

16GB microSD Datasheet

PN:

TMMSDJ016GV30TB-00N0

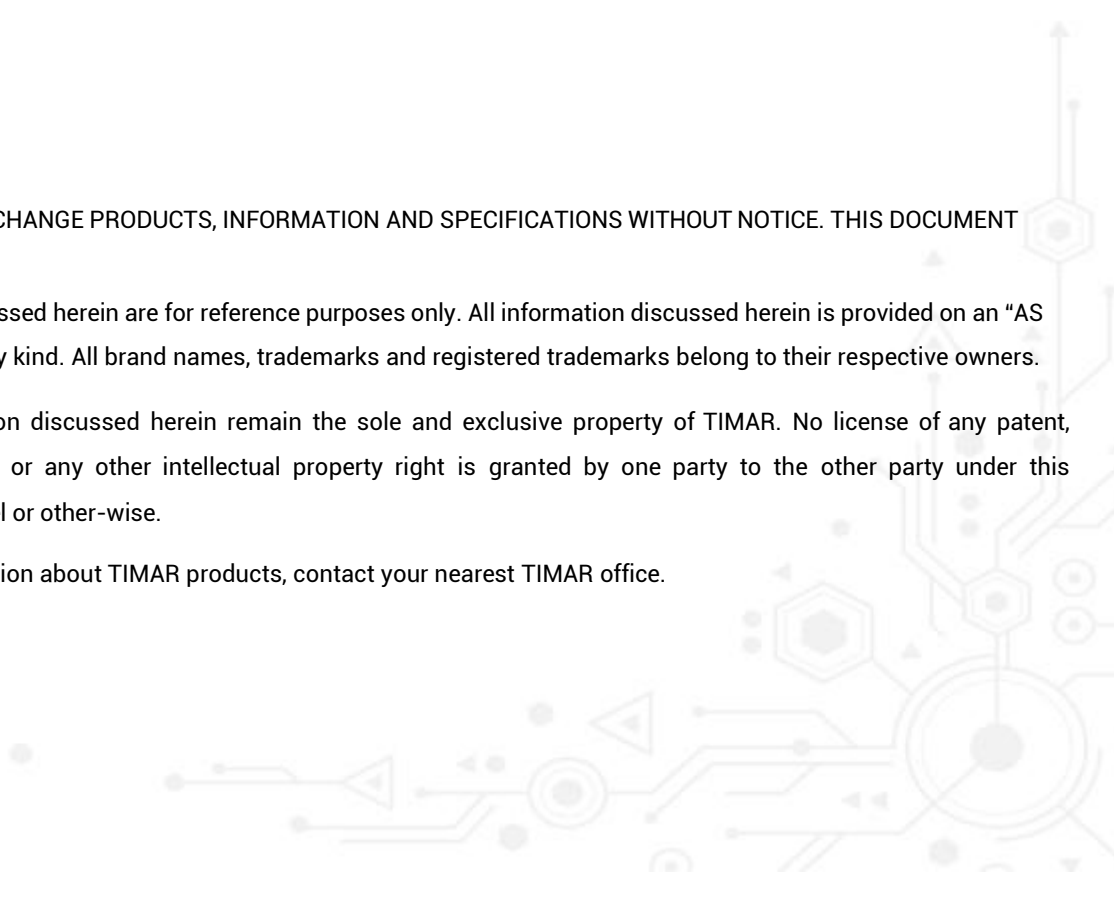
TIMAR RESERVES THE RIGHT TO CHANGE PRODUCTS, INFORMATION AND SPECIFICATIONS WITHOUT NOTICE. THIS DOCUMENT APPLIES TO COMPANY.

Products and specifications discussed herein are for reference purposes only. All information discussed herein is provided on an "AS IS" basis, without warranties of any kind. All brand names, trademarks and registered trademarks belong to their respective owners.

This document and all information discussed herein remain the sole and exclusive property of TIMAR. No license of any patent, copyright, mask work, trademark or any other intellectual property right is granted by one party to the other party under this document, by implication, estoppel or other-wise.

For updates or additional information about TIMAR products, contact your nearest TIMAR office.

All rights reserved.

A decorative graphic in the bottom right corner of the page, consisting of a light gray circuit board pattern with various geometric shapes like hexagons, circles, and lines.

Revision History

Rev.	Date	Changes	Editor
1.0	2024/08/07	Document Create.	Yufeng Zhang
/	/	/	/

CONTENT

Revision History	2
CONTENT.....	3
1 Overview.....	4
1.1 Product Description	4
1.2 Features Summary	4
2 Pin Assignment	5
3 Product List.....	5
4 Current Consumption.....	6
5 Bus Operation Conditions.....	7
5.1 For 3.3V Signaling	7
5.1.1 Threshold Level for High Voltage Range	7
5.1.2 Peak Voltage and Leakage Current.....	7
5.1.3 Bus Signal Line Load.....	7
5.1.4 Bus Signal Levels	7
5.1.5 Bus Timing(Default)	8
5.1.6 Bus Timing (High-Speed Mode).....	10
5.2 For 1.8V Signaling	12
5.2.1 Threshold Level for High Voltage Range	12
5.2.2 Peak Voltage and Leakage Current.....	12
5.2.3 Bus Timing Specification in SDR12, SDR25, SDR50 and SDR104 Modes	12
5.2.4 Bus Timing Specification in DDR50 Mode.....	14
6 Physical Dimension	17

1 Overview

1.1 Product Description

The microSD communication is based on an advanced 9 and 8-pin interface (SD: 9pin, microSD: 8pin) designed to operate in at maximum operating frequency of 208MHz and 2.7V ~ 3.6V operating voltage range with 2 Type signaling (1.8V & 3.3V). More detail information on the interface, and mechanical description is defined as a part of this specification.

