexadecimal numbers are written with a lower case "h" suffix, e.g., FFFFh and 80h.
- Binary numbers are written with a lower case "b" suffix (e.g., 10b).
- Binary numbers larger than four digits are written with a space dividing each group of four digits, as in 1000 0101 0010b.
- All other numbers are decimal.

Key Words

- May: Indicates flexibility of choice with no implied recommendation or requirement.
- Shall: Indicates a mandatory requirement. Designers shall implement such mandatory requirements to ensure interchangeability and to claim conformance with the specification.
- Should: Indicates a strong recommendation but not a mandatory requirement. Designers should give strong consideration to such recommendations, but there is still a choice in implementation.

Application Notes

Some sections of this document provide guidance to the host implementers as follows:

Application Note: This is an example of an application note.

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1. General Description

1.1. Scope

This chapter describes the mechanical and electromechanical features of the microSD memory card. The microSD is functionally compatible with the SD Memory card but is smaller in dimensions. The microSD can be inserted into a passive SD or miniSD Memory Card Adapter and operate as an SD Memory card. All technical drafts follow DIN ISO standard.

1.2. Primary Reference Document

This addendum refers extensively to any released version of the Part 1 Physical Layer Specification and the related Supplementary Notes except for contents specified in this document.

1.3. Concept

The functions of the microSD package are:

- Protecting the chip
- Easy handling for the end user
- Reliable electrical interconnection
- Bearing textual information and image
- Customer appeal

The functions of the microSD Connector are:

- Attaching and fixing the card
- Electrical interconnecting the card to the system board
- Protection against card inverse insertion

1.4. Naming of microSD Memory Card

The name microSD has been defined by the Marketing Committee. In the microSD Specifications issued by the MSTG, there are three (3) names used: microSD Memory Card, microSD Card, and microSD. These three (3) names all refer to the same thing.

The logo mark design is defined by the SD/SDA Logo Guideline Version 2.00 issued by the SDA Marketing Committee.

2. Pin Assignment

2.1. Pin Assignment of microSD Card

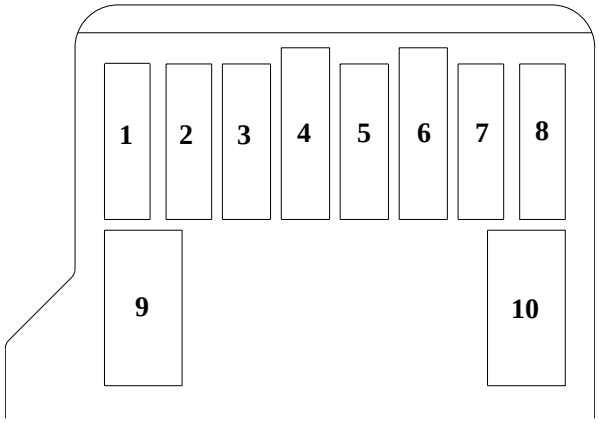


Figure 2-1 : Contact Area

Pin#	SD Mode			SPI Mode		
	Name	**Type[1]**	**Description**	**Name**	**Type[1]**	**Description**
1	DAT2[2,5]	I/O/PP	Data Line [Bit 2]	RSV		
2	CD/DAT3[2]	I/O/PP[3]	Card Detect / Data Line [Bit 3]	CS	I[3]	Chip Select (neg true)
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[2,4]	I/O/PP	Data Line [Bit 1]	RSV[4]		
9	ANT1[6]	Antenna	RF Antenna	ANT1[6]	Antenna	RF Antenna
10	ANT2[6]	Antenna	RF Antenna	ANT2[6]	Antenna	RF Antenna

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 command. The Host shall keep its own DAT1-DAT3 lines in input mode, as well, while they are not used.
3) At power up this line has a 50KOhm pull up enabled in the card. This resistor serves two functions Card detection and Mode Selection. For Mode Selection, the host can drive the line high or let it be pulled high to select SD mode. If the host wants to select SPI mode it should drive the line low. For Card detection, the host detects that the line is pulled high. This pull-up should be disconnected by the user, during regular data transfer, with SET_CLR_CARD_DETECT (ACMD42)
4) DAT1 line may be used as Interrupt Output (from the Card) in SDIO mode during all the times that it is not in use for data transfer operations (refer to "SDIO Card Specification" for further details).
5) DAT2 line may be used as Read Wait signal in SDIO mode (refer to "SDIO Card Specification" for further details).
6) Optional pads: If antenna function is not being used then these pads are not required or should be NC (no connect) internally.

Table 2-1 : microSD Contact Pad Assignment

2.2. ANT1 and ANT2 Pins

The card should never be destroyed when the ANT1 and ANT2 are connected to contactless antenna and exposed to a magnetic field. And also the card should be guaranteed hot insertion (connect ANT1 and ANT2 to the antenna which is already exposed in a magnetic field) and hot removal (disconnected in a magnetic field).

The testing environment, which guarantees the card, is defined by the antenna dimension and the intensity of the magnetic field described in Table 2-2. These values are compliant with the ISO/IEC 10373-6, which defines the electrical characteristics of contactless smart cards.

Parameter	Symbol	Min	Max.	Unit	Condition
Intensity of magnetic field (ANT1, ANT2) [1,2]	$H_{ANT1-ANT2}$	-	10	A/m(rms)	13.56MHz

1) Using standard antenna is defined in ISO/IEC10373-6.
2) The card should be guaranteed not only statically connected to this antenna but also hot insertion and hot removal.

Table 2-2 : Parameter of intensity of magnetic field

3. Mechanical Specification for microSD Memory Card

3.1. Card Package

Every card package shall have the characteristics described in the following sections.

3.1.1. Design and Format

dimensions, microSD package	11 mm x 15 mm; (min. 10.9mm x 14.9mm; max.11.1mm x 15.1 mm) Other dimensions: Refer to Figure 3-1 through Figure 3-4. Testing according to MIL STD 883, Method 2016
thickness	'Inter Connect Area': 0.7mm+/-0.1mm refer to Figure 3-1 (C1) 'Card Thickness': 0.95mm Max refer to Figure 3-1 (C1 + C3) 'Pull Area': 1.0mm +/-0.1mm refer to Figure 3-1 (C)
printable area	'Suggested Outside Keep out Area': refer to Figure 3-4
surface	plain (except contact area)
edges	smooth edges
inverse insertion	protection on right corner (top view)
position of ESC contacts	along middle of shorter edge. Refer to Table 3-3.

Note: ESC stands for External Signal Contacts

Table 3-1 : microSD – Dimensions Summary

3.1.2. Reliability and Durability

temperature	Operation Temperature: -25 to 85 deg.C Storage Temperature : -40 to 85 deg.C Storage Temperature test condition: -40 deg.C (168h)/85 deg.C (500 h)
moisture and corrosion	Operation: 25 deg.C /95% relative humidity Storage: 40 deg.C /93% relative humidity Storage Temperature test condition: 40 deg.C /93% relative humidity/500h salt water spray: 3% NaCl/35C; 24h acc. MIL STD Method 1009
durability	10000 mating cycles.
bending	10N (Note 1: Appendix E.1)
torque	0.10Nm, +/-2.5 deg. max. (Note 1: Appendix E.2)
drop test	1.5m free fall
UV light exposure	UV: 254nm, 15Ws/cm² according to ISO 7816-1
visual inspection shape and form[1]	No mold skin; complete form; no cavities; surface smoothness <= -0.1 mm/cm² within contour; no cracks; no pollution (fat, oil dust, etc.) (Note 1: Appendix E.3 and E.4)

Note 1: The test methods are shown in Appendix E.

Table 3-2 : Reliability and Durability

3.1.3. Electrical Static Discharge (ESD) Requirement

ESD requirements are defined in the Physical Version 2.00 (ESD requirements are updated by the Physical Version 2.00 Supplementary Notes Version 1.00).
The ESD test methods are shown in Appendix D.

3.1.4. External Signal Contacts (ESC)

Number of ESC	8 minimum
Distance from front edge	1.1 mm
ESC grid	1.1 mm
Contact dimensions	0.8mm x 2.9 mm
Electrical resistance	30m-ohm (worst case: 100m-ohm)

Table 3-3 : microSD Package - External Signal Contacts

3.1.5. Discontinuity and Micro-Interrupt

Refer to Section 4.1.1 Vibration and Shock about discontinuity and micro-interrupt when the card is inserted to a connector.

