RoHS Recast Compliant

Industrial Micro SD 3.0

Specifications

March 5th, 2013

Version 1.1

FEATURES:

- **Fully compatible with SD Card Association specifications**

  - Part 1, Physical Layer Specification, Version 3.1 Final

  - Part 3, Security Specification, Version 3.0 Final

- **Capacity range**

  - 4, 8, 16, 32 GB

- **Performance***

  - Sustained Read: Up to 19 MB/sec

  - Sustained Write: Up to 12 MB/sec

- **SD-protocol compatible**

- **Supports SD SPI mode**

- **Backward compatible with 2.0**

- **NAND Flash Type: MLC**

- **Operating frequency: up to 100 MHz**

- **Intelligent endurance design**

  - Built-in advanced ECC algorithm

  - Wear-leveling

  - Flash bad-block management

  - Built in write protect

- **Temperature ranges**

  - Operating temperature: -25 ~ +85°C

  - Storage temperature: -40°C ~ +85°C

- **Operating voltage: 2.7V ~ 3.6V**

- **Power consumption***

  - Operating: 47 mA

  - Standby: 150 uA

- **Physical dimension :** 15mm(L) x 11mm(W) x 1mm(H)

- **RoHS Recast Compliant (2011/65/EU)**

*Vary from capacities. Performance values presented here are typical and may vary depending on settings and platforms.

Rev. 1.1

TABLE OF CONTENTS

1. General Description

As the demand of reliable and high-performance data storage in a small form factor increases, Apacer's Micro SD card 3.0 is designed specifically for multiple applications by offering high endurance, reliability, and agility, where extreme flexibility, endurance, data integrity, and exceptionally transmission are required.

The Micro SD 3.0 card fully complies with SD Card Association standard. The Command List is compatible with [Part 1 Physical Layer Specification Ver3.1 Final] definitions, while the Card Capacity of Non-secure Area, Secure Area supports [Part 3 Security Specification Ver3.0 Final] Specifications. The card allows selection of either SD or SPI mode for compatibility in data communication. To provide higher transfer rate, the card can extend to 100MHz clock frequency.

The card also comes with endurance features for data error detection and correction, write protection, and password protection.

1.1 Product Function Block

The Micro SD contains a card controller and a memory core for the SD standard interface.
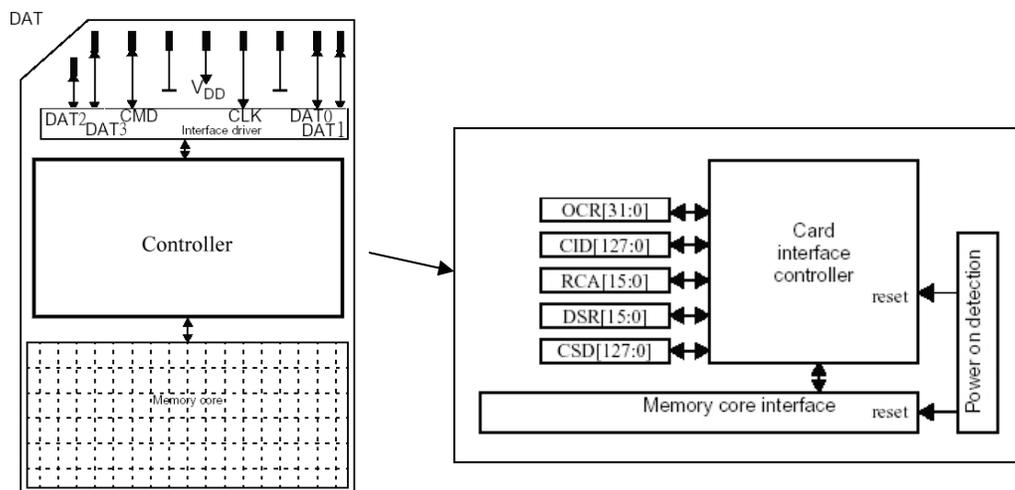
1.2 Functional description

The Micro SD device contains a high level, intelligent flash management that provides many capabilities including:

- High performance flash memory control

- ECC algorithms

- Wear leveling

- Power management

Rev. 1.1

1.2.1 Flash Management

The SD controller contains logic/physical flash block mapping and bad block management system. It will manage all flash block including user data space and spare block.

The Micro SD also contains a sophisticated defect and error management system. It does a read after write under margin conditions to verify that the data is written correctly (except in the case of write pre-erased sectors). In case that a bit is found to be defective, the SD will replace this bad bit with a spare bit within the sector header. If necessary, the Micro SD will even replace the entire sector with a spare sector. This is completely transparent to the master (host device) and does not consume any user data space.