UHS-I and High Speed mode limited on this Specification.

The microSD Cards are fully compatible with Physical Layer Specification, support Ultra High Speed(UHS), provides high write/read speed and high IOPS, It was designed to meet the security, high capacity, high performance and environmental requirements inherent in next generation

consumer electronic devices.

The SD card system is a new mass-storage system based on innovations in semiconductor technology. It has been developed to provide an

inexpensive, mechanically robust storage medium in card form for multimedia consumer applications. SD card allows the design of inexpensive players and drivers without moving parts. A low power consumption and a wide supply voltage range favors consumer electronic devices.

- Ultra High Speed (UHS) Card
- It provides up to 104MB/s* performance. UHS cards are backward compatible on non-UHS hosts.
- Based on internal testing, performance may vary depending upon host device.
- 1 megabyte (MB) =1,000,000bytes.

1.2 Features Summary

- Complies to SD specifications version 3.0 or above
- Voltage operating: 2.7~3.6V.
- Targeted for portable and stationary applications
- Greater Performance Choices
- Bus Speed Mode:
 - DS-Default Speed mode: 3.3V signaling, frequency up to 25MHz, up to 12.5MB/sec
 - HS-High Speed mode: 3.3V signaling, frequency up to 50MHz, up to 25MB/sec
 - SDR12-1.8V signaling, frequency up to 25MHz, up to 12.5MB/sec
 - SDR25-1.8V signaling, frequency up to 50MHz, up to 25MB/sec
 - SDR50-1.8V signaling, frequency up to 100MHz, up to 50MB/sec
 - SDR104-1.8V signaling, frequency up to 208MHz, up to 104MB/sec
 - DDR50-1.8V signaling, frequency up to 50MHz, sampled on both clock edges, up to 50MB/s
- Switch function command supports Bus Speed Mode, Command System, Drive Strength, and future functions.
- Password protection (CMD42-LOCK_UNLOCK)
- Sophisticated system for error recovery including a powerful ECC
- Global Wear Leveling
- Power management for low power operation
- Add TF card adapter can be used in SD card socket

2 Pin Assignment

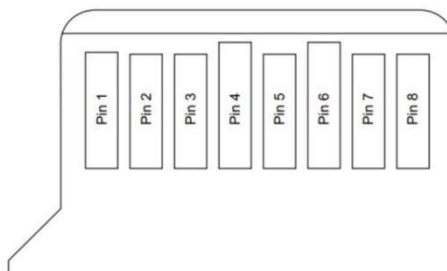


Table 1. Pin Assignment

Pin No.	SD Mode			SPI Mode		
	Name	Type	Description	Name	Type	Description
1	DAT2	I/O/PP	Data Line [Bit 2]	RSV		Reserved
2	CD/DAT3	I/O/PP	Card Detect / Data Line [Bit 3]	CS	I	Chip Select
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	I/O/PP	Data Line [Bit 1]	RSV		Reserved

Note:

S: power supply; I: input; O: output; PP: I/O using push -pull drivers

3 Product List

Table 2. Product List

Part Number	Capacity	Actual Size (Minimum)	Speed Class ¹	Write/Read Speed (Up to) ²	UHS-I Mode	Type
TMMSDJ016GV30TB-00N0	16GB	14.4GB	C10 U3 V30 A2	Up to 98/100 MB/s	SDR104	microSDHC

Note1:

● Measurement based on VTE3100 & VTE4100 TestMetrix device, SW 3.2A software or up version. The card must be reformatted between each script test.

● Test scripts:

- SD_Card (Spec3.0-4.0 HC & XC -UHS-I) SD 3.0 Speed Class (Grade 1/3) [rev32A].vte

- SD [Spec 5.1_HC&XC_UHS-I] Speed Class (Grade 1) & VSC_6_10_30 [VTE4100, Rail_UHS-I+II] SK1 [5.2.0.2-52B-A05].vte

- SD [Spec 5.1_HC&XC_UHS-I] A1/A2 Test - SDR50 (w CMD12_DB) [VTE4100, Rail_UHS-I+II] SK1 [5.2.0.1-52A-A00].vte Note2:

● Measurement based on VTE3100 & VTE4100 TestMetrix device, SW 3.2A software or up version. The card must be reformatted between each script test.

● Test scripts:

- SD_Card(Spec3.0_High&Extended-Capacity_UHS-I and Non-UHS-I)_Compliance [rev32A]-B87.vte

- SD_Card (Spec2.0-3.0 High&Extended-Capacity_UHS-I) Performance-Speed (Multiple Block Sequential) [rev31M] - SDR104-With Background Data.vte

● Maximum speed differs from the bus I/F speed. It varies depending upon the card performance. The average speed that a device writes to an SD

memory card may vary depending upon the device and the operation it is performing. Normal and high-speed cards can also be used with UHS-I host devices, but the high performance enabled by a UHS-I host device can only be achieved with a UHS-I memory card.

Note3:

● The products engineered with proprietary technology to reach speeds beyond UHS-I 104MB/s, require compatible devices capable of reaching such speeds. Based on internal testing, performance may be lower depending upon host device, interface, usage conditions, and other factors.

● Test Condition: Internal test

4 Current Consumption

Standby current: 600uA (Maximum value)

Standby current: 500uA (average value)

Operating current: 350mA (Maximum value)

Operating current: 300mA (average value)

*Test condition: Realtek5308 card reader (Voltage 3.3V), Fluke289C multi-meter.

