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:

USD-4GB-INDUSTRIAL

EN
This Datasheet is presented by the manufacturer

DE
Dieses Datenblatt wird vom Hersteller bereitgestellt

FR
Cette fiche technique est présentée par le fabricant

USD-4GB-INDUSTRIAL Memory Card

This is a Class 10 SD-HC 4GB Industrial rated microSD card. These cards are unique and feature an advanced firmware to prevent corruption in harsh environments, and can instil a higher level of confidence in the end product when these cards are used.

These cards are superior to standard commercial grade cards and other standard industrial grade cards, due to their advanced firmware, which can prevent a phenomenon called 'Read Disturb' from occurring, along with other advanced enhancements. Read Disturb can result in random bit changes causing corruption when the same information is read continuously without being overwritten. This is possible to do when using them in 4D Systems modules due to the nature of the graphics, and therefore these cards offer advanced protection against this due to the firmware's unique ability to prevent this from occurring.

The uSD-4GB Industrial Grade memory card can be used to store images, animations, text, graphics objects, for data logging, and many more uses, when used in the 4D intelligent display modules.

These cards are SPI Compatible, they are sourced directly from the Manufacturer, Phison in Taiwan, and are the recommended micro SD card for use with 4D Systems products.

Not all cards on the market are SPI compatible, and therefore not all cards can be used in 4D Systems products. Buy with confidence, choose the cards recommended by 4D Systems.

Extremely small footprint measuring only 15mm x 11mm x 0.8mm

Features:

- High reliability, operating at -40^{o}C to 85^{o}C
- Water proof, Dust proof and ESD Resistant
- Enhanced endurance by Advanced Dynamic/ Static Wear Leveling algorithm
- Read Disturb Protector -Auto Refresh technology to ensure data integrity especially in frequent read operations
- Enhanced power cycling support
- Support BCH ECC engine up to 40bit/1KByte
- Support CPRM
- RoHS compliant
- CE & FCC certification

Phison Electronics Corporation

Industrial PS8032 microSD 3.0 Specification

(PS8032+ MLC)

Version 1.4
Document Number: S-14071

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Overview

- **Capacity**
  - MLC: 4GB up to 64GB
- **Flash Type**
  - Toshiba 19nm MLC
- **Bus Speed Mode**
  - 4GB~64GB: UHS-I
- **Power Consumption**[Note1]
  - Power Up Current < 250uA
  - Standby Current < 250uA
  - Read Current <200mA
  - Write Current <200mA
- **Performance**
  - Read: Up to 26 MB/s
  - Write: Up to 16 MB/s
- **Advanced Flash Management**
  - Static and Dynamic Wear Leveling
  - Bad Block Management
  - SMART Function [Noted2]
  - Auto-Read Refresh
- **Storage Temperature Range**
  - -40°C ~ 85°C
- **Operation Temperature Range**
  - Gold grade: -25°C ~ 85°C
  - Diamond grade: -40~85°C
- **RoHS compliant**

Notes:

1. Please see “5.1 Power Consumption” for details.
2. This function is enabled by customer requirement and please see “1.2.4 Smart Function” for detail

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1. INTRODUCTION

1.1. General Description

The Micro Secure Digital (microSD) card version 3.0 is fully compliant to the specification released by SD Card Association. The Command List supports [Part 1 Physical Layer Specification Ver3.01 Final] definitions. Card Capacity of Non-secure Area, Secure Area Supports [Part 3 Security Specification Ver3.00 Final] Specifications.

The microSD 3.0 card comes with 8-pin interface, designed to operate at a maximum operating frequency of 50MHz or 100MHz. It can alternate communication protocol between the SD mode and SPI mode. It performs data error detection and correction with very low power consumption. Its capacity could be more than 4GB and up to 64GB in the future with FAT32 which is called Micro SDHC (microSD High Capacity).

Phison Industrial micro Secure Digital 3.0 card is one of the most popular cards today based on its high performance, good reliability and wide compatibility. Not to mention that it's well adapted for hand-held applications in semi-industrial/medical markets already. Moreover, with customized firmware technique, Phison Industrial 8032 microSD 3.0 can be configured with pSLC SD Mode and presents outstanding performance along with better P/E cycles.

1.2. Flash Management

1.2.1. Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, PS8032 applies the BCH ECC Algorithm, which can detect and correct errors occur during Read process, ensure data been read correctly, as well as protect data from corruption.

1.2.2. Wear Leveling

NAND Flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some area get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling technique is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

Phison provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND Flash is greatly improved.

1.2.3. Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks”. Phison implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

1.2.4. Smart Function

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an special function that allows a memory device to automatically monitor its health. Phison provides a program named SmartInfo Tool to observe Phison’s SD and microSD cards. **Note that this tool can only support Phison’s PS8032 controller and industrial SD and microSD cards.** This tool will display the controller version, flash type, firmware version, endurance life ratio, good block ratio, and so forth. In addition, a warning message will

appear under the following 3 conditions:

(1) When the life ratio remained is less than **10%**,

(2) When the amount of abnormal power on is more than **3,500** cycles, and

(3) When there are less than **5** usable blocks for replacing bad blocks.

1.2.5. Auto-Read Refresh

Auto-Read Refresh is especially applied on devices that read data mostly but rarely write data, such as GPS. When blocks are continuously read, then the device cannot activate wear leveling since it can only be applied while writing data. Thus, errors will accumulate and become uncorrectable. Accordingly, to avoid errors exceed the amount ECC can correct and blocks turn bad, Phison's firmware will automatically refresh the bit errors when the error number in one block approaches the threshold, ex., 24 bits.