1.2.2 Powerful ECC Algorithms

The powerful ECC algorithms will enhance flash block use rate and whole device life. The SD controller supports up to 68bits ECC circuits to protect data transfer.

1.2.3 Power Management

A power saving feature of the Micro SD is automatic entrance and exit from sleep mode. Upon completion of an operation, the SD will enter the sleep mode to conserve power if no further commands are received within X seconds, where X is programmable by software. The master does not have to take any action for this to occur. The SD is in sleep mode except when the host is accessing it, thus conserving power.

Any command issued by the master to the Micro SD will cause it to exit sleep mode and response to the master.

2. Electrical characteristics

2.1 Card Architecture
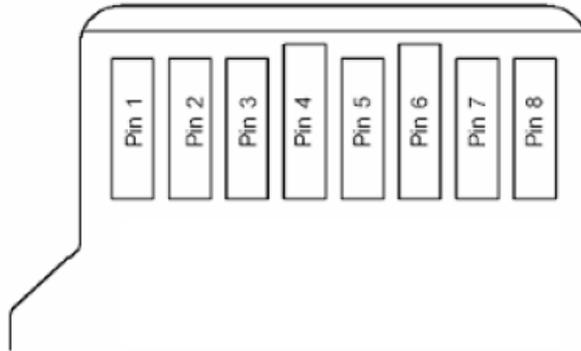
2.2 Pin Assignment

Pin	SD Mode		SPI Mode	
	Name	**Description**	**Name**	**Description**
1	DAT2	Data line[bit 2]	Reserved	
2	CD/DAT3 [2]	Card Detect/Data line [bit 3]	CS	Chip select
3	CMD	Command/Response	DI	Data in
4	VDD	Supply voltage	VDD	Supply voltage
5	CLK	Clock	SCLK	Clock
6	VSS	Supply voltage ground	VSS	Supply voltage ground
7	DAT0	Data line[bit 0]	DO	Data out
8	DAT1	Data line[bit 1]	Reserved	

Rev. 1.1

2.3 Capacity Specification

The following table shows the specific capacity for the SD 3.0 card.

Capacity	Total Bytes
4 GB	3,972,005,888
8 GB	7,960,788,992
16 GB	15,997,075,456
32 GB	32,078,036,992

Note: total bytes are viewed under Windows operating system and were measured by SD format too.

2.4 Performance

Performances of the SD 3.0 card are shown in the table below.

Modes \ Capacity	4 GB	8 GB	16 GB	32 GB
Read (MB/s)	19	19	19	19
Write (MB/s)	12	12	12	12

Note: results may vary depending on settings and platforms.

2.5 Electrical

Operating Voltages

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Power Supply Voltage	2.7	3.6	V

Power consumption

Modes \ Capacity	4 GB	8 GB	16 GB	32 GB
Operating (**mA**)	40	42	45	47
Standby (**uA**)	100	100	100	150

Note: results may vary depending on settings and platforms.