5 Bus Operation Conditions

5.1 For 3.3V Signaling

5.1.1 Threshold Level for High Voltage Range

Table 3. Threshold Level for High Voltage

Parameter	Symbol	Min	Max	Unit	Remark
Supply Voltage	V_{DD}	2.7	3.6	V	
Output High Voltage	V_{OH}	$0.75 \cdot V_{DD}$		V	$I_{OH}=2mA$ V_{DD} min
Output Low Voltage	V_{OL}		$0.125 \cdot V_{DD}$	V	$I_{OL}=2mA$ V_{DD} min
Input High Voltage	V_{IH}	$0.625 \cdot V_{DD}$	$V_{DD}+0.3$	V	
Input Low Voltage	V_{IL}	$V_{SS}-0.3$	$0.25 \cdot V_{DD}$	V	
Power Up Time			250	ms	From 0V to V_{DD} min

5.1.2 Peak Voltage and Leakage Current

Table 4. Peak Voltage and Leakage Current

Parameter	Symbol	Min	Max	Unit	Remark
Peak voltage on all lines		-0.3	$V_{DD}+0.3$	V	
All Inputs					
Input Leakage Current		-10	10	μA	
All Outputs					
Output Leakage Current		-10	10	μA	

5.1.3 Bus Signal Line Load

Table 5. Bus Operating Conditions - Signal Line's Load

Parameter	Symbol	Min	Max	Unit	Remark
Pull-up resistance	R_{CMD} R_{DAT}	10	100	$K\Omega$	To prevent bus floating
Total bus capacitance for each signal line	CL		40	pF	1 card $C_{HOST}+C_{BUS}$ shall not exceed 30pF
Card capacitance for each signal pin	C_{CARD}		10	pF	
Maximum signal inductance			16	nH	
Pull-up resistance inside card(pin1)	R_{DAT3}	10	90	$K\Omega$	May be used for card detection
Capacity Connected to Power Line	C_C		5	μF	To prevent inrush current

5.1.4 Bus Signal Levels

As the bus can be supplied with a variable supply voltage, all signal levels are related to the supply voltage.

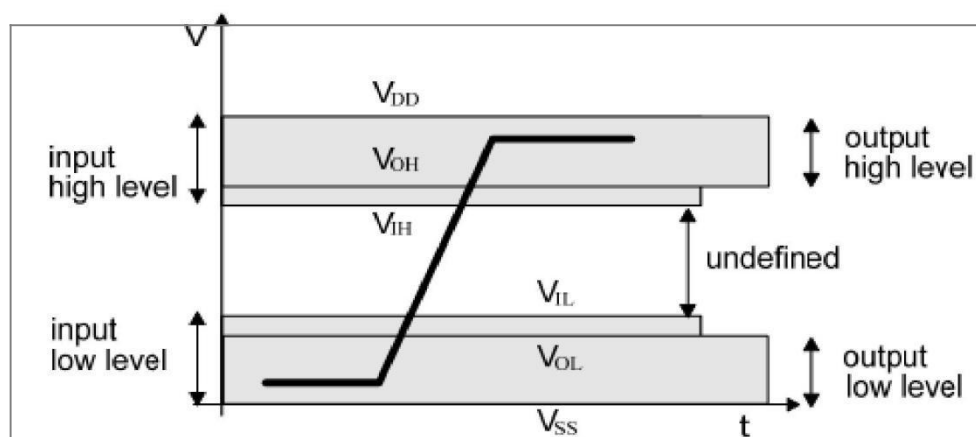


Figure 1. Bus Signal Levels

To meet the requirements of the JEDEC specification JESD8-1A and JESD8-7, the card input and output voltages shall be within the specified ranges shown in Table 6 for any V_{DD} of the allowed voltage range.

5.1.5 Bus Timing(Default)

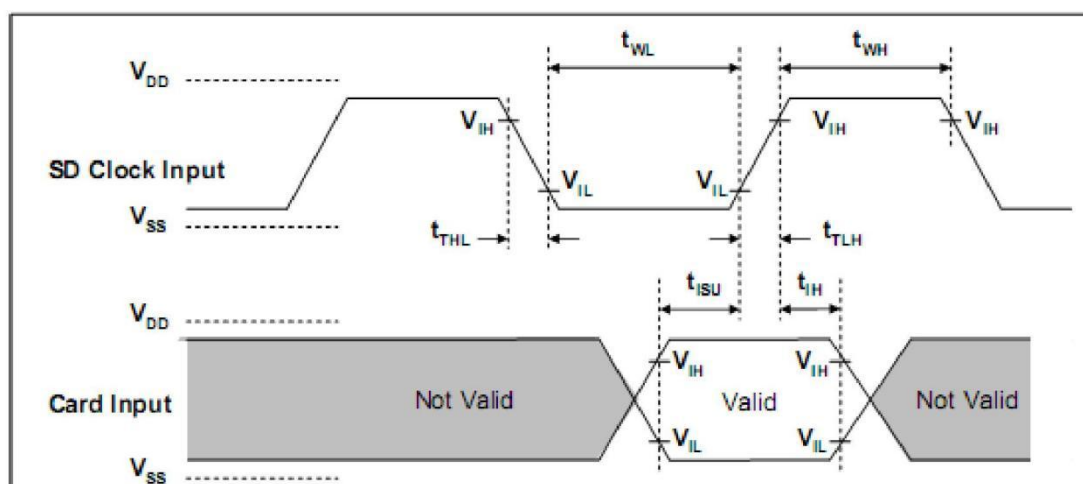


Figure 2. Card input Timing (Default Speed Card)