2. PRODUCT SPECIFICATIONS

- **Capacity**
  - MLC: 4GB up to 64GB (Diamond & Gold)
- **Operation Temp. Range**
  - Gold Series: -25~85°C
  - Diamond Series: -40~+85°C
- **Storage Temp. Range**
  - -40~+85°C
- **Support SD system specification version 3.0**
- **Card capacity of non-secure area and secure area support [Part 3 Security Specification Ver3.0 Final] Specifications**
- **Support SD SPI mode**
- **Designed for read-only and read/write cards**
- **Bus Speed Mode (use 4 parallel data lines)**
  - **UHS-I mode**
    - SDR12: SDR up to 25MHz, 1.8V signaling
    - SDR25: SDR up to 50MHz, 1.8V signaling
    - SDR50: 1.8V signaling, frequency up to 100MHz, up to 50 MB/sec
    - DDR50: 1.8V signaling, frequency up to 50MHz, sampled on both clock edges, up to 50 MB/sec

    Note: Timing in 1.8V signaling is different from that of 3.3V signaling.
- **The command list supports [Part 1 Physical Layer Specification Ver3.1 Final] definitions**
- **Copyrights Protection Mechanism**
  - Compliant with the highest security of SDMI standard
- **Support CPRM (Content Protection for Recordable Media) of SD Card**
- **Card removal during read operation will never harm the content**
- **Password Protection of cards (optional)**
- **Write Protect feature using mechanical switch**
- **Built-in write protection features (permanent and temporary)**
- **+4KV/-4KV ESD protection in contact pads**
- **Operation voltage range: 2.7 ~ 3.6V**

- **Performance**
  - MLC

Capacity	Mode	Flash Structure	Sequential	
			Read (MB/s)	Write (MB/s)
4GB	UHS-I	TSB 19nm 4GB x 1	26	12
8GB	UHS-I	TSB 19nm 8GB x 1	26	12
16GB	UHS-I	TSB 19nm 8GB x 2	26	12
32GB	UHS-I	TSB 19nm 8GB x 4	26	12
64GB	UHS-I	TSB 19nm 8GB x 8	26	16

NOTES:

1. The performance is obtained from TestMetrix Test (@500MB).
2. Samples are made of Toshiba 19nm MLC Toggle NAND Flash.
3. Performance may vary from flash configuration and platform.
4. The table above is for your reference only. The criteria for MP (mass production) and for accepting goods shall be discussed based on different flash configuration.

3. ENVIRONMENTAL SPECIFICATIONS

3.1. Environmental Conditions

Temperature and Humidity

- Storage Temperature Range
  - -40°C ~ 85°C
- Operation Temperature Range
  - Gold grade: -25°C ~ 85°C
  - Diamond grade: -40°C ~ 85°C

Table 3-1 High Temperature Test Condition (Gold Series)

	Temperature	Humidity	Test Time
Operation	85°C	0% RH	168 hours
Storage	85°C	0% RH	500 hours

Result: No any abnormality is detected.

Table 3-2 High Temperature Test Condition (Diamond Series)

	Temperature	Humidity	Test Time
Operation	85°C	0% RH	300 hours
Storage	85°C	0% RH	500 hours

Result: No any abnormality is detected.

Table 3-3 Low Temperature Test Condition (Gold Series)

	Temperature	Humidity	Test Time
Operation	-25°C	0% RH	168 hours
Storage	-40°C	0% RH	300 hours

Result: No any abnormality is detected.

Table 3-4 Low Temperature Test Condition (Diamond Series)

	Temperature	Humidity	Test Time
Operation	-40°C	0% RH	168 hours
Storage	-40°C	0% RH	500 hours

Result: No any abnormality is detected.

Table 3-5 High Humidity Test Condition (Gold Series)

	Temperature	Humidity	Test Time
Operation	40°C	95% RH	4 hours
Storage	40°C	95% RH	500 hours

Result: No any abnormality is detected.

Table 3-6 High Humidity Test Condition (Diamond Series)

	Temperature	Humidity	Test Time
Operation	55°C	95% RH	4 hours
Storage	55°C	95% RH	500 hours

Result: No any abnormality is detected.

Table 3-7 Temperature Cycle Test (Gold Series)

	Temperature	Test Time	Cycle
Operation	-25°C	30 min	20 Cycles
	85°C	30 min	
Storage	-40°C	30 min	20 Cycles
	85°C	30 min	

Result: No any abnormality is detected.

Table 3-8 Temperature Cycle Test (Diamond Series)

	Temperature	Test Time	Cycle
Operation	-40°C	30 min	20 Cycles
	85°C	30 min	
Storage	-40°C	30 min	50 Cycles
	85°C	30 min	

Result: No any abnormality is detected.

Shock

Table 3-9 Shock Specification

	Acceleration Force	Half Sin Pulse Duration
Industrial microSD card	1500G	0.5ms

Result: No any abnormality is detected when power on.

Vibration

Table 3-10 Vibration Specification

	Condition		Vibration Orientation
	Frequency/Displacement	Frequency/Acceleration	
Industrial microSD card	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G	X, Y, Z axis/30 min for each

Result: No any abnormality is detected when power on.

Drop

Table 3-11 Drop Specification

	Height of Drop	Number of Drop
Industrial microSD card	150cm free fall	6 face of each unit

Result: No any abnormality is detected when power on.

Bending

Table 3-12 Bending Specification

	Force	Action
Industrial microSD card	≥ 10N	Hold 1min/5times

Result: No any abnormality is detected when power on.

Torque

Table 3-13 Torque Specification

	Force	Action
Industrial microSD card	0.1N-m or +/-2.5 deg	Hold 30 seconds/5times

Result: No any abnormality is detected when power on.

Salt Spray Test

Table 3-14 Salt Spray Specification

	Condition	Action
Industrial microSD card	Concentration: 3% NaCl Temperature: 35℃	Storage for 24 HRS

Result: No any abnormality is detected when power on.