3.2. Mechanical Form Factor

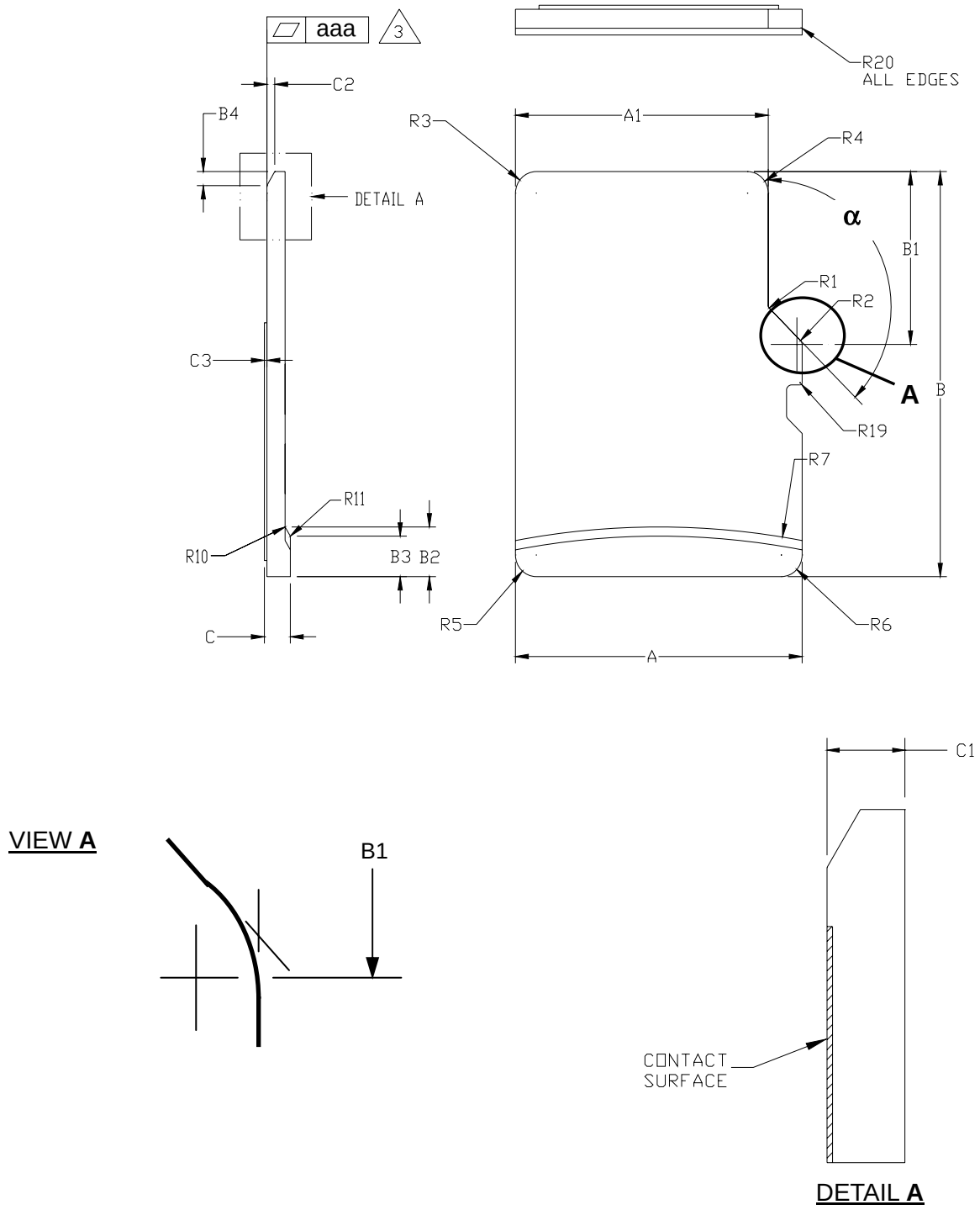
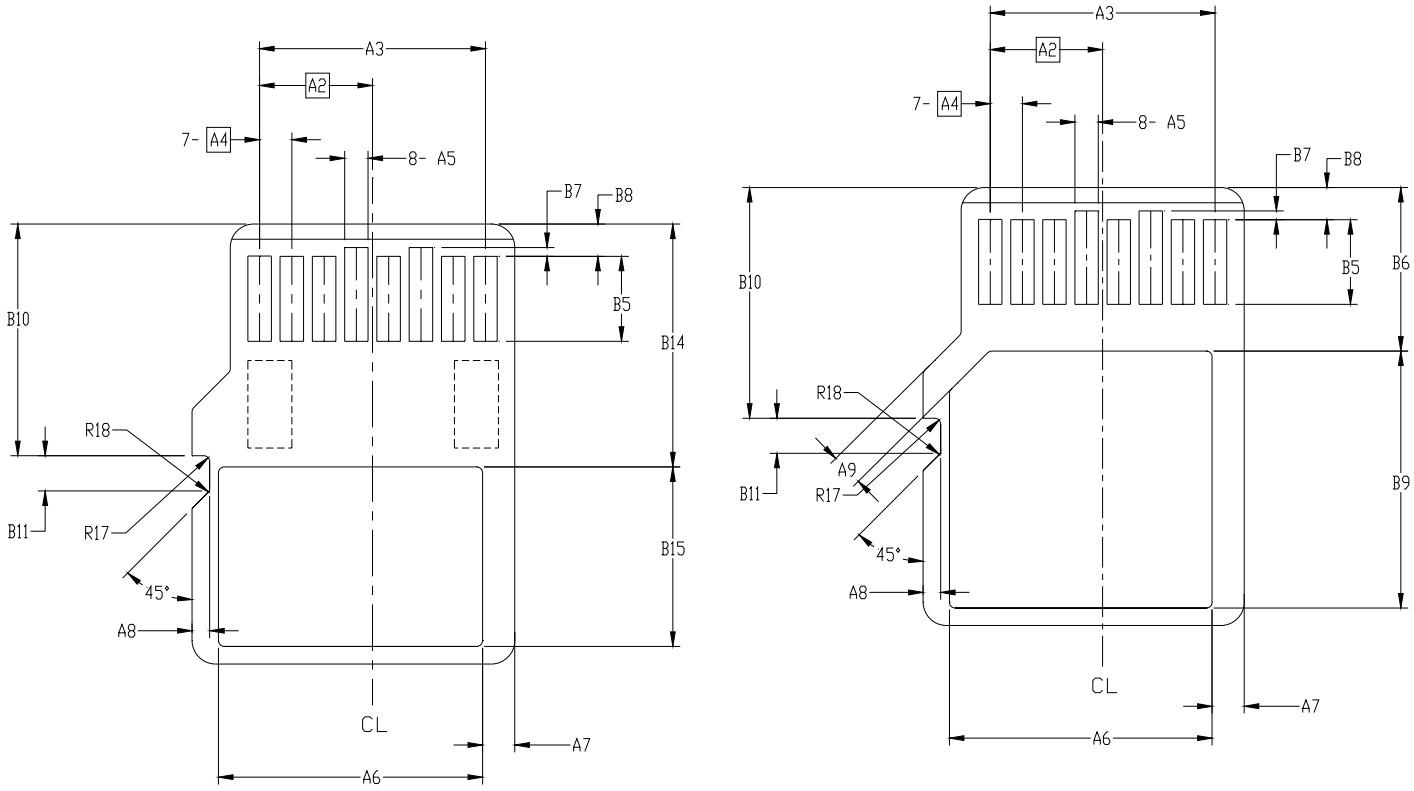


Figure 3-1 : Mechanical Description: Top View



TYPE A: Recommended **TYPE B: Alternate**

Figure 3-2 : Mechanical Description: Bottom View

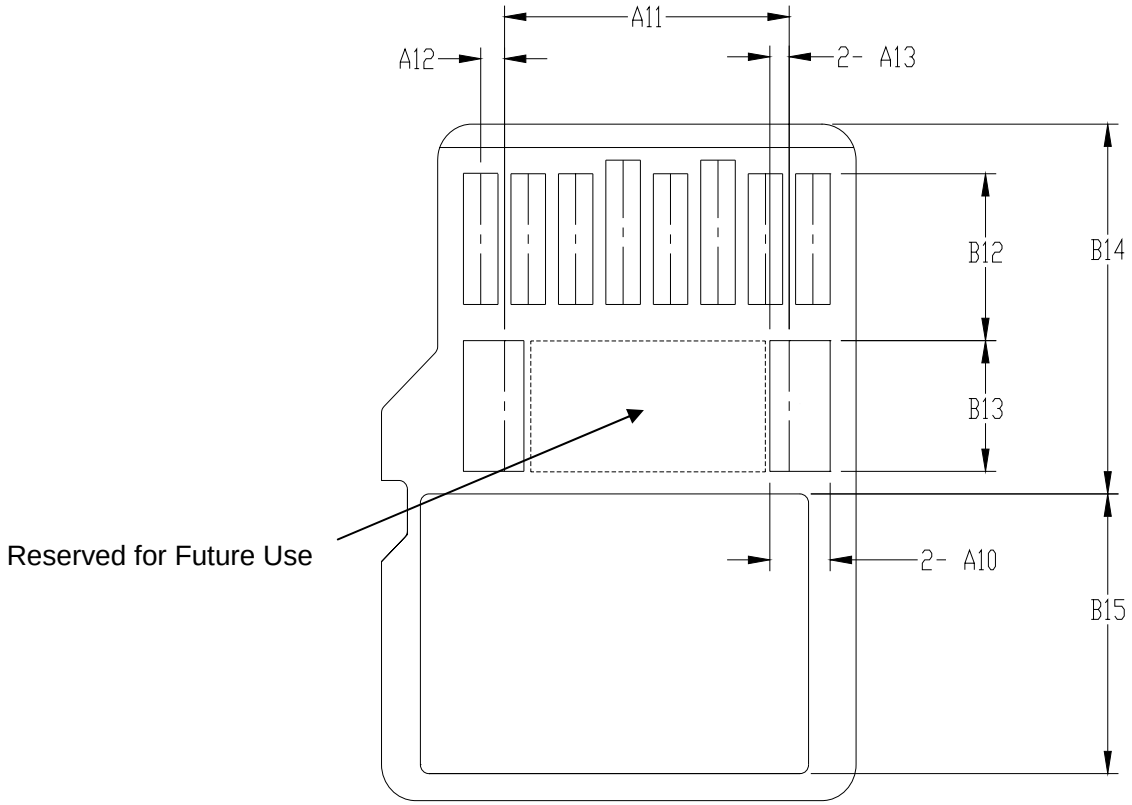


Figure 3-3 : Mechanical Description: Second Contact Row

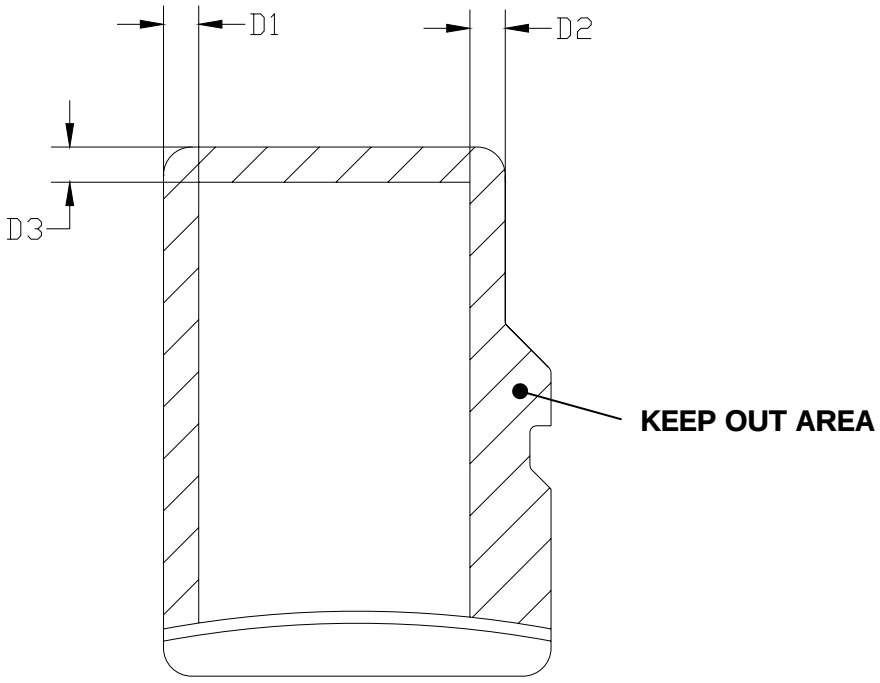


Figure 3-4 : Mechanical Description: Keep Out Area

	COMMON DIMENSIONS			
SYMBOL	MIN	NOM	MAX	NOTE
A	10.90	11.00	11.10	
A1	9.60	9.70	9.80	
A2	-	3.85	-	BASIC
A3	7.60	7.70	7.80	
A4	-	1.10	-	BASIC
A5	0.75	0.80	0.85	
A6	-	-	8.50	
A7	0.90	-	-	
A8	0.60	0.70	0.80	
A9	0.80	-	-	
A10	1.35	1.40	1.45	
A11	6.50	6.60	6.70	
A12	0.50	0.55	0.60	
A13	0.40	0.45	0.50	
B	14.90	15.00	15.10	
B1	6.30	6.40	6.50	
B2	1.64	1.84	2.04	
B3	1.30	1.50	1.70	
B4	0.42	0.52	0.62	
B5	2.80	2.90	3.00	
B6	5.50	-	-	
B7	0.20	0.30	0.40	
B8	1.00	1.10	1.20	
B9	-	-	9.00	
B10	7.80	7.90	8.00	
B11	1.10	1.20	1.30	
B12	3.60	3.70	3.80	
B13	2.80	2.90	3.00	
B14	8.20	-	-	
B15	-	-	6.20	
C	0.90	1.00	1.10	
C1	0.60	0.70	0.80	
C2	0.20	0.30	0.40	
C3	0.00	-	0.15	
D1	1.00	-	-	
D2	1.00	-	-	
D3	1.00	-	-	
R1	0.20	0.40	0.60	
R2	0.20	0.40	0.60	
R3	0.70	0.80	0.90	
R4	0.70	0.80	0.90	
R5	0.60	0.80	0.90	
R6	0.60	0.80	0.90	
R7	29.50	30.00	30.50	
R10	-	0.20	-	
R11	-	0.20	-	
R17	0.10	0.20	0.30	
R18	0.20	0.40	0.60	
R19	0.05	-	0.20	
R20	△4	-	0.15	
α	133°	135°	137°	
aaa			0.10	

Notes:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. △3 COPLANARITY IS ADDITIVE TO C1 MAX THICKNESS.
4. △4 ALL EDGES SHALL NOT BE SHARP AS TESTED PER UL1439 "Test for Sharpness of Edges on Equipment."
5. Refer to Appendix E about test method of warpage.