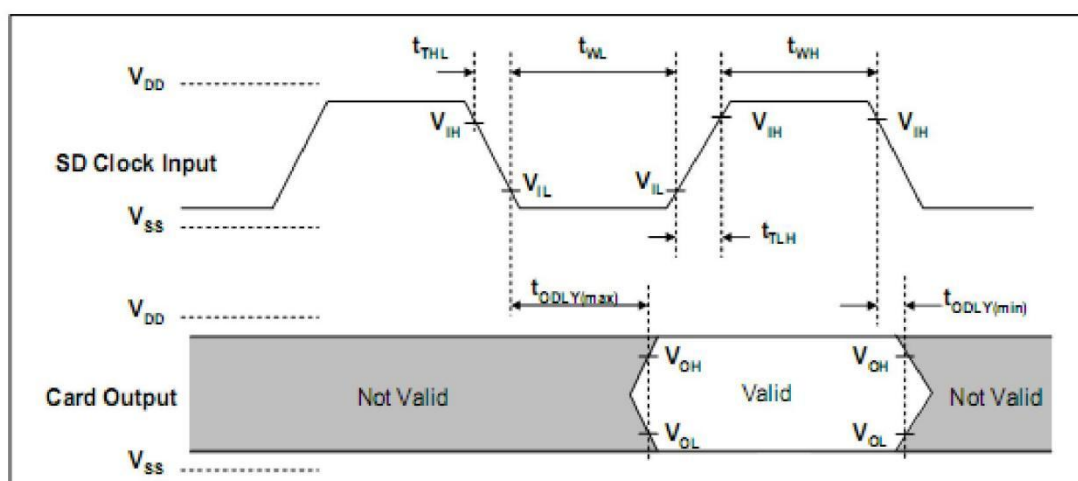


Figure 3. Card Output Timing (Default Speed Mode)

Table 6. Bus Timing-Parameters Values (Default Speed)

Parameter	Symbol	Min.	Max	Unit	Remark
Clock CLK (All values are referred to min (V_{IH}) and max (V_{IL}))					
Clock frequency Data Transfer Mode	f _{pp}	0	25	MHz	C _{CARD} ≤ 10pF (1 card)
Clock frequency Identification Mode	f _{0D}	0 ¹ /100	400	KHz	C _{CARD} ≤ 10pF (1 card)
Clock low time	t _{WL}	10		ns	C _{CARD} ≤ 10pF (1 card)
Clock high time	t _{WH}	10		ns	C _{CARD} ≤ 10pF (1 card)
Clock rise time	t _{TLH}		10	ns	C _{CARD} ≤ 10pF (1 card)
Clock fall time	t _{THL}		10	ns	C _{CARD} ≤ 10pF (1 card)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	t _{ISU}	5		ns	C _{CARD} ≤ 10pF (1 card)
Input hold time	t _{IH}	5		ns	C _{CARD} ≤ 10pF (1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Data Transfer Mode	t _{ODLY}	0	14	ns	C _L ≤ 40pF (1 card)
Output Delay time during Identification Mode	t _{ODLY}	0	50	ns	C _L ≤ 40pF (1 card)

Note1:

0 Hz means to stop the clock. The given minimum frequency range is for cases where continuous clock is required (refer to Chapter 4.4 -Clock Control in Physical Layer Specification)

5.1.6 Bus Timing (High-Speed Mode)

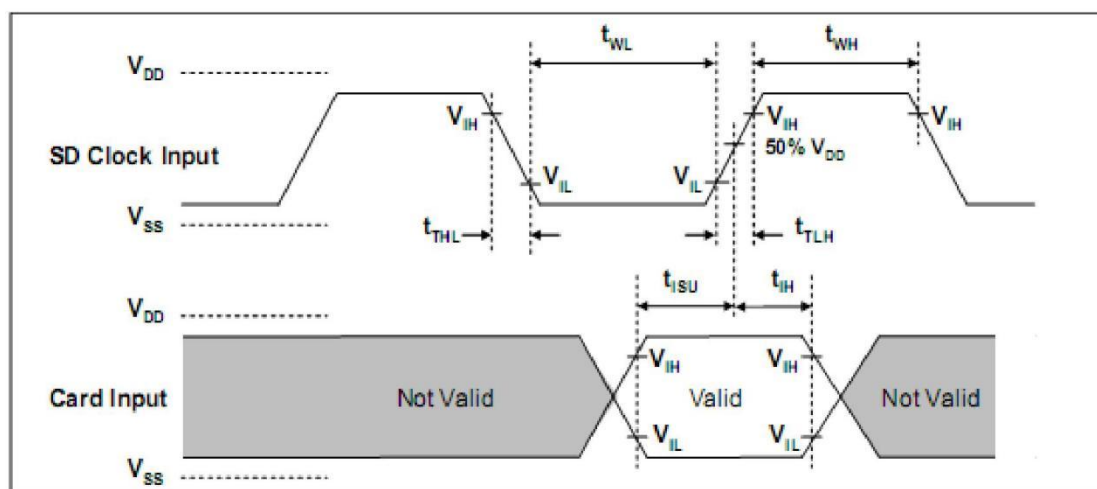


Figure 4. Card Input Timing(High Speed Card)

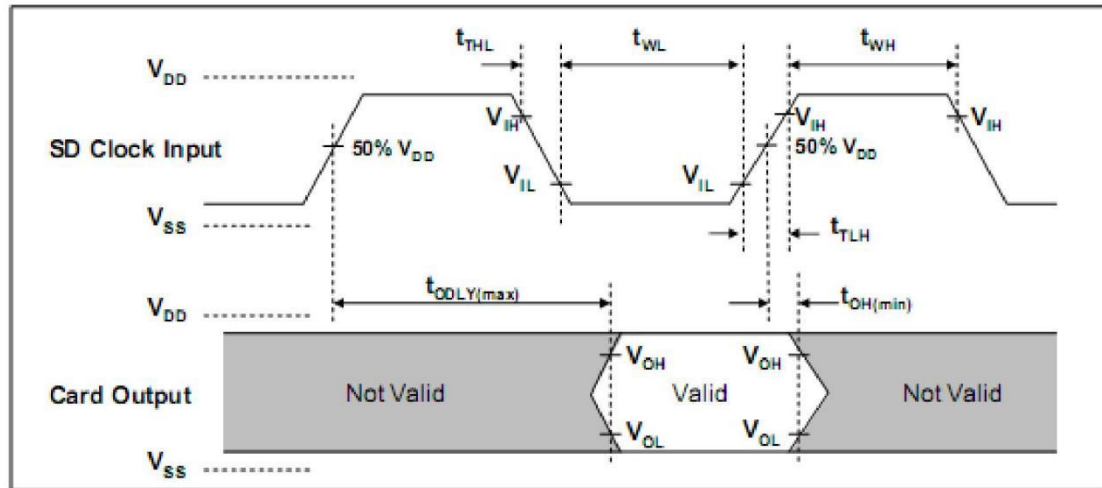


Figure 5. Card Output Timing(High Speed Mode)