Waterproof Test

Table 3-15 Waterproof Specification

	Condition	Action
Industrial microSD card	Water temperature: 25℃ Water depth: The lowest point of unit is locating 1000mm below surface.	Storage for 30 mins

Result: JIS IPX7 compliance. No any abnormality is detected when power on.

Test X-Ray Exposure Test

Table 3-16 X-Ray Exposure Specification

	Condition	Action
Industrial microSD card	0.1 Gy of medium-energy radiation (70 keV to 140 keV, cumulative dose per year) to both sides of the card	Storage for 30 mins

Result: ISO 7816-1 compliance. No any abnormality is detected when power on.

Electrostatic Discharge (ESD)

Table 3-17 Contact ESD Specification

	Condition	Result
Industrial microSD card	Contact: +/- 4KV each item 25 times Air: +/- 8KV 10 times	PASS

EMI Compliance

- FCC: CISPR22
- CE: EN55022
- BSMI 13438

4. SD CARD COMPARISON

Table 4-1 Comparing SD3.0 Standard and SD3.0 SDHC

	SD3.0 Standard (Backward compatible to 2.0 host)	SD3.0 SDHC
Addressing Mode	Byte (1 byte unit)	Block (512 byte unit)
HCS/CCS bits of ACMD41	Support	Support
CMD8 (SEND_IF_COND)	Support	Support
CMD16 (SET_BLOCKLEN)	Support	Support (Only CMD42)
Partial Read	Support	Not Support
Lock/Unlock Function	Mandatory	Mandatory
Write Protect Groups	Optional	Not Support
Supply Voltage 2.0v – 2.7v (for initialization)	Not Support	Not Support
Total Bus Capacitance for each signal line	40pF	40pF
CSD Version (CSD_STRUCTURE Value)	1.0 (0x0)	2.0 (0x1)
Speed Class	**Optional**	Mandatory (Class 2 / 4 / 6 / 10)

5. ELECTRICAL SPECIFICATIONS

5.1. Power Consumption

The table below is the power consumption of PS8032 with different flash memory types.

Table 5-1 Power Consumption of PS8032 Industrial microSD card

Flash Mode	Max. Power Up Current (uA)	Max. Standby Current (uA)	Max. Read Current (mA)	Max. Write Current (mA)
Single Flash[Note1] (1 x 8bit)	150	150	100	100
SDR/DDR	250	250	200	200

NOTE:

1. Data transfer mode is single channel.

5.2. Electrical Specifications

Absolute Maximum Rating

Item	Symbol	Parameter	MIN	MAX	Unit
1	V_{DD}-V_{SS}	DC Power Supply	-0.3	+3.3	V
2	V_{IN}	Input Voltage	V_{SS}-0.3	V_{DD}+0.3	V
3	Ta	Operating Temperature (Gold)	-25	+85	℃
4	Ta	Operating Temperature (Diamond)	-40	+85	℃
5	Tst	Storage Temperature	-40	+85	℃
6	V_{DD}	V_{DD} Voltage	2.7	3.6	V

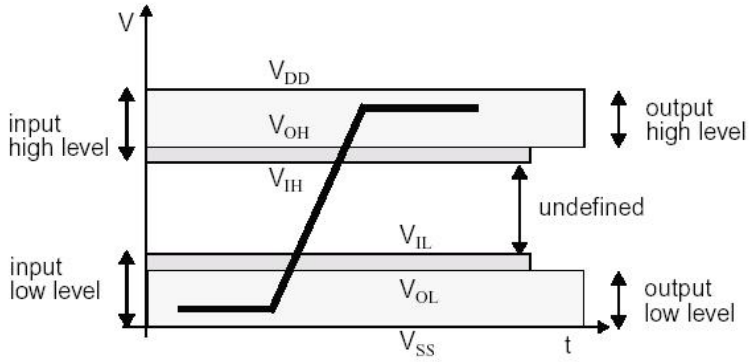
5.3. DC Characteristic

5.3.1. Bus Operation Conditions for 3.3V Signaling

Table 5-2 Threshold Level for High Voltage Range

Parameter	Symbol	Min	Max	Unit	Remarks
Supply voltage	V_{DD}	2.7	3.6	V	
Output High Voltage	V_{OH}	0.75*V_{DD}		V	IOH=-100uA V_{DD}Min.
Output Low Voltage	V_{OL}		0.125*V_{DD}	V	I_{OL} = 100uA $V_{DD\ min}$
Input High Voltage	V_{IH}	0.625*V_{DD}	V_{DD}+0.3	V	
Input Low Voltage	V_{IL}	V_{SS}-0.3	0.25 *V_{DD}	V	
Power up time			250	ms	from 0v to VDD min.