3. Physical Characteristics

3.1 Physical Dimension

Reserved for Future Use

DETAIL A

VIEW A

CONTACT SURFACE

DETAIL A

Rev. 1.1
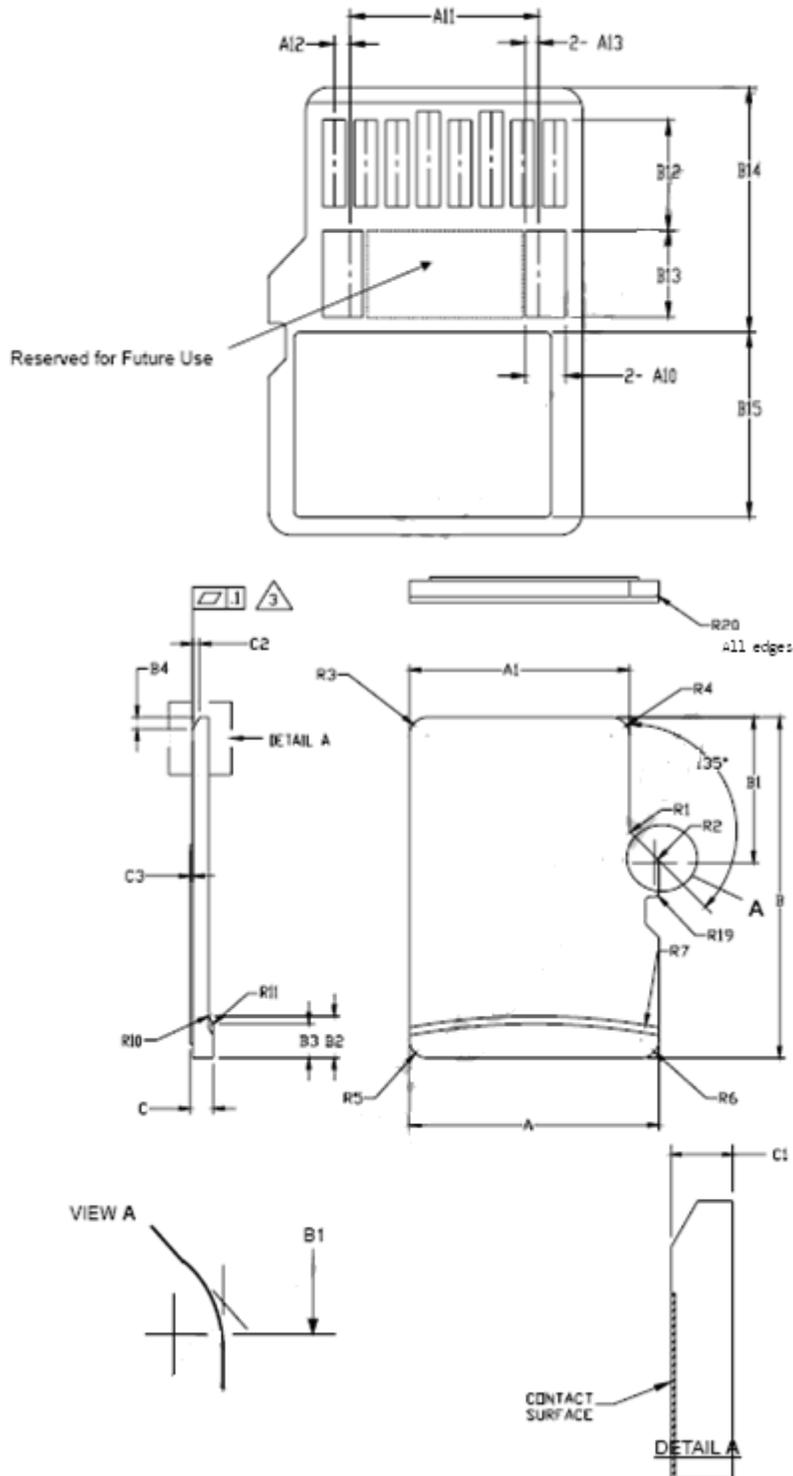
	COMMON DIMENSIONS			
SYMBOL	MIN	NOM	MAX	NOTE
A	10.90	11.00	11.10	
A1	9.60	9.70	9.80	
A2	-	3.85	-	BASIC
A3	7.60	7.70	7.80	
A4	-	1.10	-	BASIC
A5	0.75	0.80	0.85	
A6	-	-	8.50	
A7	0.90	-	-	
A8	0.60	0.70	0.80	
A9	0.80	-	-	
A10	1.35	1.40	1.45	
A11	6.50	6.60	6.70	
A12	0.50	0.55	0.60	
A13	0.40	0.45	0.50	
B	14.90	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.

Rev. 1.1

3.2 Environmental Specifications

Climatic Testing			
Test Item	**DUT State**	**Test Condition (Gold Series)**	
		Temperature	**Duration**
High Temperature	Storage	85℃	500 Hours
High Temperature	Operation	85℃	168 Hours
Low Temperature	Storage	- 40℃	300 Hours
Low Temperature	Operation	- 25℃	168 Hours
High Temperature & High Humidity	Storage	40℃ 95%	500 Hours
High Temperature & High Humidity	Operation	40℃ 95%	4 Hour
Thermal Cycling	Storage*	- 40℃ ~ 85℃ 30min hold each	20 Cycles

Durability Testing	
Test Item	**Descriptions**
Insertion/Removal	10,000 cycles

Rev. 1.1

Bending	10nt/Stimes for 6 faces and 4 corners (each drop was performed 3 times, total of 30 drops)
Electrostatic Discharge	Contact discharge: HCP & VCP Air discharge:　　ALL – 　VSS (±), 　　　　　　　　　　ALL – 　VCC (±) 　　　　　　　　　VCC – 　VSS (±), 　　　　　　　　　　ALL – 　ALL (±)
Ultraviolet Radiation	Units are non-operating. UVB bandwidth：313nm. Test irradiation：0.63 w/m²/nm. Radiation cycle：Radiation on for 4 hours at temperature 60°C, then radiation off for 4 hours at temperature 50°C. Number of cycle：6 cycles. Duration of test：48 hours
Drop	1.Sm free fall, 10times
Salt Water Spray	3+/-1%NaCl; 35℃; 24hrs
Torque	0.SN-m or 0.2Sdegree S time; 30sec/direction