Table 7. Bus Timing - Parameters Values (High Speed)

Parameter ¹	Symbol	Min.	Max	Unit	Remark
Clock CLK (All values are referred to min (V _{IH})and max (V _{IL}))					
Clock frequency data transfer Mode	fpp	0		MHz	C _{CARD} ≤ 10pF (1 card)
Clock low time	t _{WL}	7		ns	C _{CARD} ≤ 10pF (1 card)
Clock high time	t _{WH}	7		ns	C _{CARD} ≤ 10pF (1 card)
Clock rise time	t _{TLH}		3	ns	C _{CARD} ≤ 10pF (1 card)
Clock fall time	t		3	ns	C _{CARD} ≤ 10pF (1 card)
CMD, (referenced to CLK)					
Input set-up time	t _{ISU}	6		ns	C _{CARD} ≤ 10pF (1 card)
Input hold time	t _{IH}	2		ns	C _{CARD} ≤ 10pF (1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Mode	t _{ODLY}		14	ns	C _L ≤ 40pF (1 card)
Output	t _{OH}	2.5		ns	C _L ≥ 15pF (1 card)
Total	each line	C _L	40	pF	1 card

Note1:

In order to satisfy sever timing , host shall drive only one card.

5.2 For 1.8V Signaling

5.2.1 Threshold Level for High Voltage Range

Table 8. Threshold Level for High Voltage

Parameter	Symbol	Min	Max	Unit	Remark
Supply Voltage	V_{DD}	2.7	3.6	V	
Regulator Voltage	V_{DDIO}	1.7	1.95	V	Generated by V_{DD}
Output High Voltage	V_{OH}	1.4		V	$I_{OH} = -2mA$
Output Low Voltage	V_{OL}		0.45	V	$I_{OL}=2mA$
Input High Voltage	V_{IH}	1.27	2.0	V	
Input Low Voltage	V_{IL}	$V_{SS}-0.3$	0.58	V	

5.2.2 Peak Voltage and Leakage Current

Table9. Peak Voltage and Leakage Current

Parameter	Symbol	Min	Max	Unit	Remark
Input Leakage Current		-2	2	μA	DAT3 pull-up is disconnected

5.2.3 Bus Timing Specification in SDR12, SDR25, SDR50 and SDR104 Modes

I Clock Timing

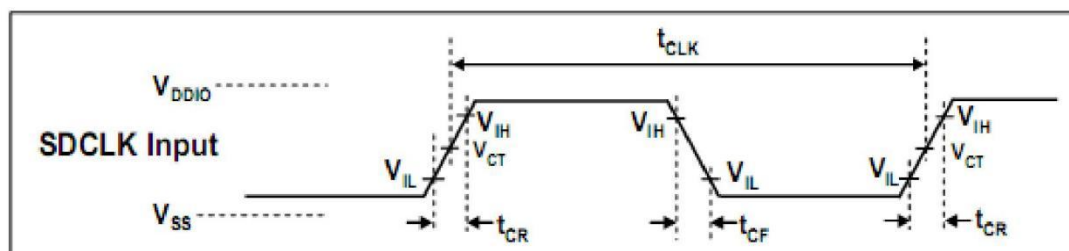


Figure 6. Clock Signal Timing

Table 10. Clock Signal Timing

Symbol	Min	Max	Unit	Remark
t_{CLK}	4.8	-	ns	208MHz (Max.), Between rising edge, $V_{CT}=0.975V$
t_{CR}, t	-	$0.2 * t_{CLK}$	ns	$t_{CR}, t_{CF} < 0.96ns$ (max.) at 208MHz, $C_{CARD}=10pF$ $t_{CR}, t_{CF} < 2.00ns$ (max.) at 100MHz, $C_{CARD}=10pF$ The absolute maximum value of t_{CR}, t_{CF} is 10ns regardless of clock frequency.
Clock Duty	30	70	%	

I Card Input Timing

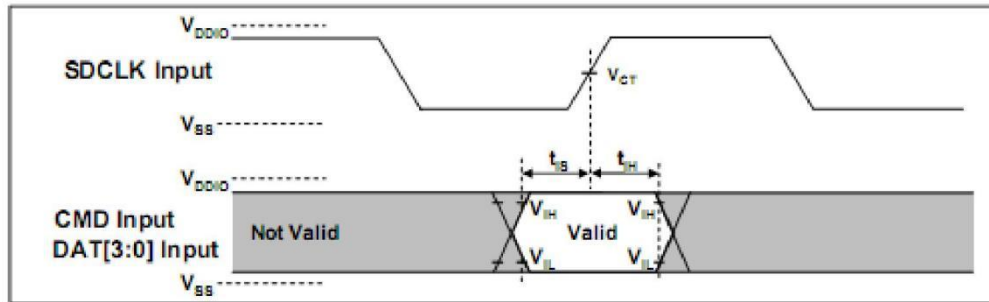


Figure 7. Card Input Timing

Table 11. SDR50 and SDR104 Input Timing

Symbol	Min	Max	Unit	SDR104 mode
tIS	1.40	-	ns	C _{CARD} = 10pF, V _{CT} = 0.975V
tIH	0.80	-	ns	C _{CARD} = 5pF, V _{CT} = 0.975V
Symbol	Min	Max	Unit	SDR12, SDR25 and SDR50 modes
tIS	3.00	-	ns	C _{CARD} = 10pF, V _{CT} = 0.975V
tIH	0.80	-	ns	C _{CARD} = 5pF, V _{CT} = 0.975V