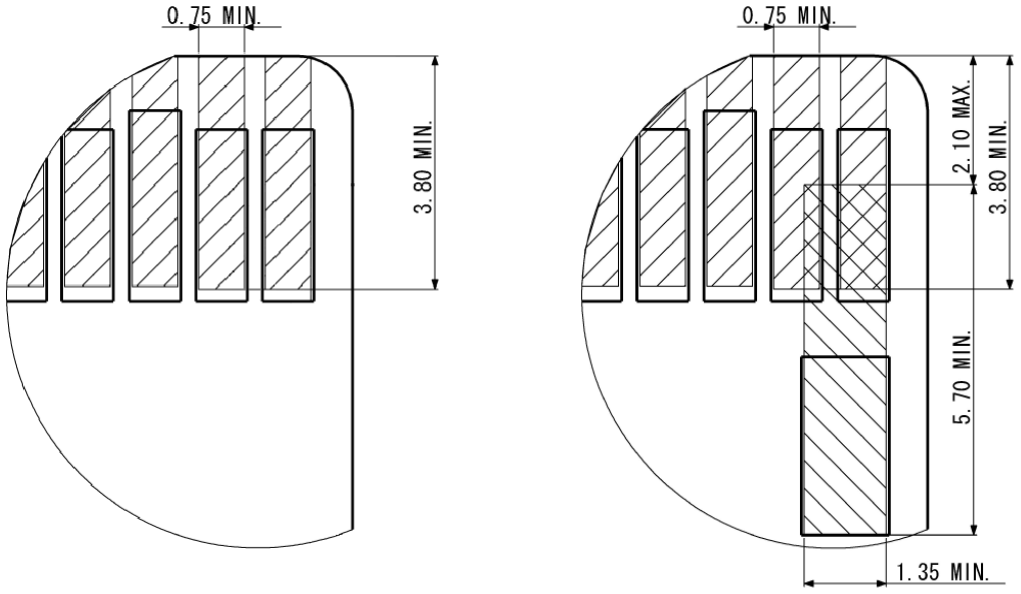
Table 3-4 : microSD Package: Dimensions

3.3. Via Hole Keep Out Zone

The following mechanical requirements are mandatory for the microSD Memory Card.

Note:

1. The via-hole (through hole) should not be positioned within hatched area.
2. All surfaces of the microSD Memory Card, except SD contact pads, shall be of nonconductive material.



Single Row Contacts Dual Row Contacts

Figure 3-5 : Via-Hole (Through Hole) Keep Out Zone

3.4. Surface Roughness

Every card package shall meet the roughness requirement as specified in this section.
Surface roughness as defined per ASTM B46.1-2002.

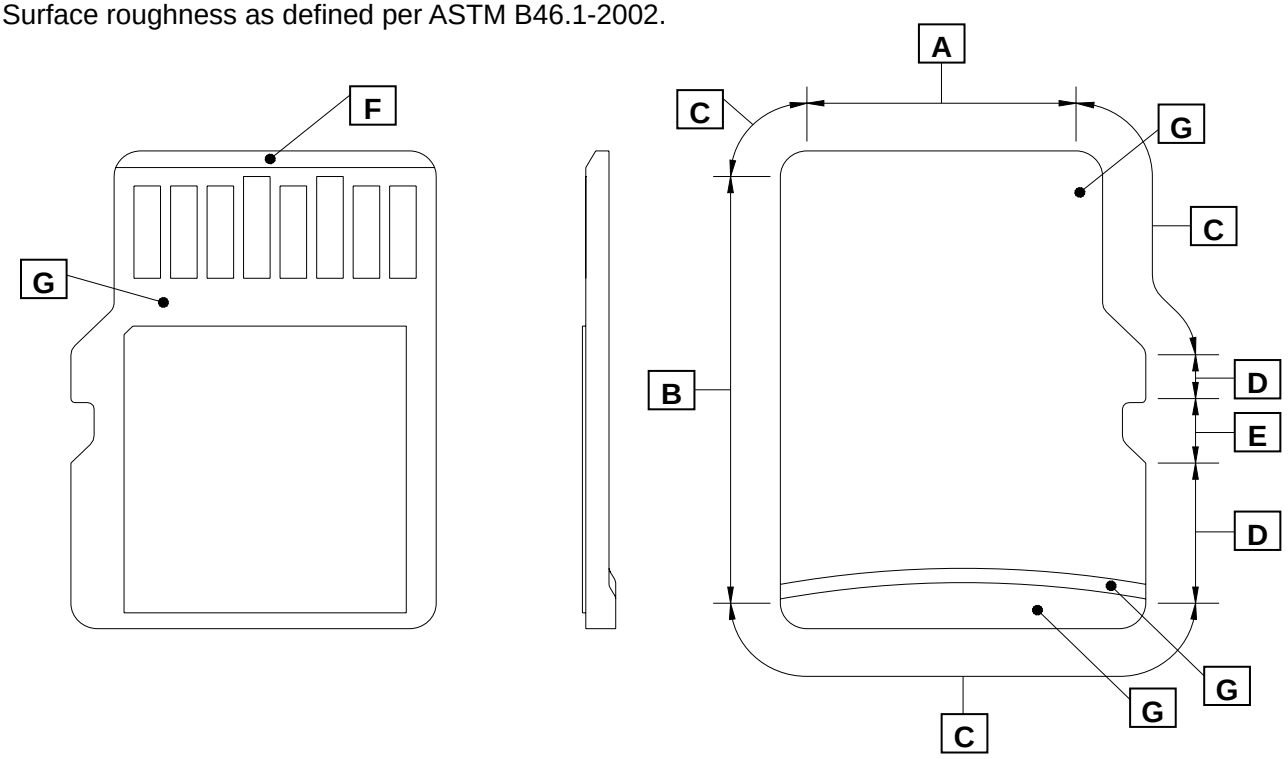


Figure 3-6 : microSD Memory Card Roughness Areas

Surfaces	A B	C D E	F	G
Ra	3.10	9.00	1.40	1.80
Rt	27.00	90.00	18.00	16.00

Units in micrometers

Table 3-5 : Maximum Roughness Values

Parameter	Measurement Type[1]	Cut-off	Cut-off Length (mm)	Evaluation Length (mm)
Ra	line	yes	0.80	4.0
	area	no	-	-
Rt	line	no	-	4.0
	area	no	-	-

1) Measurement may be performed by either line method or area method.

Table 3-6 : Measurement Parameters

3.5. Nonconductive Area

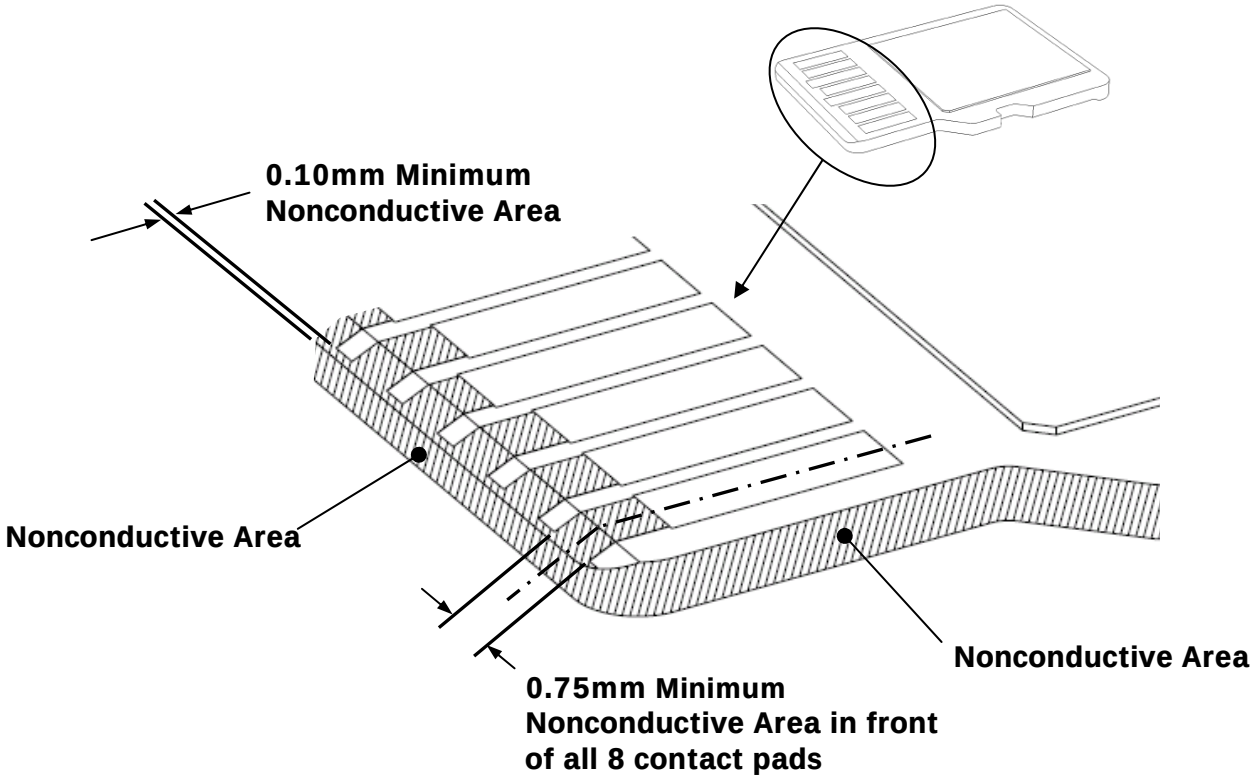


Figure 3-7 : microSD Memory Card Nonconductive Area

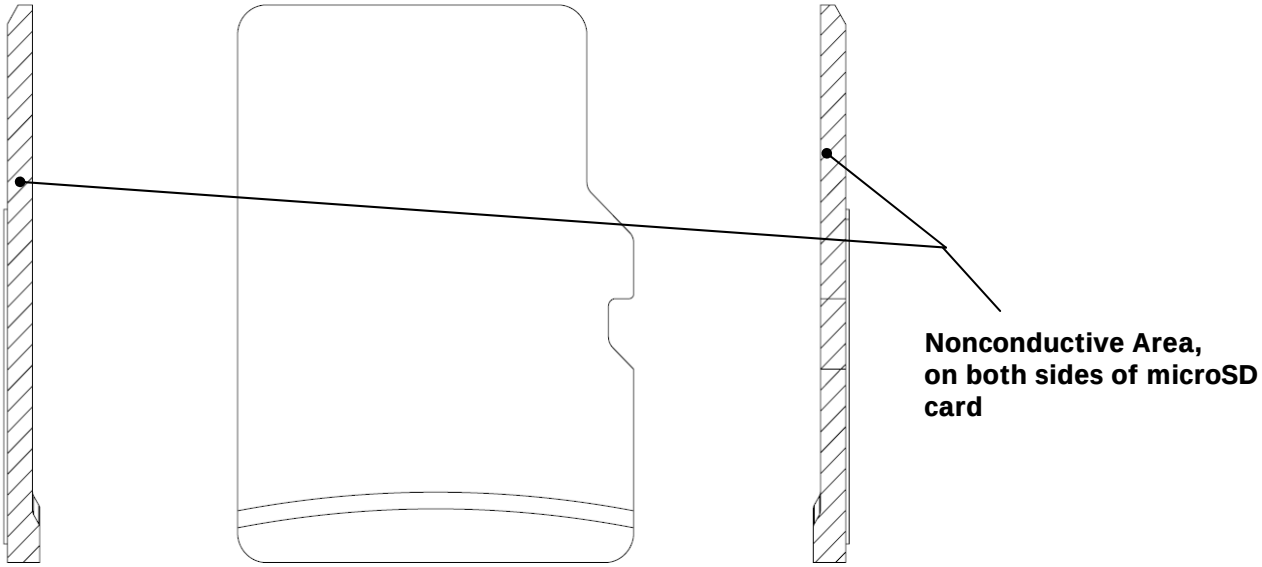


Figure 3-8 : Nonconductive Area on Sides of Card

4. microSD Card Connecter

4.1. microSD Connector Reliability

The microSD Connector shall meet or exceed all reliability test requirements of this section. Unless otherwise specified, all test measurements shall be made at:

Temperature	15deg.C to 35deg.C
Air pressure	86 to 106 kPa
Relative humidity	25% to 85%

If above conditions are too moderate to obtain reproducible results, the following conditions should be used.