Rev. 1.1

4. AC Characteristics

4.1 Micro SD Interface Timing (Default)

Shaded areas are not valid
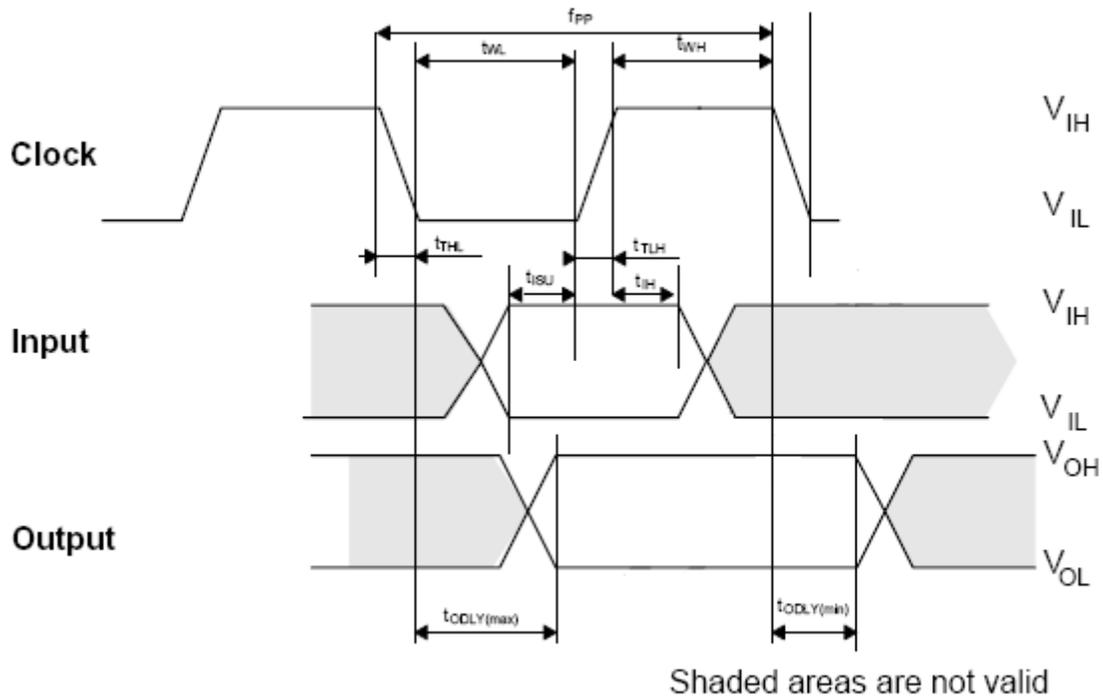
SYMBOL	PARAMETER	MIN	MAX	UNIT	Note
Clock CLK (All values are referred to min(V_{IH}) and max(V_{IL})					
f_{PP}	Clock frequency Data Transfer Mode	0	25	MHz	$C_{card} \leq 10$ pF (1 card)
f_{OD}	Clock frequency Identification Mode	$0_{(1)}/100$	400	kHz	$C_{card} \leq 10$ pF (1 card)
t_{WL}	Clock low time	10	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{WH}	Clock high time	10	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{TLH}	Clock rise time	-	10	ns	$C_{card} \leq 10$ pF (1 card)
t_{THL}	Clock fall time	-	10	ns	$C_{card} \leq 10$ pF (1 card)
t_{ISU}	Input setup time	5	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{IH}	Input hold time	5	-	ns	$C_{card} \leq 10$ pF (1 card)

Rev. 1.1

t_{ODLY}	Output delay time	0	14	ns	C_L≤40 pF (1 card)
t_{ODLY}	Output Delay time during Identification Mode	0	50	ns	C_L≤40 pF (1 card)

(1)0Hz means to stop the clock. The given minimum frequency range is for cases that requires the clock to be continued.