I Output Timing of Fixed Data Window (SDR12, SDR25 and SDR50)

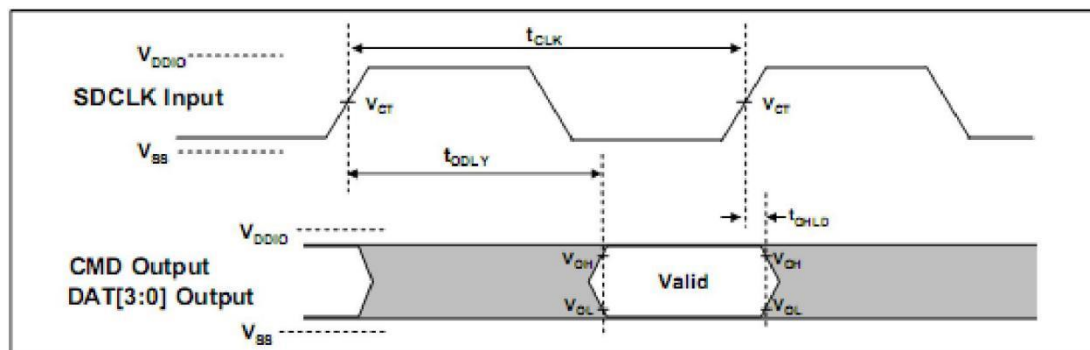


Figure 8. Output Timing of Fixed Data Window

Table 12. Output Timing of Fixed Data Window

Symbol	Min	Max	Unit	Remark
tODLY	-	7.5	ns	t _{CLK} ≥ 10.0ns, C _L = 30pF, using driver Type B, for SDR50.
tODLY	-	14	ns	t _{CLK} ≥ 20.0ns, C _L = 40pF, using driver Type B, for SDR25 and SDR12.
tOH	1.5	-	ns	Hold time at the tODLY (min.). C _L = 15pF

I Output Timing of Variable Window (SDR104)

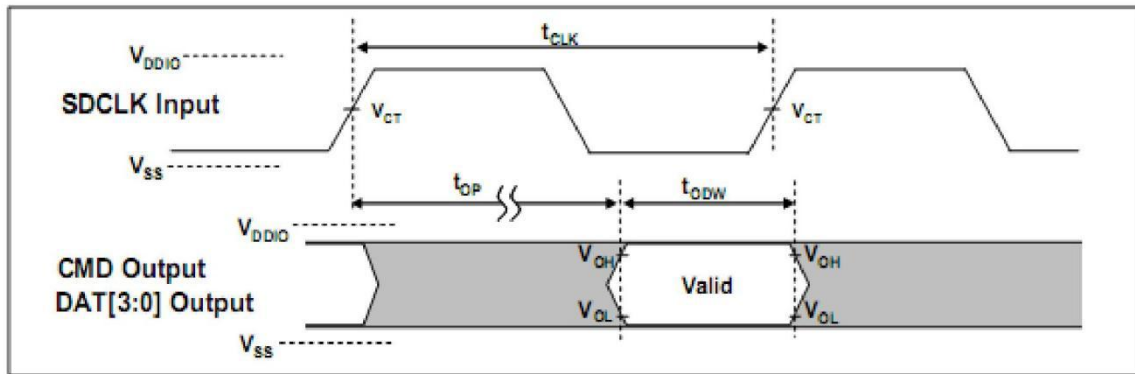


Figure 9. Output Timing of Variable Data Window

Table 13. Output Timing of Variable Data Window

Symbol	Min	Max	Unit	Remark
t_{OP}	0	2	UI	Card Output Phase
Δt_{OP}	-350	+1550	ps	Delay variation due to temperature change after tuning
t_{ODW}	0.60	-	UI	$t_{ODW} = 2.88\text{ns}$ at 208MHz

5.2.4 Bus Timing Specification in DDR50 Mode

I Clock Timing

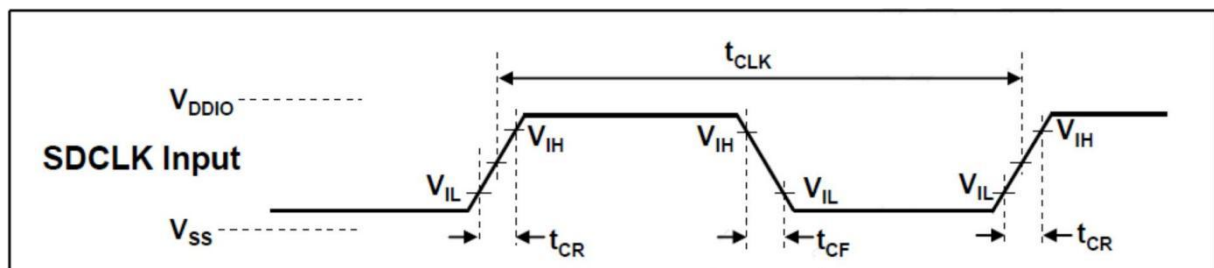


Figure 10. Clock Signal Timing

Table 14. Clock Signal Timing

Symbol	Min	Max	Unit	Remark
t_{CLK}	20	-	ns	50MHz (Max.), Between rising edge
t_{CR}, t_{CF}	-	$0.2 * t_{CLK}$	ns	$t_{CR}, t_{CF} < 4.00\text{ns}(\text{max.})$ at 50MHz, $C_{CARD} = 10\text{pF}$