Bus Signal Levels



Bus signal levels

Table 5-3 Peak Voltage and Leakage Current

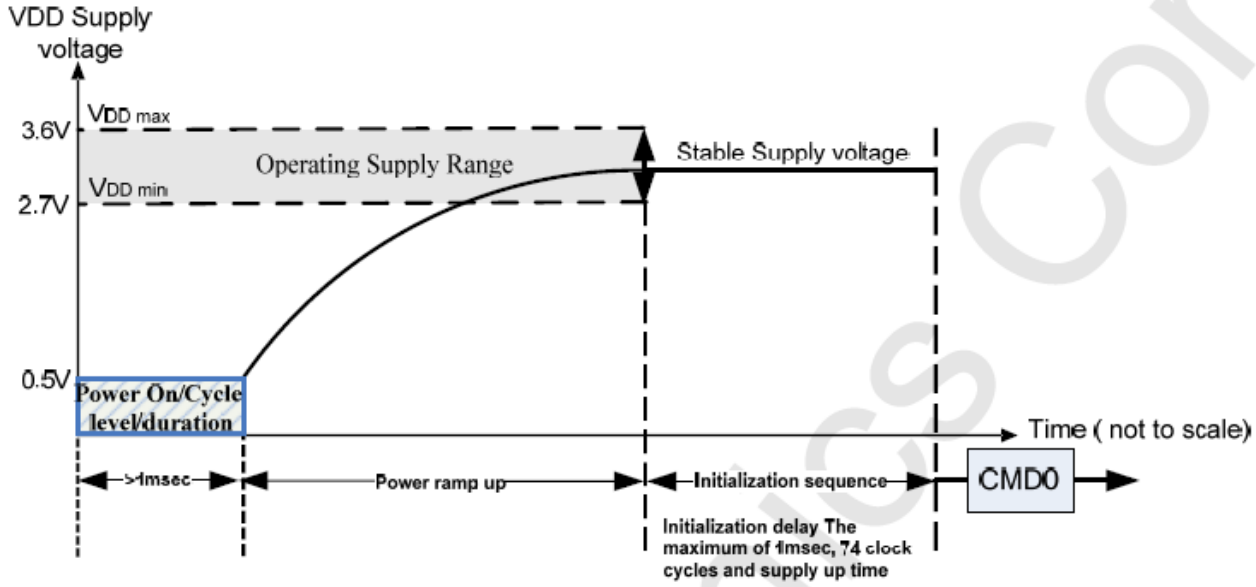
Parameter	Symbol	Min	Max.	Unit	Remarks
Peak voltage on all lines		-0.3	V_{DD}+0.3	V	
All Inputs					
Input Leakage Current		-10	10	uA	
All Outputs					
Output Leakage Current		-10	10	uA	

5.3.2. Bus Signal Line Levels

Parameter	symbol	Min	Max	Unit	Remark
Pull-up resistance	R_{CMD} R_{DAT}	10	100	kΩ	to prevent bus floating
Total bus capacitance for each signal line	C_L		40	pF	1 card CHOST+CBUS shall not exceed 30 pF
Capacitance of the card for each signal pin	CCARD		10	pF	
Maximum signal line inductance			16	nH	f_{pp}<20 MHz
Pull-up resistance inside card (pin1)	RDAT3	10	90	kΩ	May be used for card detection

5.3.3. Power Up Time

Host needs to keep power line level less than 0.5V and more than 1ms before power ramp up.



Power On or Power Cycle

Followings are requirements for Power on and Power cycle to assure a reliable SD Card hard reset.

(1) Voltage level shall be below 0.5V

(2) Duration shall be at least 1ms.

Power Supply Ramp Up

The power ramp up time is defined from 0.5V threshold level up to the operating supply voltage which is stable between VDD (min.) and VDD (max.) and host can supply SDCLK.

Followings are recommendation of Power ramp up:

(1) Voltage of power ramp up should be monotonic as much as possible.

(2) The minimum ramp up time should be 0.1ms.

(3) The maximum ramp up time should be 35ms for 2.7-3.6V power supply.

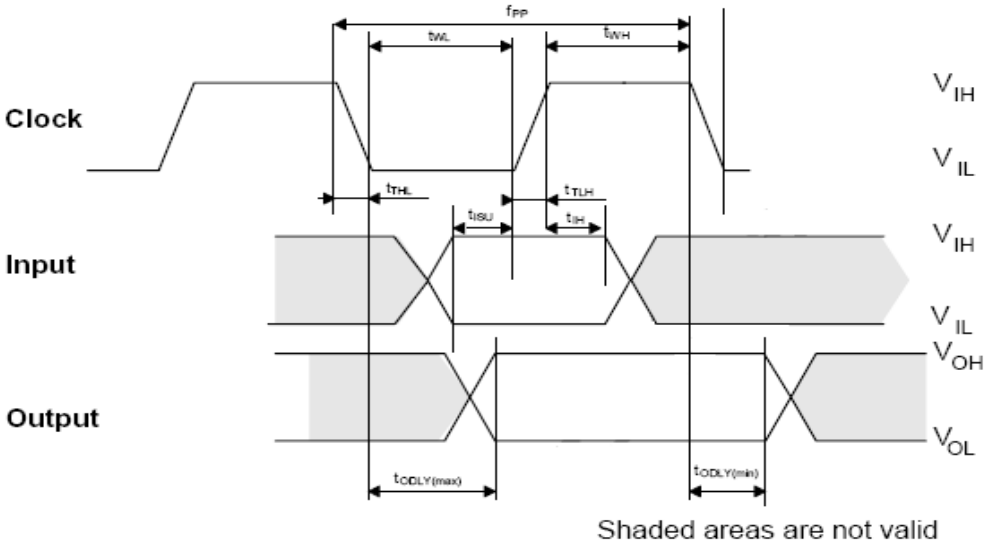
Power Down and Power Cycle

• When the host shuts down the power, the card VDD shall be lowered to less than 0.5Volt for a minimum period of 1ms. During power down, DAT, CMD, and CLK should be disconnected or driven to logical 0 by the host to avoid a situation that the operating current is drawn through the signal lines.

• If the host needs to change the operating voltage, a power cycle is required. Power cycle means the power is turned off and supplied again. Power cycle is also needed for accessing cards that are already in *Inactive State*. To create a power cycle the host shall follow the power down description before power up the card (i.e. the card VDD shall be once lowered to less than 0.5Volt for a minimum period of 1ms).