4.2 Micro SD Interface Timing (High Speed Mode)
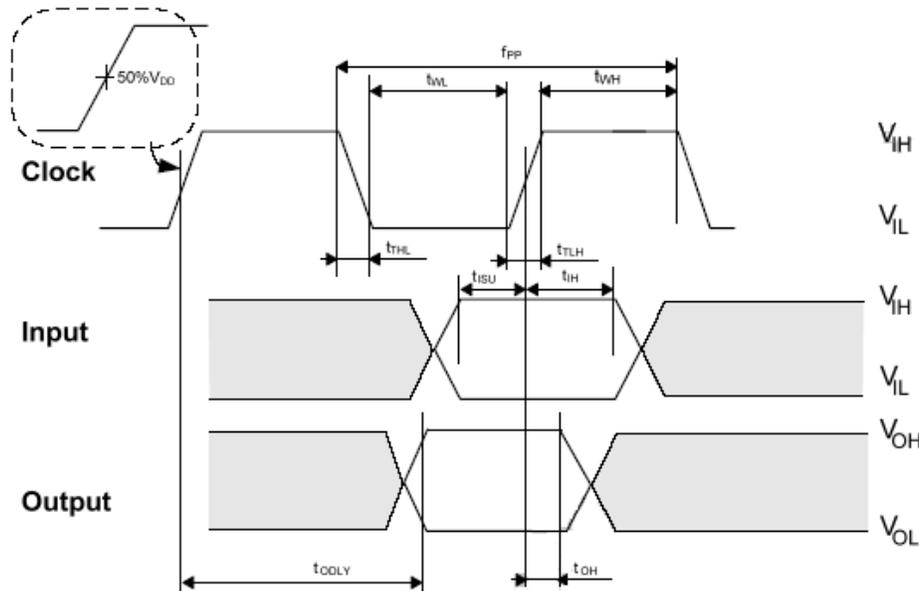
Shaded areas are not valid

| SYMBOL	PARAMETER	MIN	MAX	UNIT	Note
f_{PP}	Clock frequency data transfer mode	0	50	MHz	Ccard≤10 pF (1 card)
t_{WL}	Clock low time	7	-	ns	Ccard≤10 pF (1 card)
t_{WH}	Clock high time	7	-	ns	Ccard≤10 pF (1 card)
t_{TLH}	Clock rise time	-	3	ns	Ccard≤10 pF (1 card)
t_{THL}	Clock fall time	-	3	ns	Ccard≤10 pF (1 card)
t_{ISU}	Input setup time	6	-	ns	Ccard≤10 pF (1 card)
t_{IH}	Input hold time	2	-	ns	Ccard≤10 pF (1 card)
t_{ODLY}	Output delay time		14	ns	CL≤40 pF (1 card)
t_{OH}	Output hold time	2.5	50	ns	CL≤15 pF (1 card)
C_L	System capacitance of each line*		40	pF	CL≤15 pF (1 card)

*In order to satisfy severe timing, host shall run on only one card

12

4.3 SD Interface Timing (SDR12, SDR25 and SDR50 Modes) Input

Symbol	Min	Max	Unit	Remark
t_{CLK}	4.80	-	ns	208MHz (Max.), Between rising edge, VCT= 0.975V
t_{CR}, t_{CF}	-	$0.2* t_{CLK}$	ns	t_{CR}, t_{CF} < 2.00ns (max.) at 100MHz, CCARD=10pF
Clock Duty	30	70	%	

Shaded areas are not valid
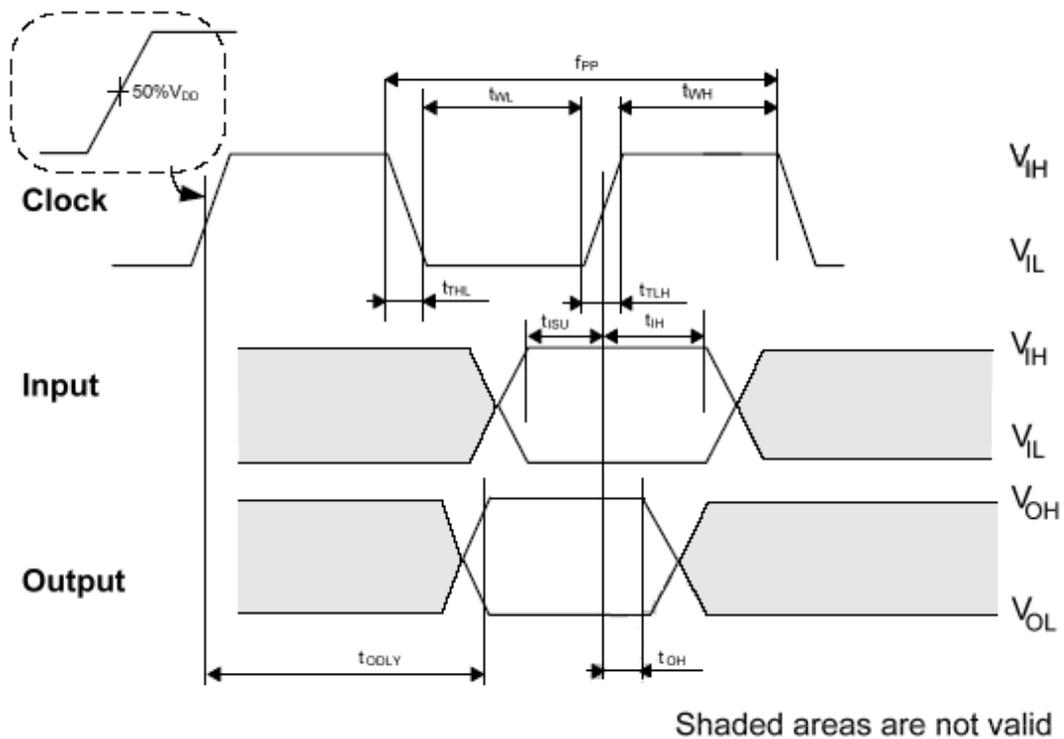
4.3.1 SDR50 Input Timing