Temperature	23deg.C +/- 1deg.C
Air pressure	86 to 106 kPa
Relative humidity	50% +/- 2%

Note : You may use either a real microSD Card or/and a dummy test card if it complies with the microSD Card specification.

Office Environment [cycles]	10,000 minimum
Harsh Environment [cycles]	3,000 minimum

4.1.1. microSD Connector Mechanical Performance

The microSD Connector mechanical performance is specified as follows.

Office Environment

STANDARD	TESTING
Guaranteed number of insertions/extractions =10,000 minimum	Refer to Section 4.1.5 Office Environment

Harsh Environment

STANDARD	TESTING
Guaranteed number of insertions/extractions = 3,000 minimum	Refer to Section 4.1.5 Harsh Environment

Total Insertion Force

STANDARD	TESTING
40 N maximum	Insert at speed of 25 mm/minute Except influence of the force for eject and card lock mechanism

Total Pulling Force

STANDARD	TESTING
0.5N minimum and 40N maximum	Extract at speed of 25 mm/minute Except influence of the force for eject and card lock mechanism

Insertion Force for Card Lock Mechanism

STANDARD	TESTING
8 N maximum (Refer to following Notes 1.2.3.5.6)	Insert at speed of 25 mm/minute

Pulling Force for Card Lock Mechanism

STANDARD	TESTING
8 N maximum (Refer to following Notes 1.2.4.5.6)	Extract at speed of 25 mm/minute

Notes
1. This section is not applicable for the hinge type connector.
2. This section shall be applicable to the connector with card lock mechanism.
3. This section specifies the insertion force that is produced by friction of the card lock mechanism. Therefore, the friction force between card and contact shall be removed from the results.
4. This section specifies the pulling force that is produced by card lock mechanism. Therefore, the friction force between card and contact shall be removed from the results. Also, this section is applicable for card slant condition.
5. Refer to the Appendix E for the recommended test method.
6 The connector or adapter lock mechanism shall be either following a) or b).
   a).Metal material where it is sliding against the card surface.
   b).Other material if mechanism can release.

Vibration

STANDARD	TESTING
a. No mechanical damage shall occur on the parts b. Shall not cause current interruption greater than 100 ns	IEC 60512-6-4 20 m/s^2 peak amplitude, 10 Hz to 2000 Hz, 5 minutes per 1 cycle, 10 cycle per 1 axis total 30 cycles per 3 axis.

Note: Method of measuring discontinuity associated with connector: At DC 5V and 150mA Max.; decent of voltage more than 50% (= less than 2.5V) as discontinuity. Discontinuity specification for the connector: Maximum 100nsec. of discontinuity period.

Shock

STANDARD	TESTING
a. No mechanical damage shall occur on the parts b. Shall not cause current interruption greater than 100 ns	IEC 60512-6-3 Acceleration 490 m/s^2 Standard holding time 11 ms, semi-sine wave, velocity change 3.44m/s.

Note: Method of measuring discontinuity associated with connector: At DC 5V and 150mA Max.; decent of voltage more than 50% (= less than 2.5V) as discontinuity. Discontinuity specification for the connector: Maximum 100nsec. of discontinuity period.

4.1.2. microSD Connector Electrical Performance

The microSD Connector electrical performance is specified as follows.

Contact Resistance-Millivolt Level Method

STANDARD	TESTING
a. Initially 100 milli-ohm maximum b. After test 40 milli-ohm maximum change	IEC 60512-2-1, Open voltage 20 mV Test current 1 mA a. Measure and record the initial resistance (Ri) of the separate connector contact interface. Refer to Figure 4-1 : Contact Resistance Measurement Method. Ri 100 milli-ohm b. Measure and record the resistance after test (Rf) of the microSD connector. Resistance value after test: Rf = Ri +/- 40 milli-ohm

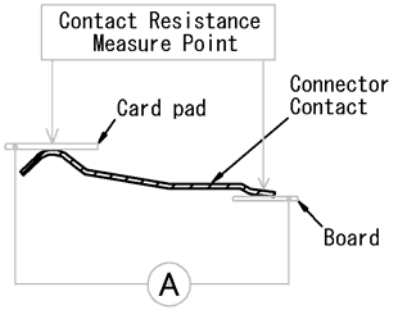


Figure 4-1 : Contact Resistance Measurement Method

Voltage Proof

STANDARD	TESTING
a. No shorting or other damages when 500 Vrms AC is applied for 1 minute b. Current leakage 1 mA maximum	IEC 60512-4-1

Insulation Resistance

STANDARD	TESTING
a. Initially 1000 M-ohm minimum b. After test 100 M-ohm minimum	IEC 60512-3-1. Measure within 1 minute after applying 500V DC.

Temperature Rise

STANDARD	TESTING
0.5 A per contact	IEC 60512-5-1. Based upon 30deg.C rise above ambient temperature.

4.1.3. microSD Connector Environmental Performance

Operating Environment

STANDARD
Operating Temperature: -25deg.C to +85deg.C Relative humidity: 95% maximum (non-condensing)

Storage Environment

STANDARD
Storage Temperature: -40deg.C to +85deg.C Relative humidity: 95% maximum (non-condensing)

4.1.4. microSD Connector Environmental Resistance

Damp Heat, Cyclic

STANDARD	TESTING
Per Contact Resistance (low level) Section, Part b Per Insulation Resistance Section, Part b	IEC 60512-11-12 10 cycles (1 cycle = 24 hours) with connectors engaged

Rapid Change of Temperature

STANDARD	TESTING
No physical damage shall occur during testing Per Contact Resistance (low level) Section, Part b Per Insulation Resistance Section, Part b	IEC 60512-11-4 -55deg.C to +85deg.C 5 minute transition time (max) 5 cycles (1 cycle = 1 hour) with connectors engaged

Dry Heat

STANDARD	TESTING
Per Contact Resistance (low level) Section, Part b	IEC 60512-11-9 85deg.C, 96 hours with connectors engaged. Exclude load and insulation resistance measurements

Cold

STANDARD	TESTING
Per Contact Resistance (low level) Section, Part b	IEC 60512-11-10 -25deg.C, 96 hours with connectors engaged

Damp Heat, Steady State

STANDARD	TESTING
Per Contact Resistance (low level) Section, Part b Per Insulation Resistance Section, Part b	IEC 60512-11-3 Steady State 40deg.C, 90 to 95% RH 96 hours with connectors engaged

Hydrogen Sulfide

STANDARD	TESTING
Per Contact Resistance (low level) Section, Part b	JEIDA 38 3 PPM hydrogen sulfide 40deg.C, approx. 80% RH 96 hours, with connectors engaged

4.1.5. microSD Connector Environmental Durability

The micro SD Connector shall meet below environmental requirements.

Test conditions for the mate/unmate cycles are:

Cycle Rate 400-600 cycles per hour
Temperature 15deg.C to 35deg.C
Relative Humidity 25% to 85%
Air Pressure 86 to 106 kPa

Office Environment

The office environment is defined in EIA-364-B Class 1.1 - year round air conditioning (non-filtered) with humidity control.

Contact resistance - Part a
Mate and unmate the connector for a total of 10,000 cycles Note
Contact resistance - Part b

Note: After each 10 cycles stop the insertion and rest the connector for 5 to 10 minutes.
Air blow card (dry air) for 3secs:
at each 100 cycle interval (10 times) from start to 1000 cycles.
at each 1000 cycle interval (9 times) from 1001 to 10,000 cycles.
Mate and unmate speed is less than 10cycles per 1 minute.

Harsh Environment

The harsh environment is defined in EIA-364-B Class 1.3—no air conditioning, no humidity control with normal heating and ventilation:

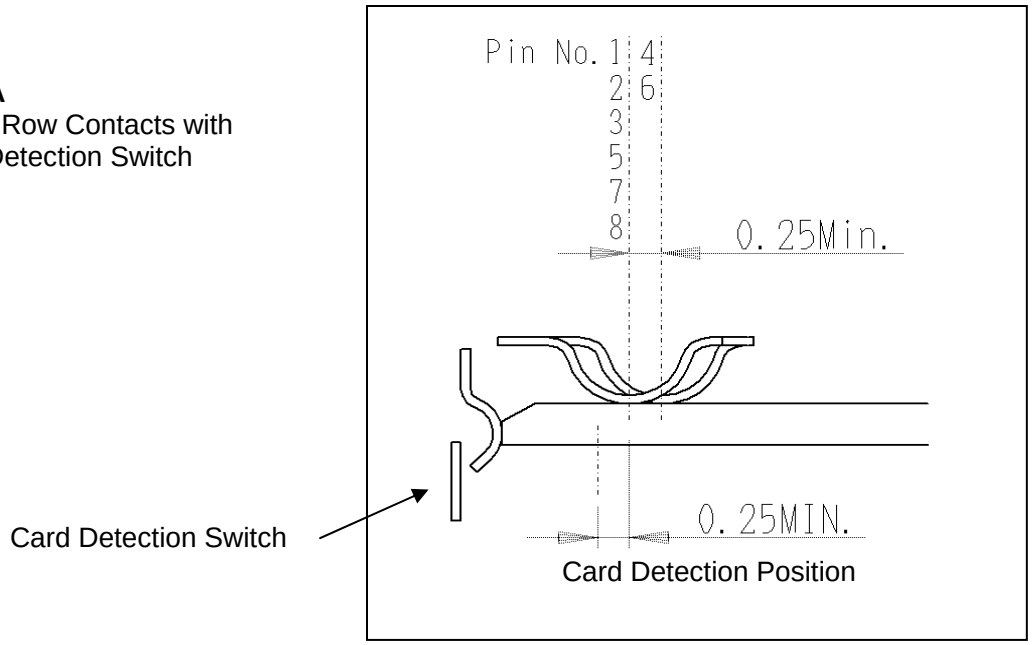
Contact resistance - Part a	
Mate and unmate the connector 500 cycles Note	TOTAL CYCLES = 500
Damp heat, cyclic Section (1 cycle=24hours)	Total 1 damp heat cycle
Mate and unmate the connector 500 cycles Note	TOTAL CYCLES = 1,000
Damp heat, cyclic Section (1 cycle=24hours)	Total 2 damp heat cycles
Mate and unmate the connector 2,000 cycles Note	TOTAL CYCLES = 3,000
Damp heat, cyclic Section (1 cycle=24hours)	Total 3 damp heat cycles
Hydrogen sulfide per Hydrogen Sulfide Section	96 hours
Contact resistance - Part b	

Note: After each 10 cycles stop the insertion and rest the connector for 5 to 10 minutes.
Air blow card (dry air) for 3secs:
at each 100 cycle interval (10 times) from start to 1000 cycles.
at each 1000 cycle interval (2 times) from 1001 to 3,000 cycles.
Mate and unmate speed is less than 10cycles per 1 minute.