5.4. AC Characteristic

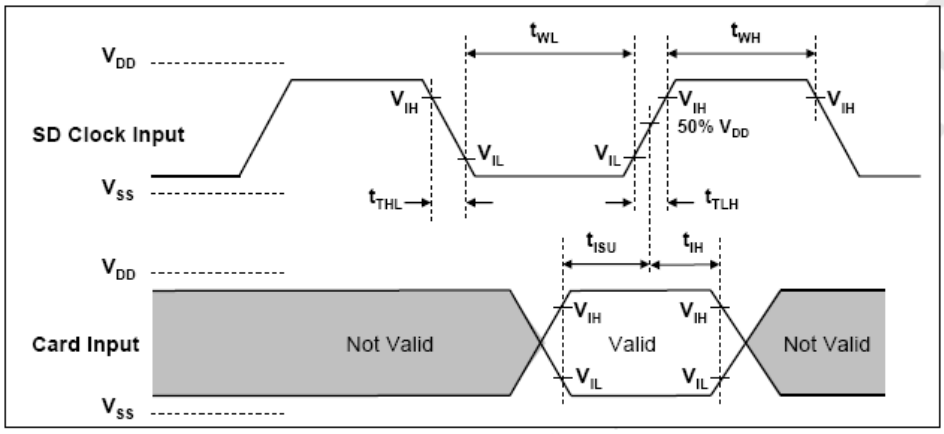
5.4.1. microSD Interface timing (Default)



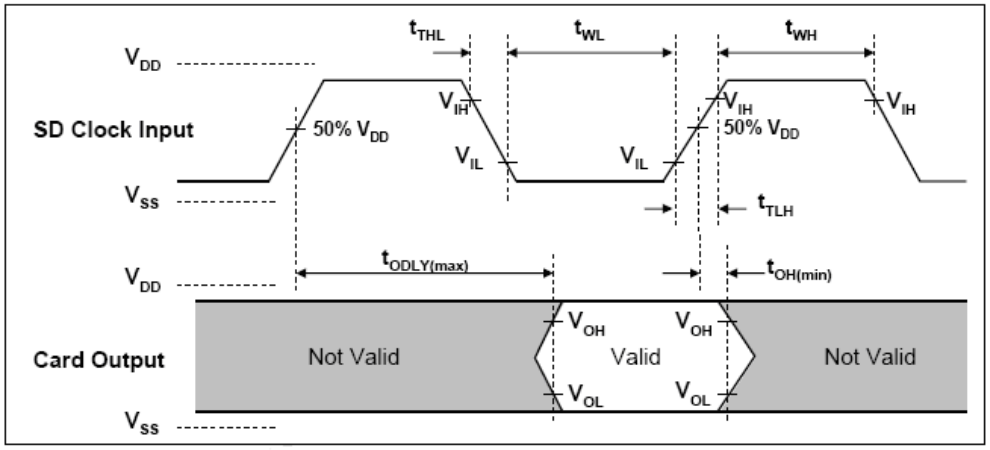
Parameter	Symbol	Min	Max	Unit	Remark
Clock CLK (All values are referred to min(V_{IH}) and max(V_{IL})					
Clock frequency Data Transfer Mode	f_{PP}	0	25	MHz	C_{card}≤ 10 pF (1 card)
Clock frequency Identification Mode	f_{OD}	$0_{(1)}$/100	400	kHz	C_{card}≤ 10 pF (1 card)
Clock low time	t_{WL}	10		ns	C_{card}≤ 10 pF (1 card)
Clock high time	t_{WH}	10		ns	C_{card}≤ 10 pF (1 card)
Clock rise time	t_{TLH}		10	ns	C_{card}≤ 10 pF (1 card)
Clock fall time	t_{THL}		10	ns	C_{card}≤ 10 pF (1 card)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	t_{ISU}	5		ns	C_{card}≤ 10 pF (1 card)
Input hold time	t_{IH}	5		ns	C_{card}≤ 10 pF (1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Data Transfer Mode	t_{ODLY}	0	14	ns	C_L≤40 pF (1 card)
Output Delay time during Identification Mode	tODLY	0	50	ns	C_L≤40 pF (1 card)

(1) 0Hz means to stop the clock. The given minimum frequency range is for cases were continues clock is required.

5.4.2. microSD Interface Timing (High-Speed Mode)



Card Input Timing (High Speed Card)



Card Output Timing (High Speed Mode)

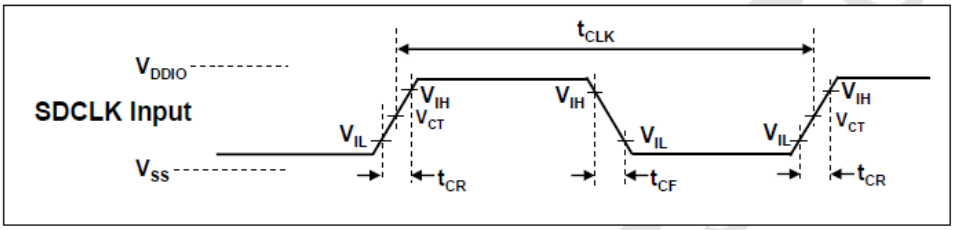
Parameter	Symbol	Min	Max	Unit	Remark
Clock CLK (All values are referred to min(V_{IH}) and max(V_{IL})					
Clock frequency Data Transfer Mode	f_{PP}	0	50	MHz	$C_{card} \leq 10$ pF (1 card)
Clock low time	t_{WL}	7		ns	$C_{card} \leq 10$ pF (1 card)
Clock high time	t_{WH}	7		ns	$C_{card} \leq 10$ pF (1 card)
Clock rise time	t_{TLH}		3	ns	$C_{card} \leq 10$ pF (1 card)
Clock fall time	t_{THL}		3	ns	$C_{card} \leq 10$ pF (1 card)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	t_{ISU}	6		ns	$C_{card} \leq 10$ pF (1 card)
Input hold time	t_{IH}	2		ns	$C_{card} \leq 10$ pF (1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Data	t_{ODLY}		14	ns	$C_L \leq 40$ pF

Transfer Mode					(1 card)
Output Hold time	T_{OH}	2.5		ns	$C_L \leq 15$ pF (1 card)
Total System capacitance of each line[1]	C_L		40	pF	CL ≤ 15 pF (1 card)

(1) In order to satisfy severe timing, the host shall drive only one card.