Card Input Timing

Rev. 1.1

Symbol	Min	Max	Unit	SDR50 Mode
t_{IS}	3.00	-	ns	CCARD =10pF, VCT= 0.975V
t_{IH}	0.80	-	ns	CCARD =5pF, VCT= 0.975V

4.3.2 Output
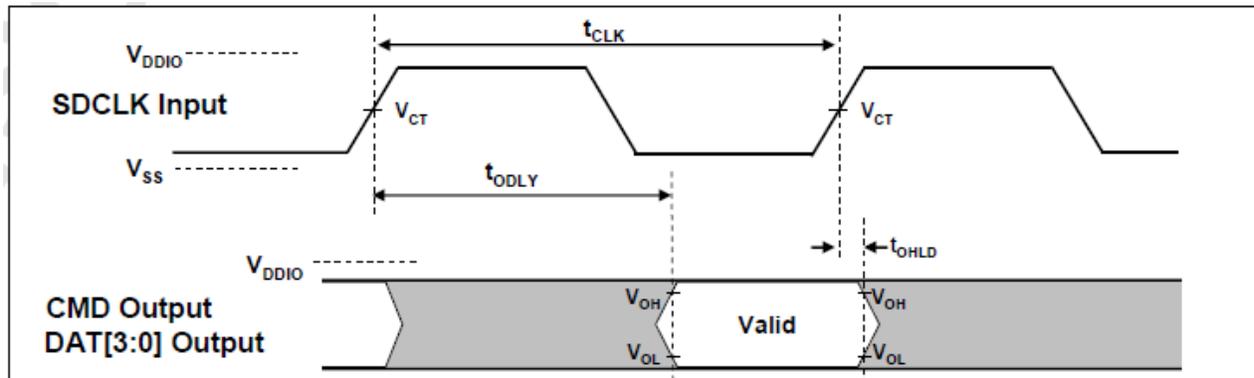
Output Timing of Fixed Data Window

Symbol	Min	Max	Unit	Remark
t_{ODLY}	-	7.5	ns	t_{CLK}>=10.0ns, CL=30pF, using driver Type B, for SDR50
t_{ODLY}	-	14	ns	t_{CLK}>=20.0ns, CL=40pF, using driver Type B, for SDR25 and SDR12,
T_{OH}	1.5	-	ns	Hold time at the t_{ODLY} (min.), CL=15pF