4.1.6. Connector Pin Spacing

This drawing indicates position of the connector pin. The card dimension allowance and inclination are not necessary to be considered.

Type A
Single Row Contacts with
Card Detection Switch



"Card Detect Position" means where the card detection switch detects the existence of the card. Refer to Appendix C about implementation of the card detection switch on the connector.

Type B
Single Row Contacts without
Card Detection Switch

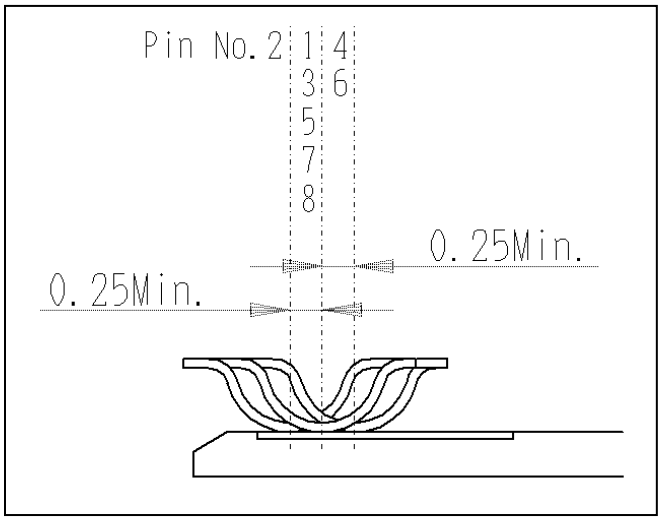


Figure 4-2 : Connector Pin Spacing

4.1.7. Card Over-travel in Push-Push Connector

The push-push connector shall prevent the situation where the contact pins of the connector over-travels the contact pads of the card. During the full insertion cycle the electrical contact to the card shall be maintained.

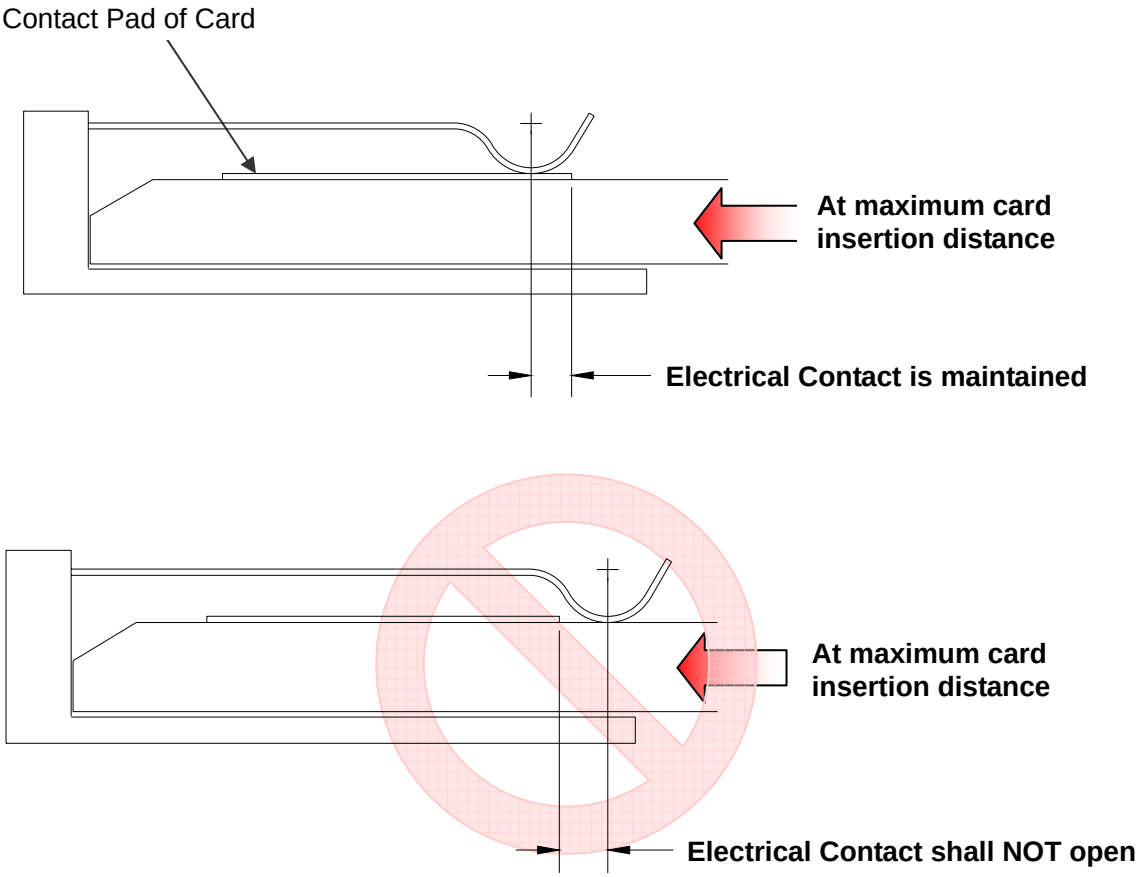


Figure 4-3 : Example of Over-travel Condition

Appendix A (Normative) : Reference

A.1 Reference

This specification refers the following documents.

(1) SD Specifications Part 1 Physical Layer Specifications

(2) SD Specifications Part 1 Physical Version 2.00 Supplementary Notes Version 1.00

(3) SD/SDA Logo Guideline Version 2.00 May 9, 2006

(4) ASME Y14.5M-1994	Geometric dimensioning and tolerancing
(5) EIA-364-B	EIA Standard Acceleration Test Procedure for Electrical Connectors
(6) ISO/IEC10373-6	Electrical characteristics of contactless smart cards
(7) ISO 7816-1	UV light exposure
(8) IEC 60512 (all parts)	Connectors for electronic equipment – Tests and measurements
(9) IEC 60512-2-1 Ed. 1.0:2002 (IEC 512-2-2a)	Electrical continuity and contact resistance tests - Test 2a: Contact resistance - Millivolt level method
(10) IEC 60512-3-1 Ed. 1.0:2002 (IEC 512-2-3a)	Insulation tests - Test 3a: Insulation resistance
(11) IEC 60512-4-1 Ed. 1.0:2003 (IEC 512-2-4a)	Voltage stress tests - Test 4a: Voltage proof
(12) IEC 60512-5-1 Ed. 1.0:2002 (IEC-512-3-5a)	Current-carrying capacity tests - Test 5a: Temperature rise
(13) IEC 60512-6-3 Ed. 1.0:2002 (IEC 512-4-6c)	Dynamic stress tests - Test 6c: Shock
(14) IEC 60512-6-4 Ed. 1.0:2002 (IEC 512-4-6d)	Dynamic stress tests - Test 6d: Vibration (sinusoidal)
(15) IEC 60512-11-3 Ed. 1.0:2002 (IEC 512-6-11c)	Climatic tests - Test 11c: Damp heat, steady state
(16) IEC 60512-11-4 Ed. 1.0:2002 (IEC 512- 6-11d)	Climatic tests - Test 11d: Rapid change of temperature
(17) IEC 60512-11-9 Ed. 1.0:2002 (IEC 512-5-11i)	Climatic tests - Test 11i: Dry heat
(18) IEC 60512-11-10 Ed. 1.0:2002 (IEC 512-6-11j)	Climatic tests - Test 11j: Cold
(19) IEC 60512-11-12 Ed. 1.0:2002 (IEC 512-6-11m)	Climatic tests - Test 11m: Damp heat, cyclic
(20) JEIDA 38	Hydrogen sulfide test
(21) MIL STD 883, Method 2016	Physical dimensions
(22) MIL STD 883, Method 1009	Salt atmosphere corrosion test
(23) ASTM B46.1-2002	Surface Texture (Surface Roughness, Waviness, and Lay)
(24) UL1439	Test for Sharpness of Edges on Equipment

Appendix B (Normative) : Special Terms

B.1 Terminology

Damp heat	Condition where temperature and humidity are controlled.
Keep Out Area	Where shall not print marks.
Via Hole Keep Out Zone	Where shall not place via hole.
warpage	Card condition out of flatness
Discontinuity	Mechanical disconnection when a card is inserted in a connector
Micro-interrupt	Signal disconnection when a card is inserted in a connector

B.2 Abbreviations

ANT1,ANT2	Antenna pins
CLK	Clock Input Pin
CMD	Command Pin
DAT	Data Pin
ESC	External Signal Contacts. Contact pads of a card.
ESD	Electrical Static Discharge
MSTG	microSD Task Group

Appendix C (Informative)
Card Detection Switch

C.1 Use of Card Detection Switch in the Connector

This chapter describes how to use the card detection switch on the host connector. The microSD card detection switch is used to detect whether the microSD is inserted to the host connector or not.

The host manufactures can choose either following a) or b) design method by host system requirements such as to achieve low power consumption, etc.
There are two types of the microSD card detection switch implementations on the host connecter.

a) Normally Open

The Card Detection Switch is open, while the microSD is removed.

b) Normally Closed

The Card Detection Switch is closed while the microSD is removed.

Table C - 1 shows the card detection switch types and its status:

Card Detection Switch Types	microSD is Removed	microSD is Inserted
Normally open	OFF (open)	ON (closed)
Normally closed	ON (closed)	OFF (open)

Table C - 1 : Card Detect Switch Function

The card insertion and removal sequence of microSD should take the following procedures:

a) microSD insertion sequence

Normally open type: The card detection switch should be turned on after all microSD contact pads are connected to the host connector contact pads.

Normally closed type: The card detection switch should be turned off after all microSD contact pads are connected to the host connector contact pads.

b) microSD removal sequence

Normally open type: The card detection switch should be turned off when the microSD is just going to be removed and before any microSD contact pad is disconnected from the host connector contact pad.

Normally closed type: The card detection switch should be turned on when the microSD is just going to be removed and before any microSD contact pad is disconnected from the host connector contact pad.

The microSD card detection switch with above insertion and removal sequence can be used for the microSD host slot power control.

Figure C- 1 shows an example of recommended implementation of the card detection switch and related circuit.