5.4.3. microSD Interface timing (SDR12, SDR25 and SDR50 Modes)

Input:

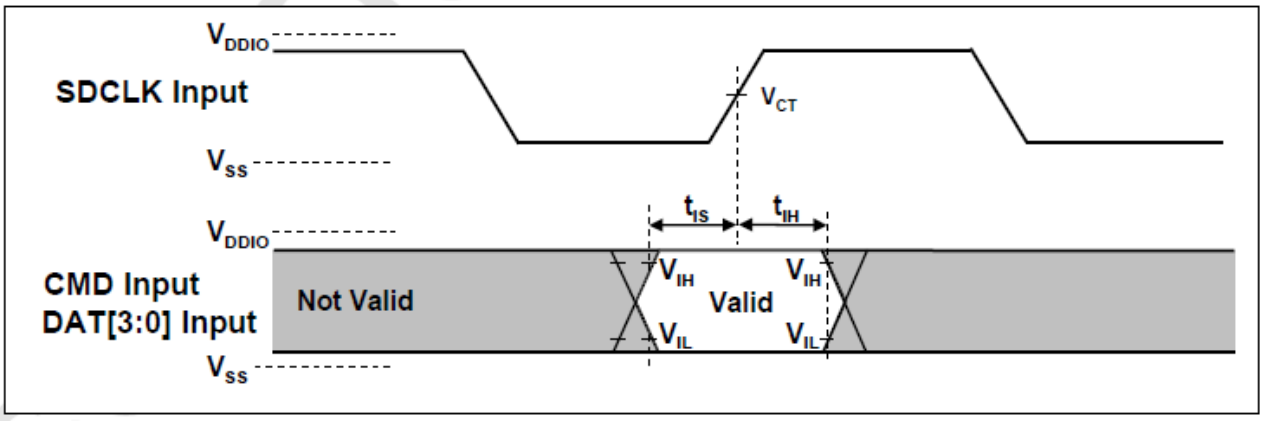


Clock Signal Timing

Symbol	Min	Max	Unit	Remark
tCLK	4.80	-	ns	208MHz (Max.), Between rising edge, VCT= 0.975V
tCR, tCF	-	0.2* tCLK	ns	tCR, tCF < 2.00ns (max.) at 100MHz, CCARD=10pF
Clock Duty	30	70	%	

Clock Signal Timing

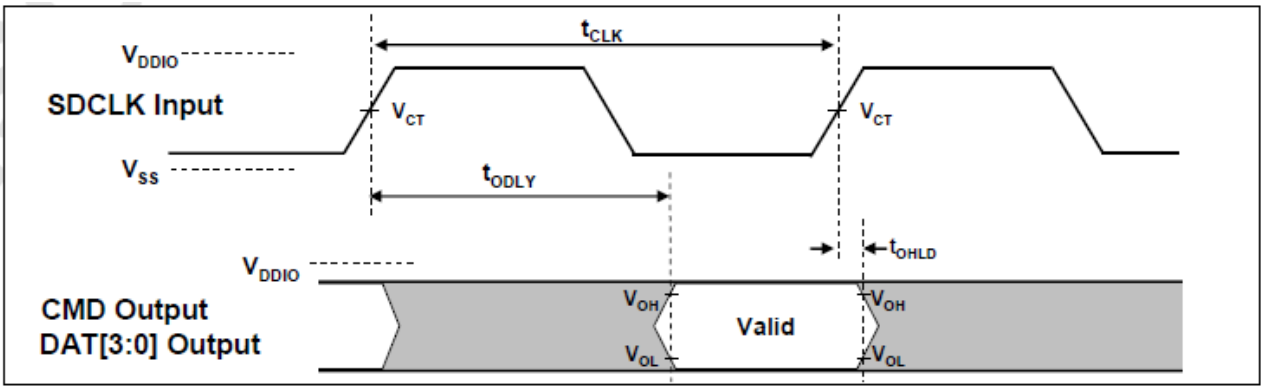
SDR50 Input Timing:



Card Input Timing

Symbol	Min	Max	Unit	SDR50 Mode
tIs	3.00	-	ns	CCARD =10pF, VCT= 0.975V
tIH	0.80	-	ns	CCARD =5pF, VCT= 0.975V

Output:

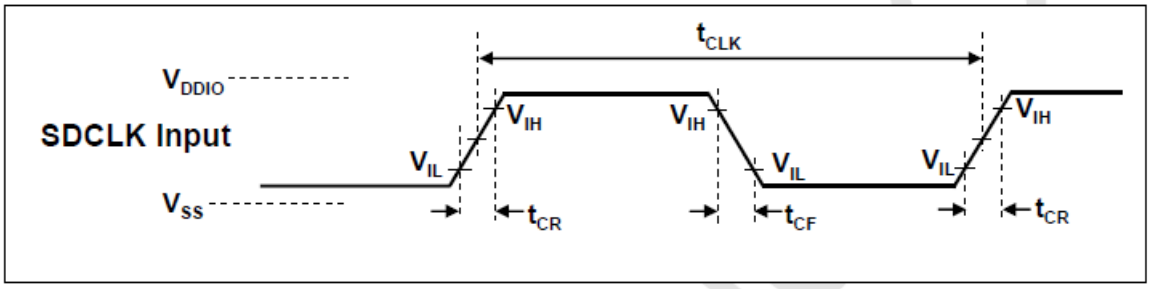


Output Timing of Fixed Data Window

Symbol	Min	Max	Unit	Remark
tODLY	-	7.5	ns	tCLK>=10.0ns, CL=30pF, using driver Type B, for SDR50
tODLY	-	14	ns	tCLK>=20.0ns, CL=40pF, using driver Type B, for SDR25 and SDR12,
TOH	1.5	-	ns	Hold time at the tODLY (min.), CL=15pF