4.3.3 SD Interface Timing (DDR50 Mode)
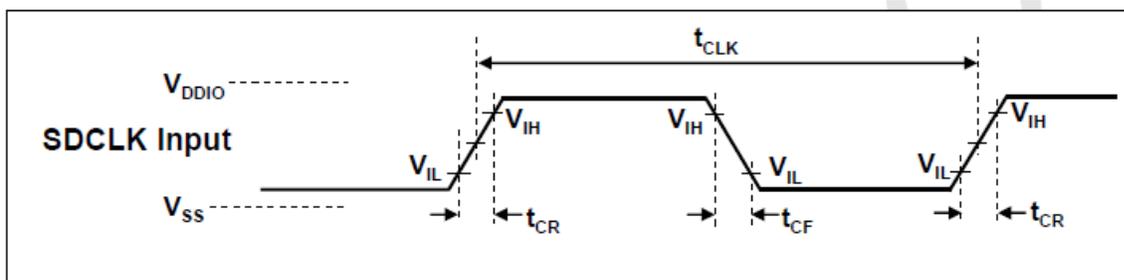
Clock Signal Timing

| 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} < 4.00ns (max.) at 50MHz, CCARD=10pF
Clock Duty	45	55	%	
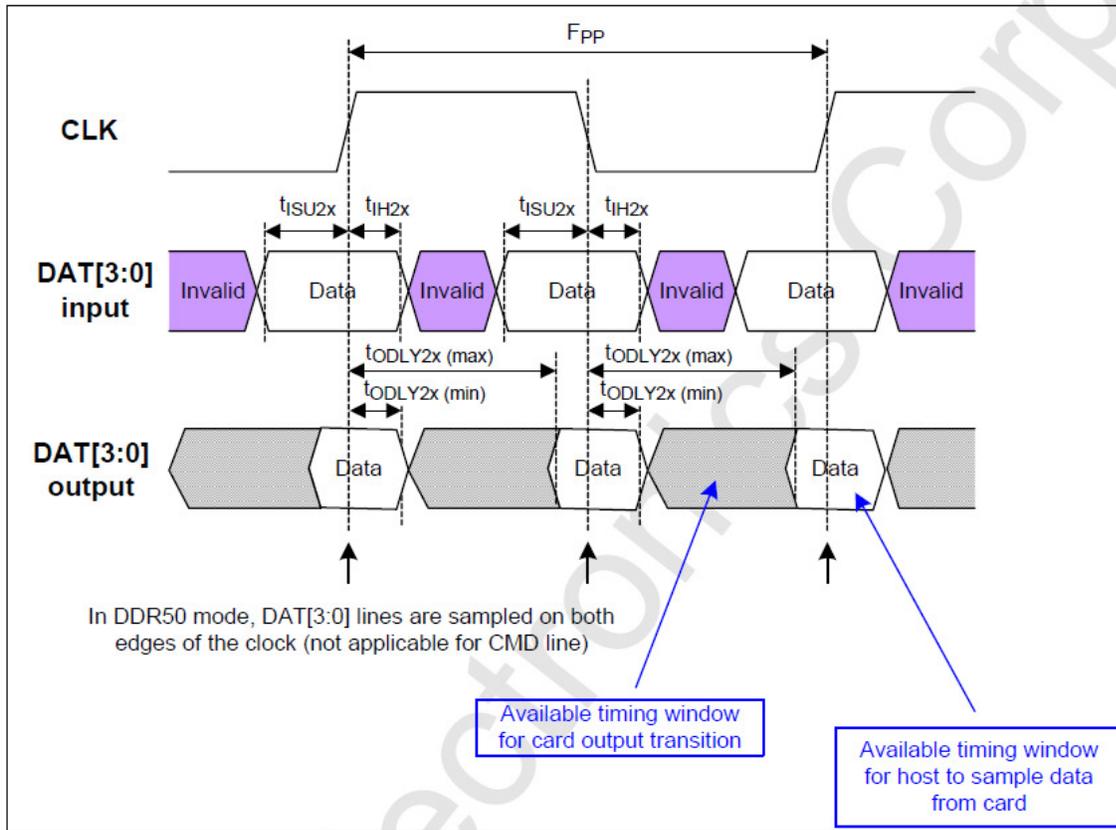
Timing Diagram DAT Inputs/Outputs Referenced to CLK in DDR50 Mode