Clock Duty	45	55	%	
------------	----	----	---	--

I Bus Timing for DDR50

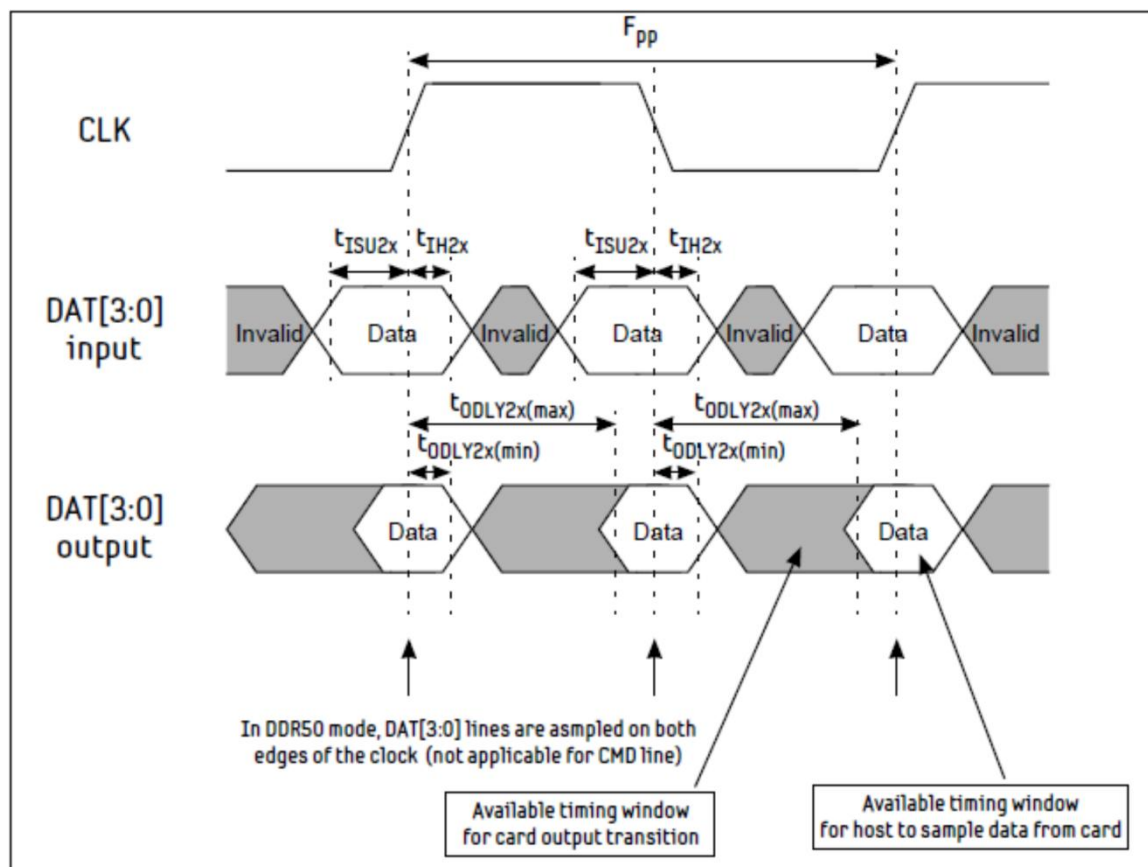


Figure 11. Timing Diagram DAT Inputs/Outputs Referenced to CLK in DDR50 Mode

Table 15. Bus Timings - Parameters Values (DDR50 mode)

Parameter	Symbol	Min.	Max	Unit	Remark
Input CMD (referenced to CLK rising edge)					
Input set-up time	t_{ISU}	3	-	ns	$C_{CARD} \leq 10pF$ (1 card)
Input hold time	t_{IH}	0.8	-	ns	$C_{CARD} \leq 10pF$ (1 card)
Output CMD (referenced to CLK rising edge)					
Output Delay time during Data Transfer Mode	t_{ODLY}	-	13.7	ns	$C_L \leq 30pF$ (1 card)
Output hold time	t_{OH}	1.5	-	ns	$C_L \geq 15pF$ (1 card)
Inputs DAT (referenced to CLK rising and falling edges)					
Input set-up time	t_{ISU2x}	3	-	ns	$C_{CARD} \leq 10pF$ (1 card)
Input hold time	t_{IH2x}	0.8	-	ns	$C_{CARD} \leq 10pF$ (1 card)
Output CMD (referenced to CLK rising and failing edges)					
Output Delay time during Data Transfer Mode	t_{ODLY2x}	-	7.0	ns	$C_L \leq 25pF$ (1 card)
Output hold time	t_{ODLY2x}	1.5	-	ns	$C_L \geq 15pF$ (1 card)

6 Physical Dimension

Table 16. Physical Dimension Specifications (Unit in mm)

Type	Measurement
Length	15mm +/- 0.1mm(B)
Width	11mm +/- 0.1mm(A)
Thickness	1.0mm+/-0.1mm(C)
	0.7mm+/-0.1mm(C1)
Weight	0.33 gram Max