Output Timing of Fixed Data Window

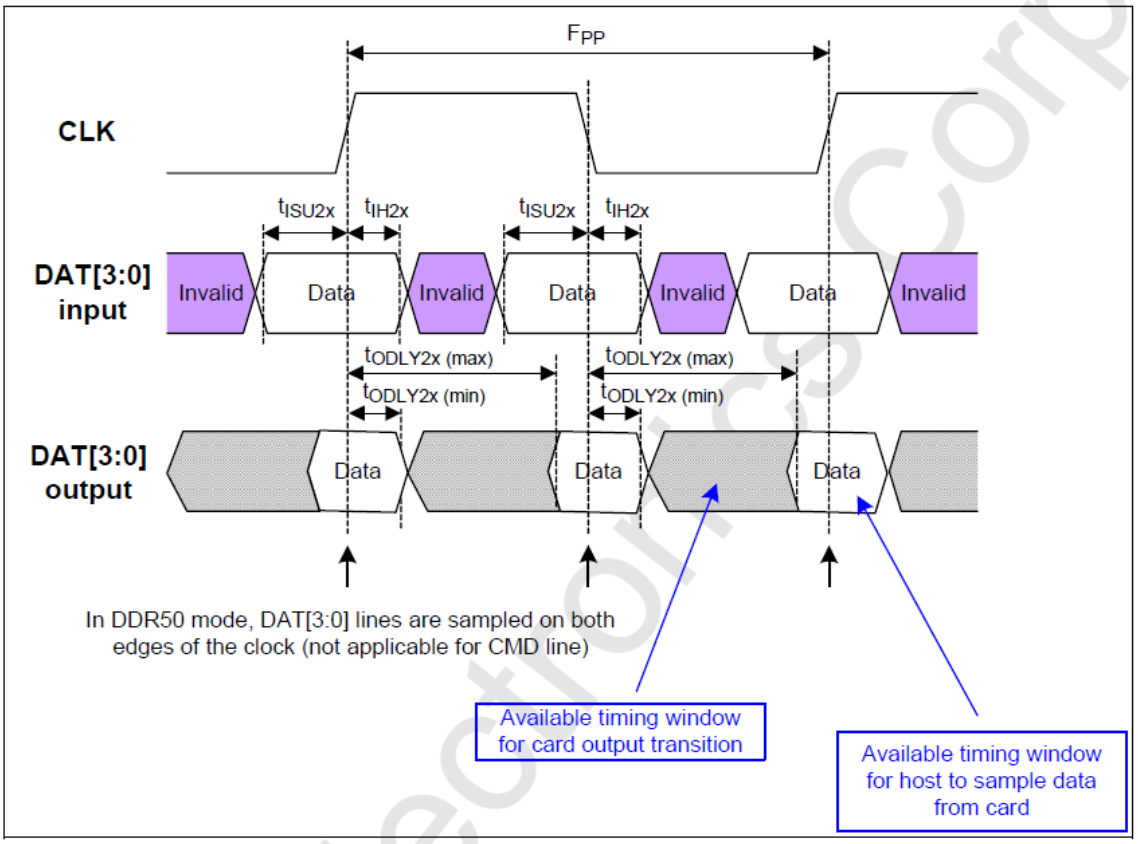
5.4.4. microSD Interface timing (DDR50 Modes)



Clock Signal Timing

Symbol	Min	Max	Unit	Remark
tCLK	**20**	**-**	**ns**	**50MHz (Max.), Between rising edge**
tCR, tCF	**-**	**0.2* tCLK**	**ns**	**tCR, tCF < 4.00ns (max.) at 50MHz, CCARD=10pF**
Clock Duty	**45**	**55**	**%**	

Clock Signal Timing



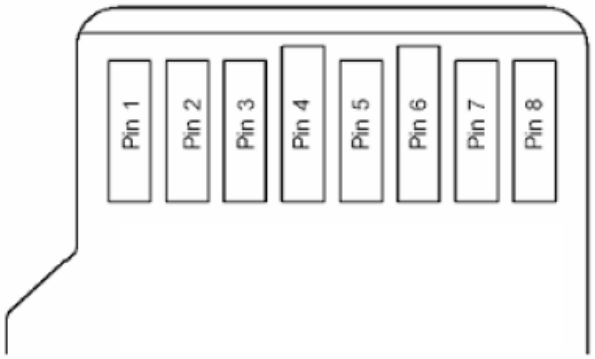
Timing Diagram DAT Inputs/Outputs Referenced to CLK in DDR50 Mode

Parameter	Symbol	Min	Max	Unit	Remark
Input CMD (referenced to CLK rising edge)					
Input set-up time	t_{ISU}	6	-	ns	C_{card}≤ 10 pF (1 card)
Input hold time	t_{IH}	0.8	-	ns	C_{card}≤ 10 pF (1 card)
Output CMD (referenced to CLK rising edge)					
Output Delay time during Data Transfer Mode	t_{ODLY}		13.7	ns	C_L≤30 pF (1 card)
Output Hold time	T_{OH}	1.5	-	ns	C_L≥15 pF (1 card)
Inputs DAT (referenced to CLK rising and falling edges)					
Input set-up time	t_{ISU2x}	3	-	ns	C_{card}≤ 10 pF (1 card)
Input hold time	t_{IH2x}	0.8	-	ns	C_{card}≤ 10 pF (1 card)
Outputs DAT (referenced to CLK rising and falling edges)					
Output Delay time during Data Transfer Mode	t_{ODLY2x}	-	7.0	ns	C_L≤25 pF (1 card)
Output Hold time	T_{OH2x}	1.5	-	ns	C_L≥15 pF (1 card)

Bus Timings – Parameters Values (DDR50 mode)

6. INTERFACE

6.1. Pad Assignment and Descriptions



pin	SD Mode			SPI Mode		
	Name	Type[1]	Description	Name	Type	Description
1	DAT2	I/O/PP	Data Line[bit2]	RSV		
2	CD/DAT3 [2]	I/O/PP [3]	Card Detect/ Data Line[bit3]	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[bit0]	DO	O/PP	Data Out
8	DAT1	I/O/PP	Data Line[bit1]	RSV		