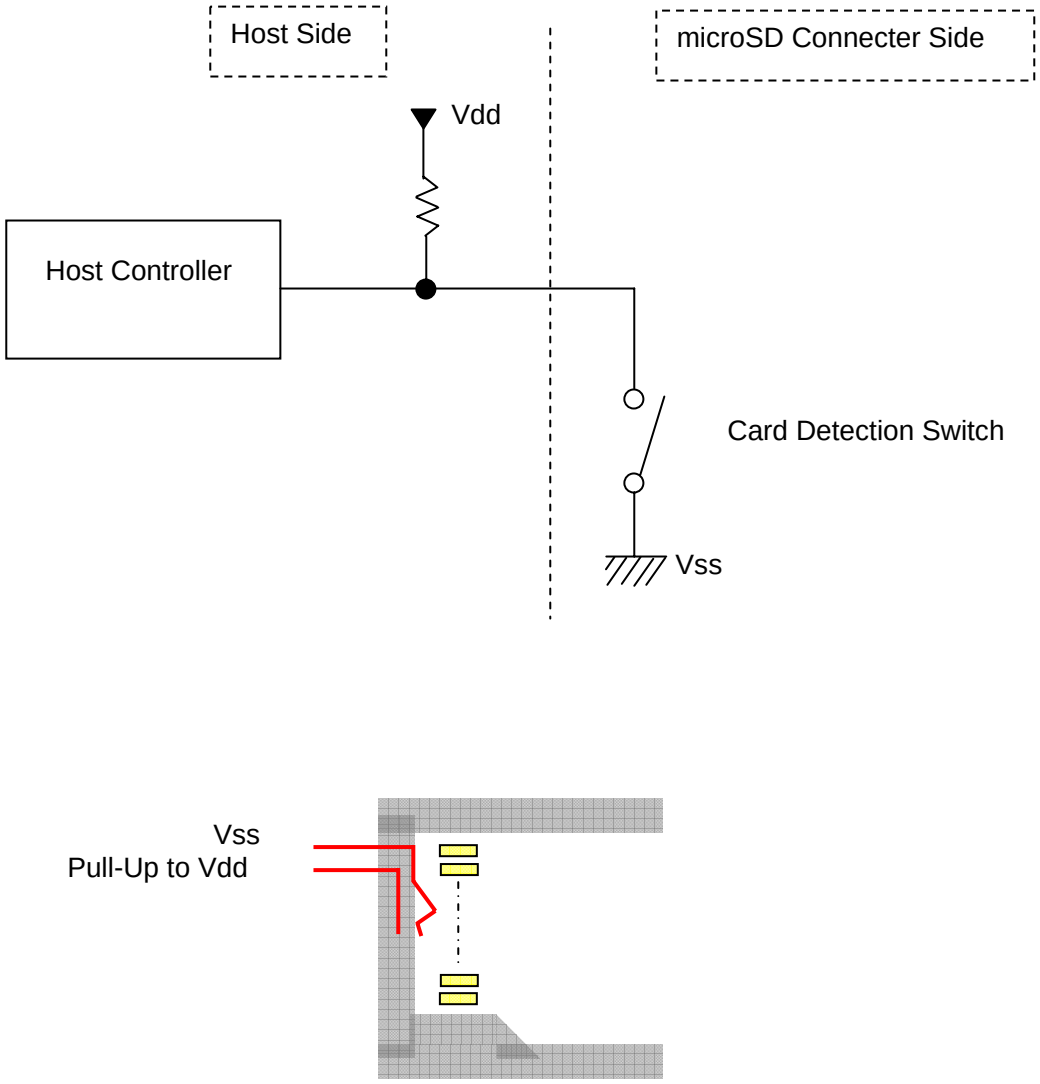


Figure C- 1 : Example of Recommended Card Detection Switch Circuit

Figure C- 2 shows an example of NOT recommended implementation of the microSD card detection switch and related circuit. It is recommended that the microSD card detection switch is not connected to Vdd directly for safety reasons. If the microSD card detection switch is connected to Vdd, it may increase probability of Vdd-Vss short circuit when some foreign substance is inserted into the host connector, or microSD card is inserted while the host connecter pin is broken, for some reason, and may cause the Vdd of the card detection switch line to accidentally contact the Vss line.

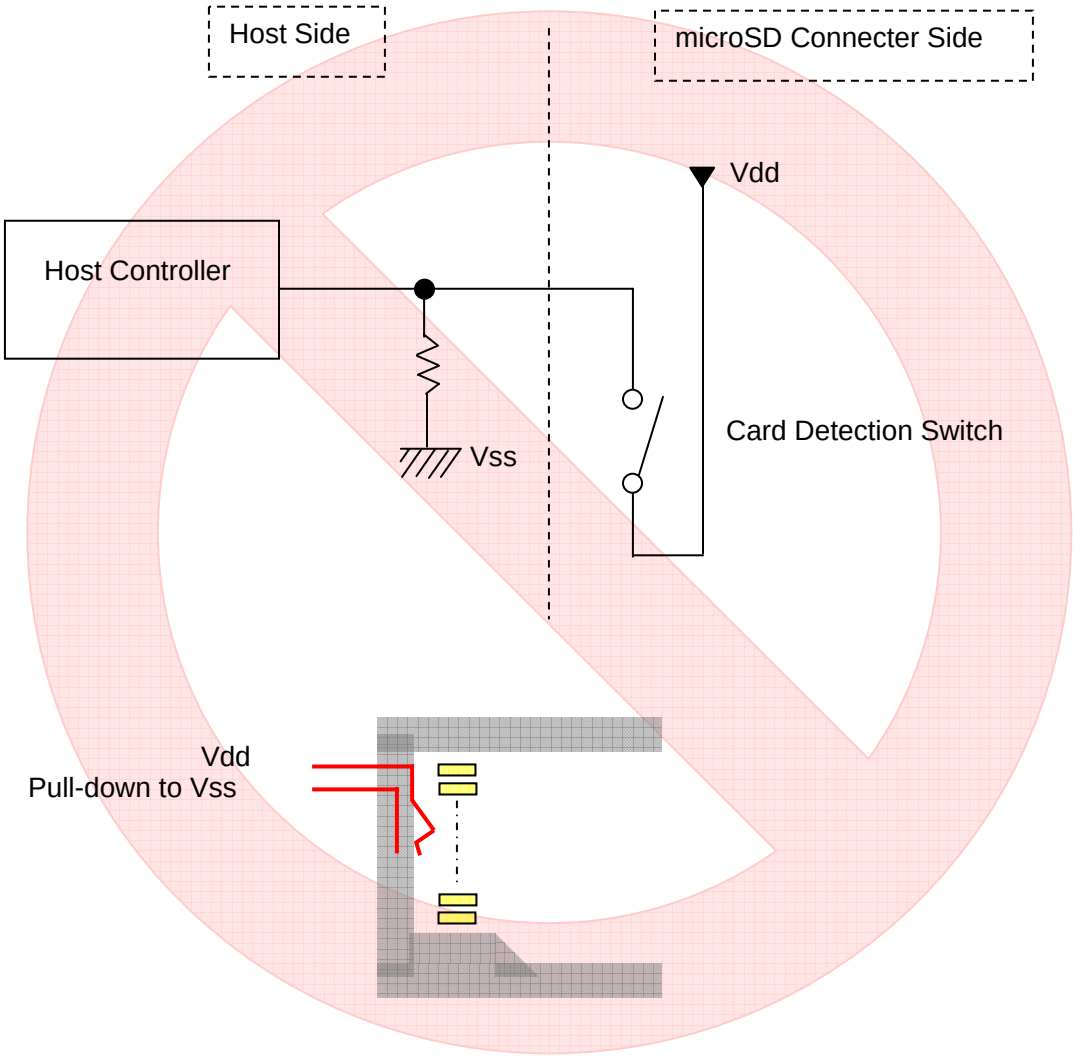


Figure C- 2 : Example of Not Recommended Card Detection Switch Circuit

Appendix D (Informative) : ESD Test Method

This section provides two ESD test methods that conform to the ESD requirements given in Section 3.1.3.

D.1 Contact Discharge Test

The following ESD test recommendation relates to the ESD requirement for contact pads 8.1.3.2 1(c) given in the Physical Layer Specification Version 2.00 (Fixed by Supplementary Notes).

1) Testing Conditions
   - IEC 61000-4-2, contact discharge +/-2kV and +/-4kV150pF, 330Ohm
   - Five (5) times per voltage and polarity for each contact pad.

2) Test Procedure
   - Write Test Data into the SD Memory Card.
   - Set the discharge voltage to +2kV
   - Discharge to the pad (Five (5) times each pad, removing residual charge on the card between every contact discharge.)
   - Repeat with -2kV, +4kV and -4kV.
   - Check the Data and SD Memory Card Function.

3) Test Result
   - The SD Memory Card shall operate as specified.
   - The SD Memory Card shall retain the Data.

D.2 Air Discharge Test

The following ESD test recommendation relates to the ESD requirement for contact pads 8.1.3.2 2 given in the Physical Layer Specification Version 2.00 (Fixed by Supplementary Notes).

1) Testing Conditions
   - IEC 61000-4-2, air discharge up to +/-15kV150pF, 330Ohm

2) Test Procedure
   - Write Test Data into the microSD Memory Card.
   - Mask the contact pads by insulating tape to avoid discharge (Figure D - 1).
   - set voltage for 4kV
   - Discharge toward the position (1) to (5) in order, each face. (Four (4) times top face as Figure D - 1 and five (5) times bottom face as Figure D - 2.) Remove residual charge on the card between each zap.
   - Repeat with -4kV, 8kV, -8kV, 15kV, -15kV.
   - Remove the insulating tape
   - Check the Data and microSD Memory Card Function.

3) Test Result
   - The microSD Memory Card shall operate as specified.
   - The microSD Memory Card shall retain the Data.

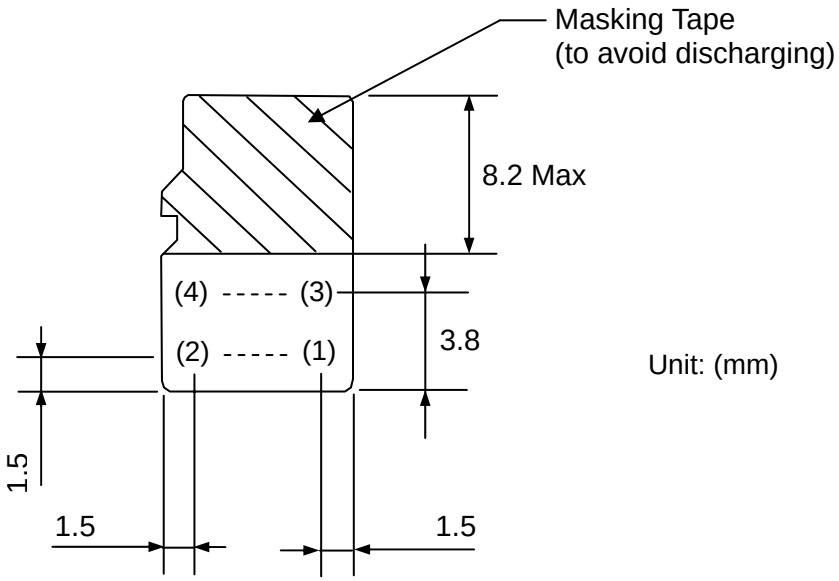


Figure D - 1 : Top Face Discharge Positions

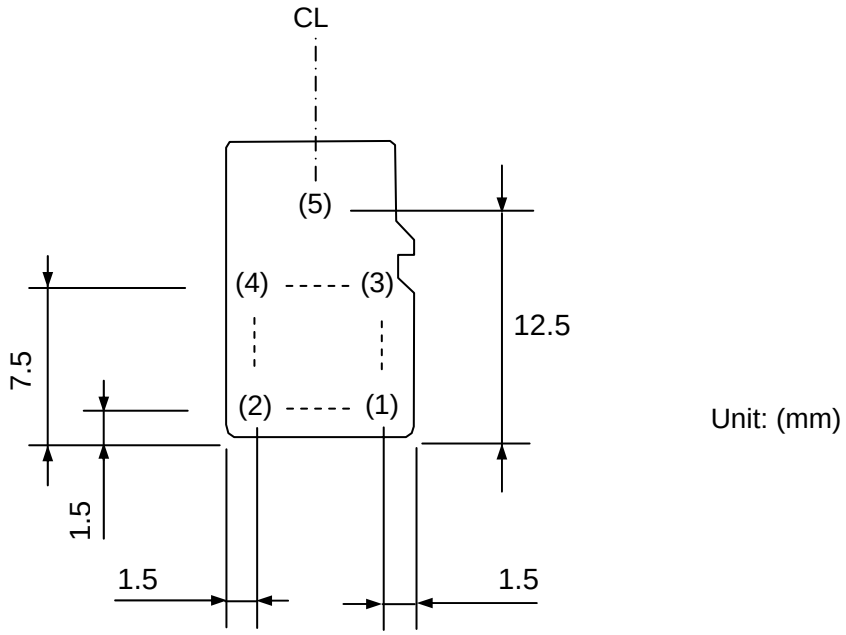


Figure D - 2 : Bottom Face Discharge Positions

Appendix E (Informative) : Mechanical Testing Methods

This Appendix describes examples of test methods recommended by the SDA to be used for the compliance tests.