4.3.4 Bus Timings – Parameters Values (DDR50 Mode)

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

15

5. Product Ordering Information

5.1 Product Code Designations

A P – MSD x x x C X 4 X – 1 TM

Flash Type:
     T: Toshiba MLC

F/W

CTL Solution

4: SDHC

Configuration
   S：one chip
   D：two chip
   H：four chip

Temperature:
      C: Commercial Temperature
      I: Extended Temperature

Capacities:
   04G: 4GB
   08G   8GB
   16G   16GB
   32G   32GB

Model Name

Apacer Product Code

Rev. 1.1
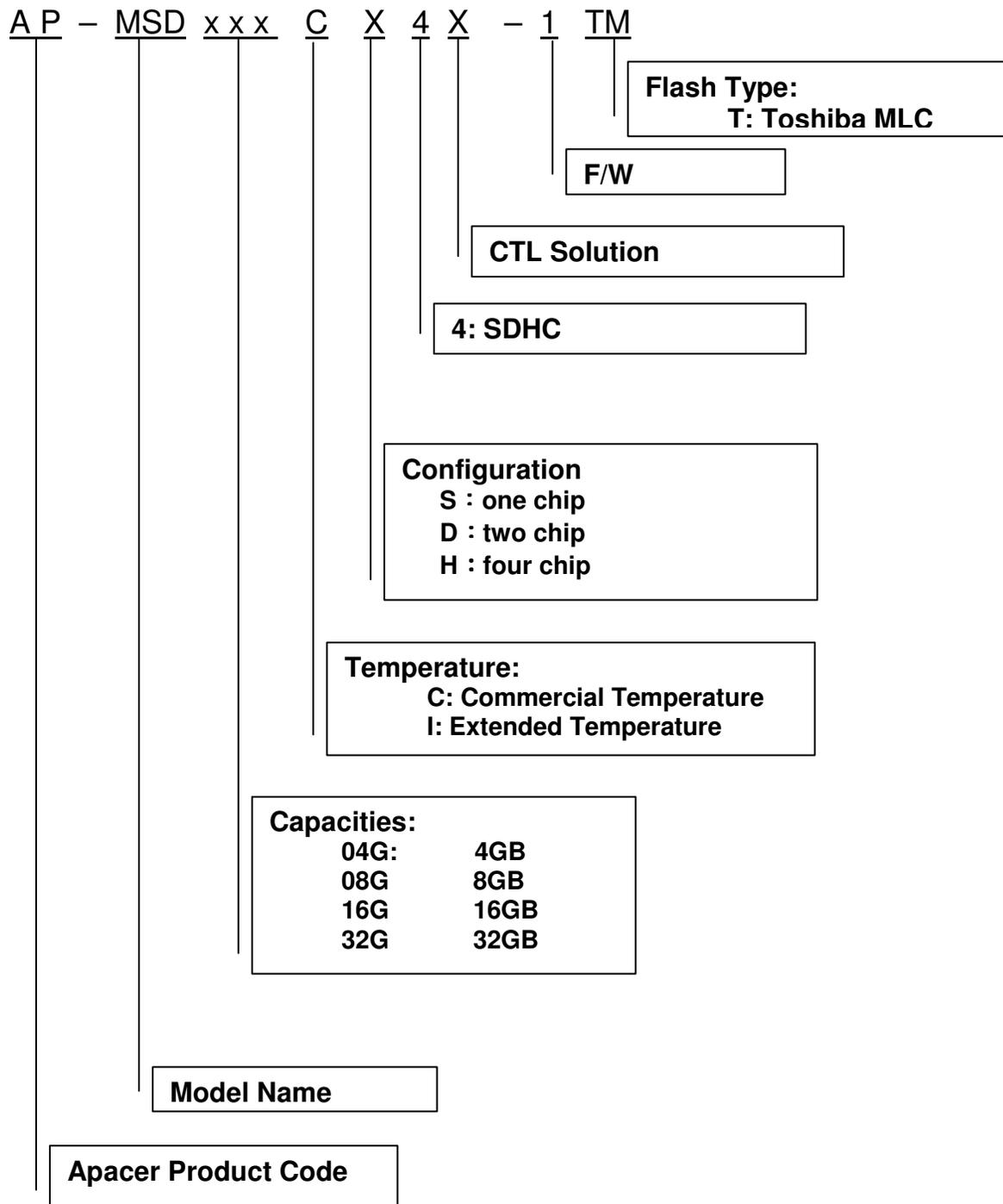
5.2   Valid Combinations

5.2.1 Commercial Temperature

Capacity	AP/N
4GB	AP-MSD04GCS4P-1TM
8GB	AP-MSD08GCS4P-1TM
16GB	AP-MSD16GCD4P-1TM
32GB	AP-MSD32GCH4P-1TM

Note: Please consult with Apacer sales representatives for availabilities.

Rev. 1.1

Revision History

Revision	Description	Date
1.0	Official release	03/01/2013
1.1	Revised operating temperature	03/05/2013

Global Presence

Taiwan (Headquarters)

Apacer Technology Inc.
4th Fl., 75 Hsin Tai Wu Rd., Sec.1
Hsichih, New Taipei City
Taiwan 221
R.O.C.
Tel: +886-2-2698-2888
Fax: +886-2-2698-2889
amtsales@apacer.com

U.S.A.

Apacer Memory America, Inc.
386 Fairview Way, Suite102,
Milpitas, CA 95035
Tel: 1-408-518-8699
Fax: 1-408-935-9611
sa@apacerus.com

Japan

Apacer Technology Corp.
5F, Matsura Bldg., Shiba, Minato-Ku
Tokyo, 105-0014, Japan
Tel: 81-3-5419-2668
Fax: 81-3-5419-0018
jpservices@apacer.com

Europe

Apacer Technology B.V.
Science Park Eindhoven 5051 5692 EB Son,
The Netherlands
Tel: 31-40-267-0000
Fax: 31-40-267-0000#6199
sales@apacer.nl

China

Apacer Electronic (Shanghai) Co., Ltd
1301, No.251,Xiaomuqiao Road, Shanghai,
200032, China
Tel: 86-21-5529-0222
Fax: 86-21-5206-6939
sales@apacer.com.cn

India

Apacer Technologies Pvt Ltd,
535, 1st Floor, 8th cross, JP Nagar 3rd Phase,
Bangalore – 560078, India
Tel: 91-80-4152-9061
sales_india@apacer.com

Rev. 1.1

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Apacer](#):

[AP-MSD04GCS4P-1TM](#) [AP-MSD08GCS4P-1TM](#) [AP-MSD16GCD4P-1TM](#)