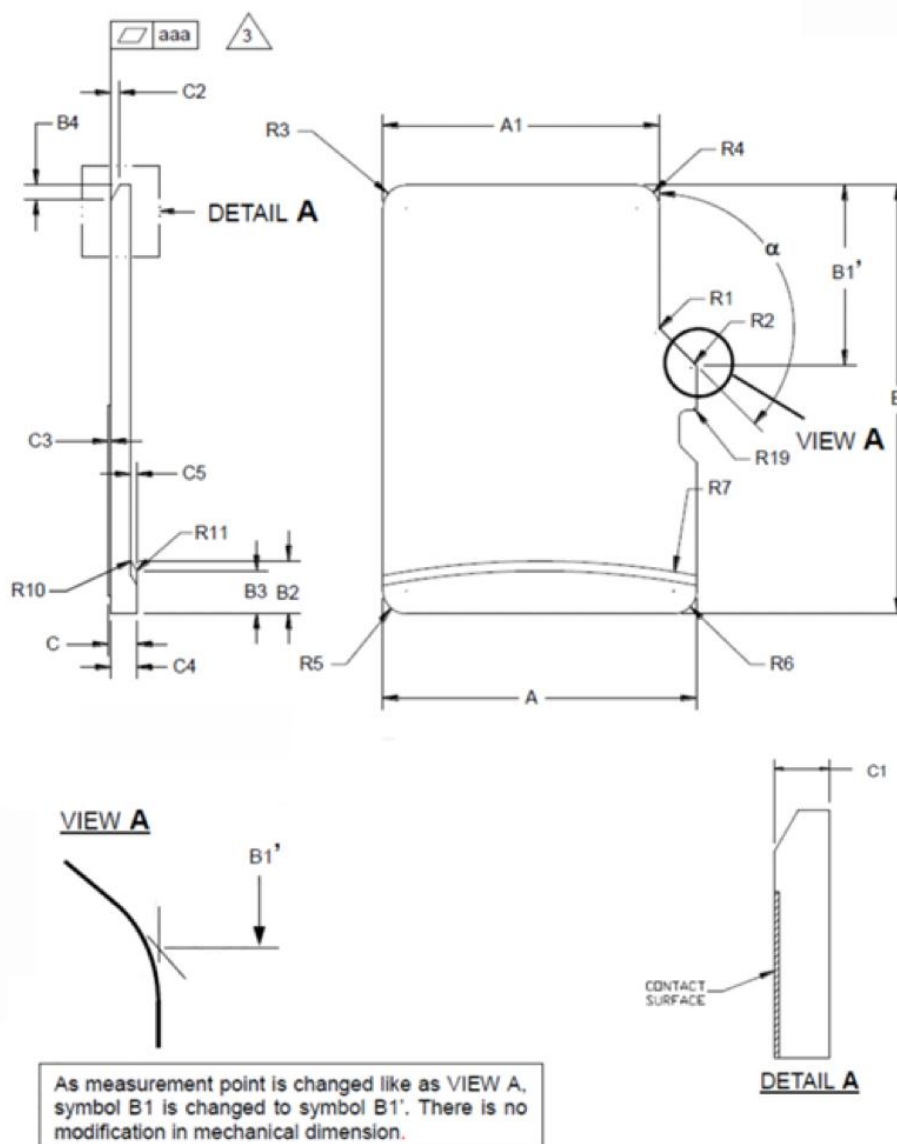


Figure 12. Mechanical Description: Top View

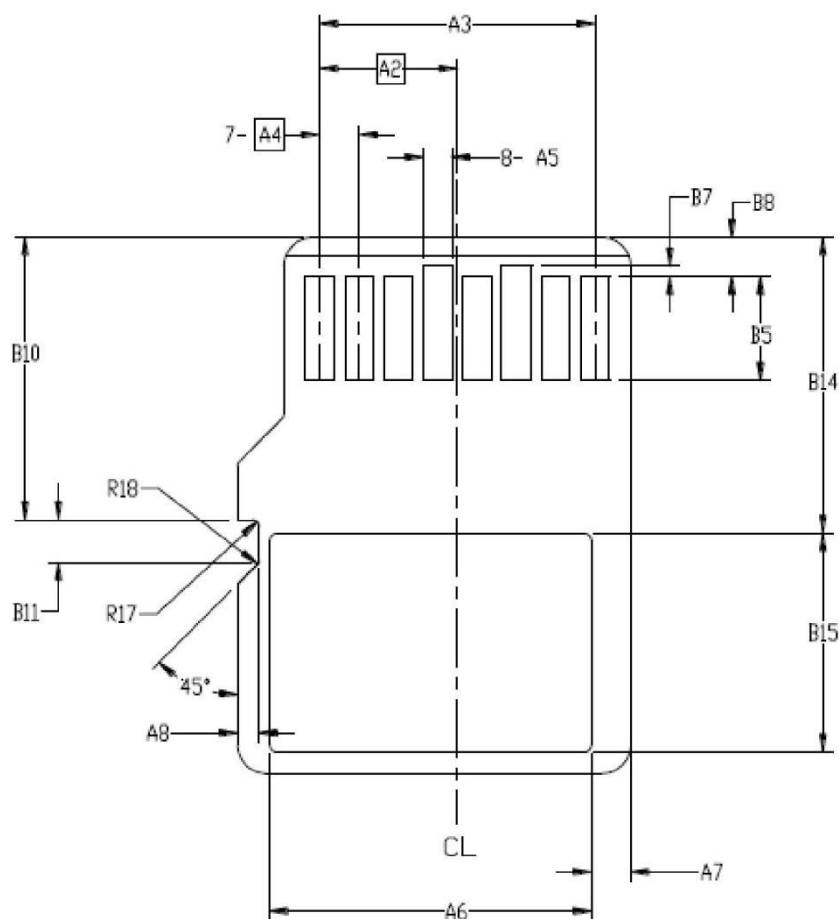


Figure 13. Mechanical Description: Bottom View

Table 17. microSD Package: Dimensions

SYMBOL	MIN (mm)	NOM (mm)	MAX (mm)	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	
B	14.90	15.00	15.10	
B1,	6.13	6.23	6.33	
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	
B7	0.20	0.30	0.40	

B8	1.00	1.10	1.20	
B10	7.80	7.90	8.00	
B11	1.10	1.20	1.30	
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	
C4	0.80	-	1.10	
C5	0.15	-	-	
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	