E.1 Bend Test Fixture Example

The Bend test relates to the Bending specification – given in Table 3-2 : Reliability and Durability.

Place the microSD Memory Card on the fixture with surface facing upward.
Apply 10 N to the center of the surface of the card as shown in Figure E - 1.
Hold time = 60 Sec.
Test card on both surfaces.

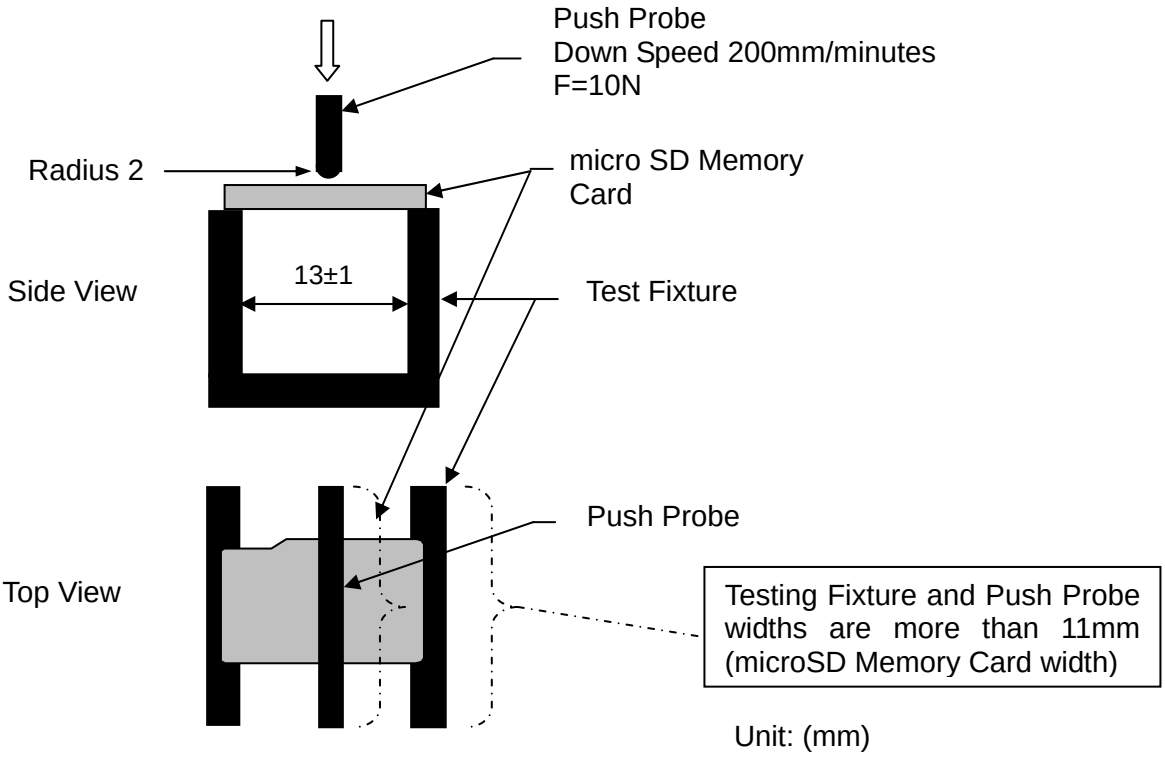


Figure E - 1 : Bend Test Fixture Example

E.2 Torque Test Fixture Example

The Torque test relates to the Torque specification – given in Table 3-2 : Reliability and Durability.

Apply torque to the unfixed end of the microSD Memory Card.
Torque = 0.10 Nm.
Hold time = 30 Sec.
The maximum angle displacement is +/- 2.5 degrees on measurement.

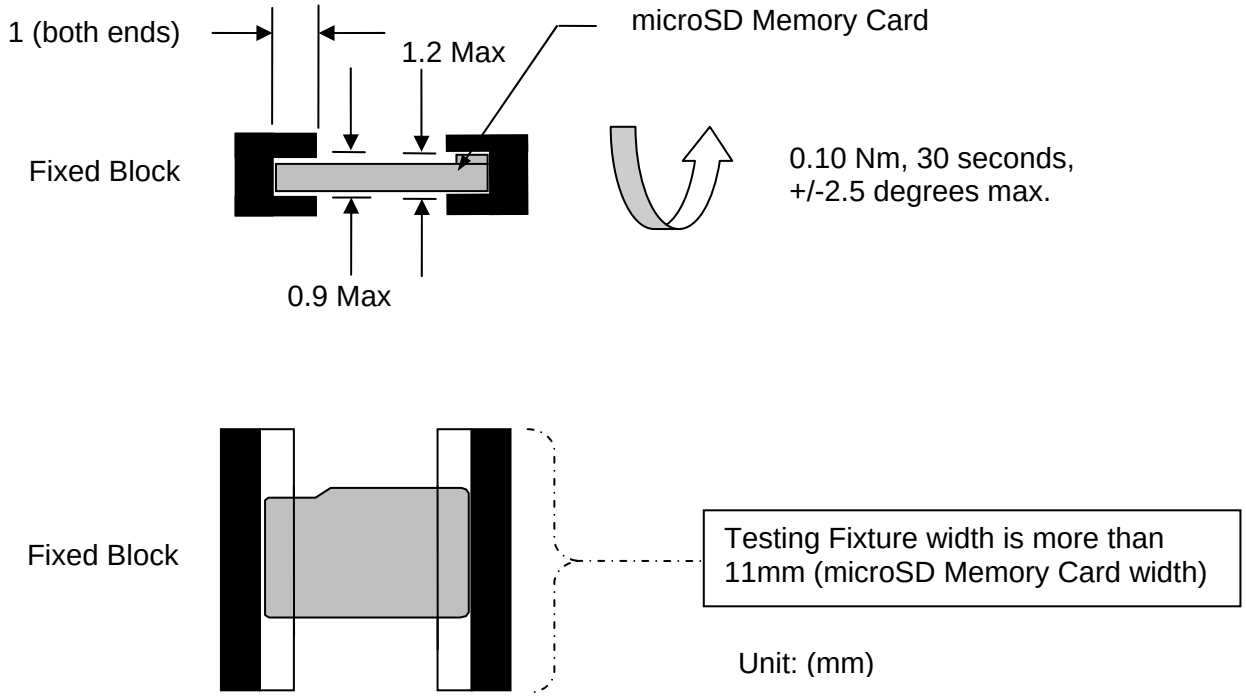
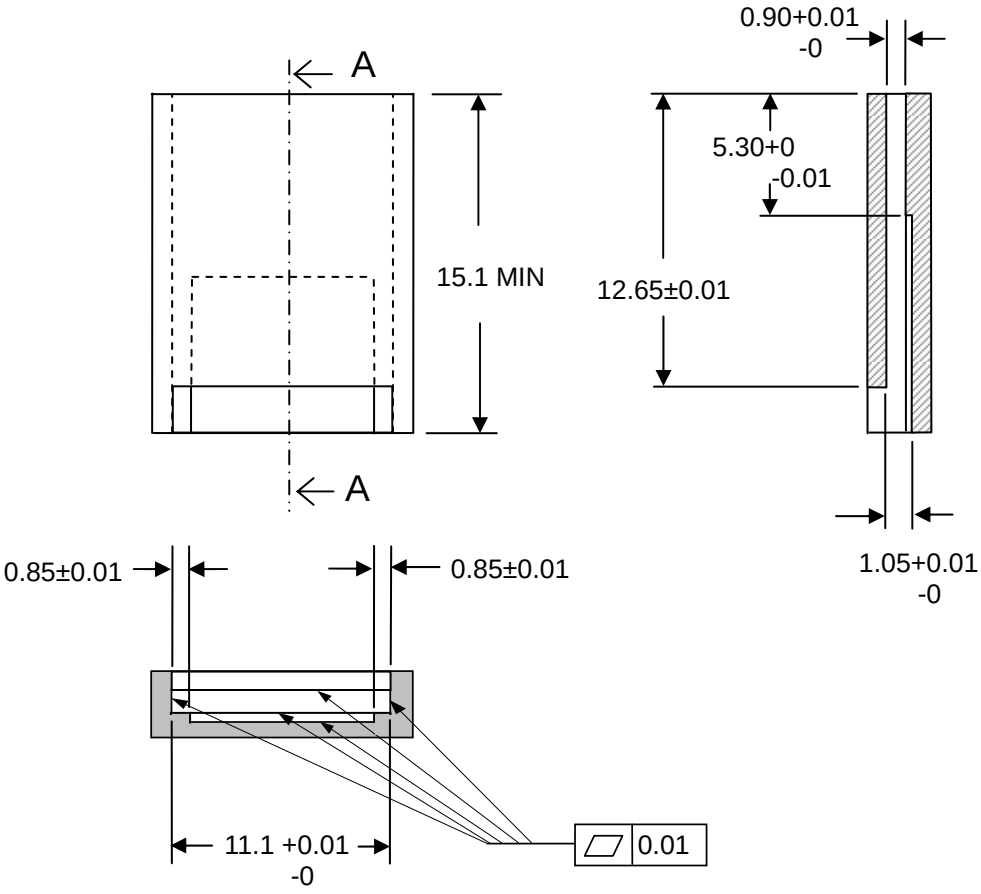