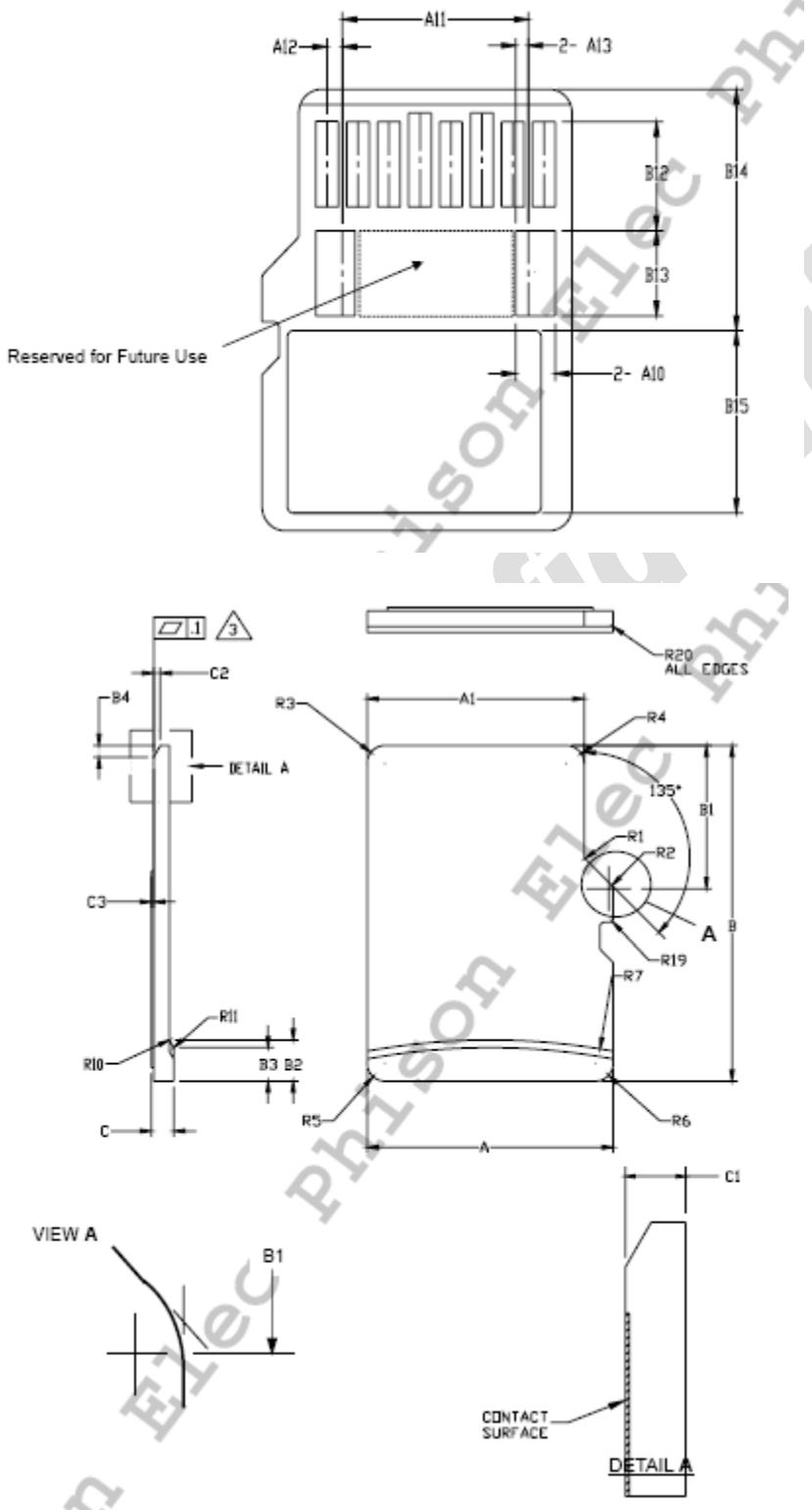
(1) S: power supply, I: input; O: output using push-pull drivers; PP:I/O using push-pull drivers

(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. It is defined so, in order to keep compatibility to MultiMedia Cards.

(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 period, with SET_CLR_CARD_DETECT (ACMD42) command.

Name	Width	Description
CID	128bit	Card identification number; card individual number for identification. **Mandatory**
RCA[1]	16bit	Relative card address; local system address of a card, dynamically suggested by the card and approved by the host during initialization. **Mandatory**
DSR	16bit	Driver Stage Register; to configure the card's output drivers. **Optional**
CSD	128bit	Card Specific Data; information about the card operation conditions. **Mandatory**
SCR	64bit	SD Configuration Register; information about the SD Memory Card's Special Features capabilities **Mandatory**
OCR	32bit	Operation conditions register. **Mandatory.**
SSR	512bit	SD Status; information about the card proprietary features **Mandatory**
OCR	32bit	Card Status; information about the card status **Mandatory**

7. PHYSICAL DIMENSION



	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	0.70	0.80	0.90	
R6	0.70	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	0.02	-	0.15	

Notes:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

2. DIMENSIONS ARE IN MILLIMETERS.

3. COPLANARITY IS ADDITIVE TO C1 MAX. THICKNESS.

Revision History

Revision	History	Draft Date	Remark
1.0	Modify spec format	2012/8/28	Justina
1.1	Modify reliability note	2013/5/13	Justina
1.2	Modify environment conditions	2013/7/24	Justina
1.3	Modify Pseudo SLC information	2013/11/1	Justina
1.4	1.Remove Pseudo SLC 2. Add Noted of Smart function 3. Modify 512MB combination and Performance data 4. Add Mechanical reliability testing items	2014/2/7	Wenyi

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