Figure E - 2 : Torque Test Fixture Example

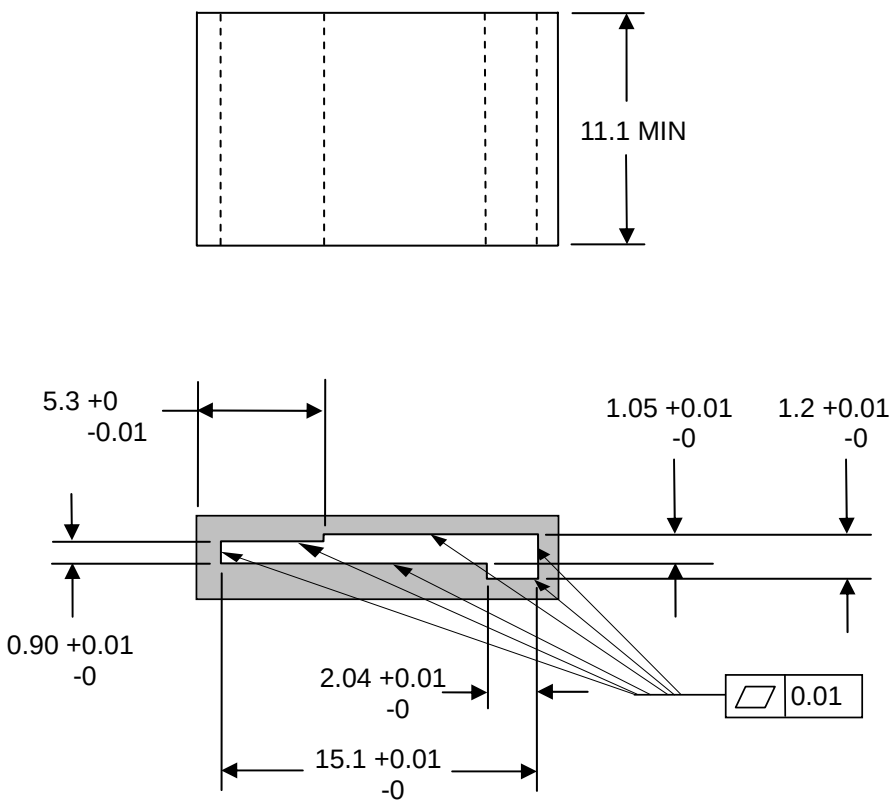
E.3 Card Warpage Testing Fixture Example

The Warpage test relates to the Visual Inspection Shape and Form specification – given in Table 3-2 : Reliability and Durability.
The microSD Memory Card shall pass through or be inserted and dropped out by its own weight.



(Unit: mm)

Figure E - 3 : Card Warpage Testing Fixture Example, Insert and Drop



(Unit: mm)

Figure E - 4 : Card Warpage Testing Fixture Example, Pass Through

E.4 Card Friction Test Method Example

This Section provides an example of a card friction test to ensure that the card has better performance and durability.

1) Test Procedure
   - Contact force of each pin in the Jig is 0.4±0.04N.
   - Extraction speed is less than 1mm/minute.
   - Condition: 20 to 25deg. C and 30% maximum humidity.
   - Each pin in the Jig is finished gold over nickel plating.

2) Test Results
   - The card extraction force shall be 2.2 N maximum as measured in the Jig.

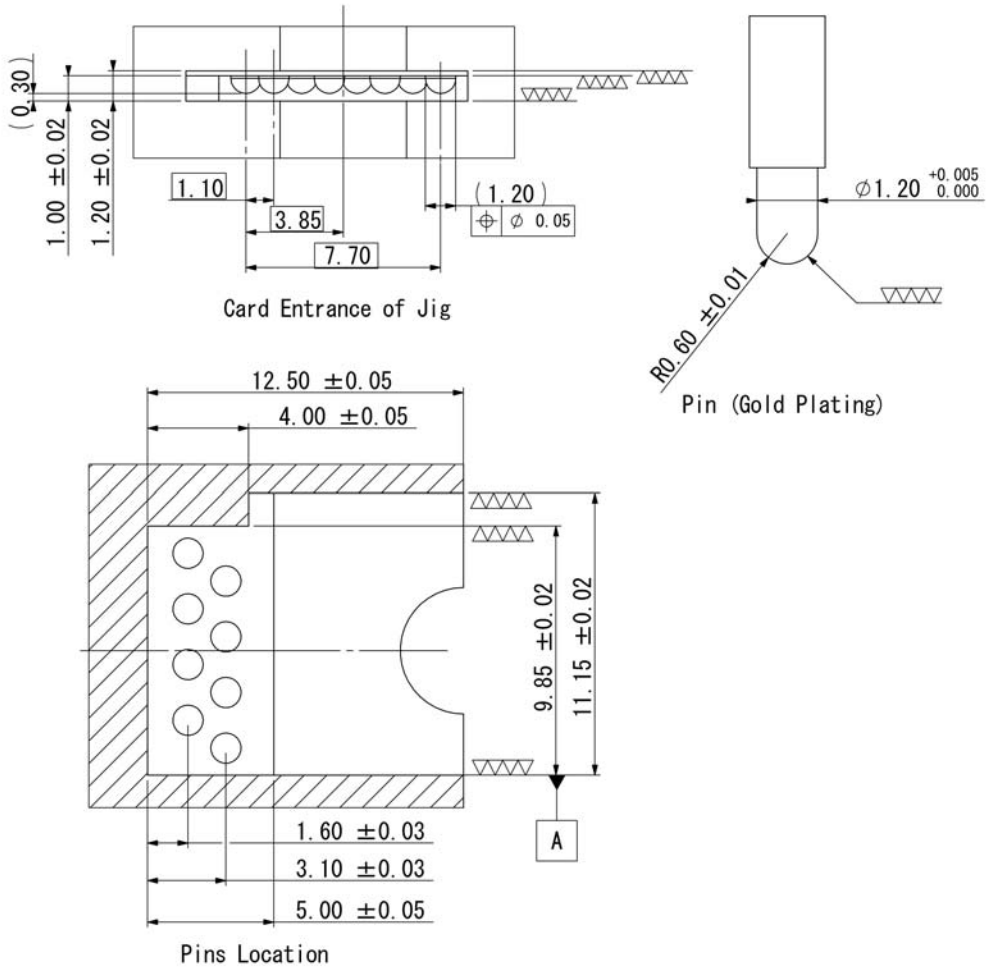


Figure E - 5 : Card Friction Test Jig Example

E.5 Measurement Method of the Insertion Force

This measurement method is defined to test Section 4.1.1 Insertion Force for Card Lock Mechanism. Card insertion force shall be measured by pushing with flat plate.

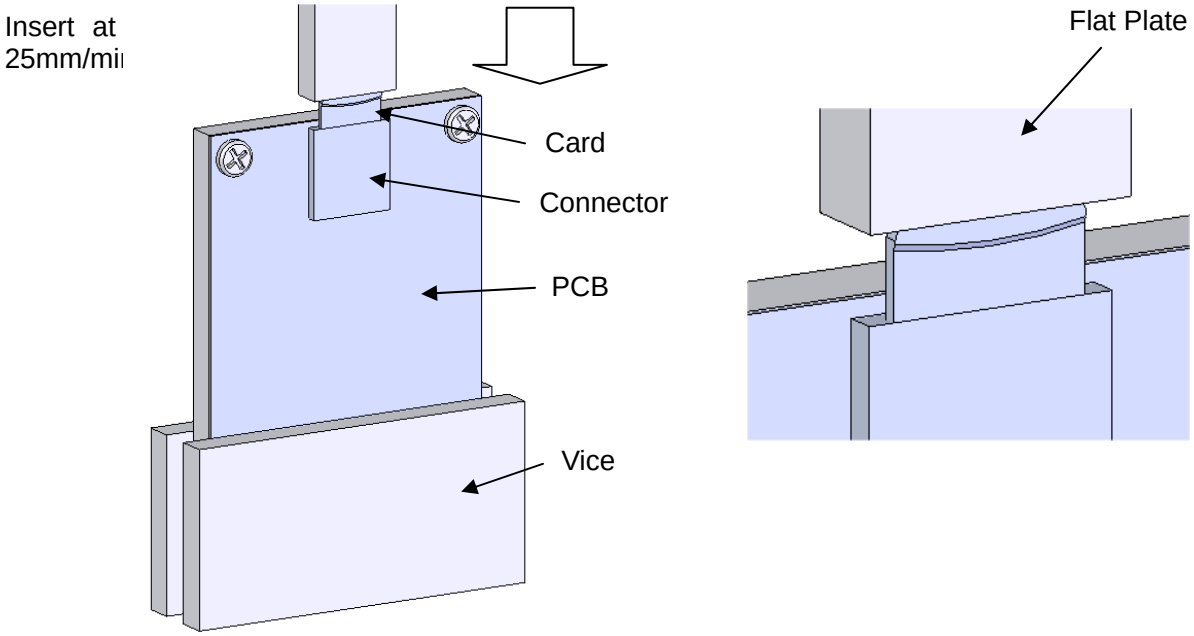


Figure E - 6 : Measurement Method of the Insertion Force

E.6 Measurement Method of the Pulling Force

This measurement method is defined to test Section 4.1.1 Pulling Force for Card Lock Mechanism. Card pulling force shall be measured by pulling a wire threaded through one of three holes in the top of the card. Repeat measurement for each hole.

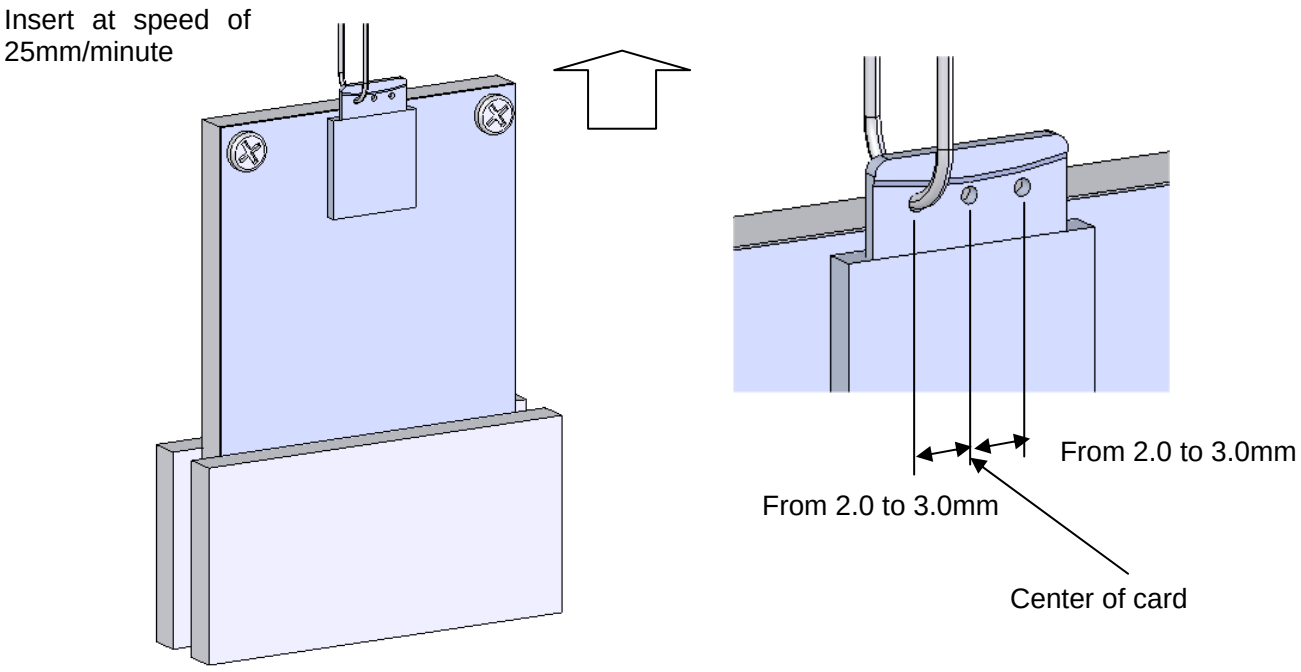


Figure E - 7 : Measurement Method of the Pulling Force