Terabit™

Industrial Flash Memory SD Card CL10 Grade 3

Data Sheet

Shanghai Terabit Technology Co., Ltd

Revision History

Version	Date	Changes	Note
V001	2015-06-28	Release	
	2016-09-10	512GB available	Toshiba NAND MLC

Contents

1. Product Features

Interface	9PIN
Form Factor	SDA 3.0 SDXC
Dimension	32.0 x 24.0 x 2.1 ±0.1 (mm)
Capacity	NAND MLC: 8~512GB NAND SLC: 8~64GB
Performance	Read up to 94MB/s Write up to 81MB/s
Power Supply	D/C 2.7~3.6V
Operating Temperature	Industrial: -25~+85°C Extended: -40~+85°C
Weight	<20g
Storage Temperature	-55~+95°C
Humidity	8%~95%(non-condensing)
Shock	Non-operating 1500G peak, 0.5ms Operating 50G peak, 11ms
Vibration	Jet (Random) Vibration, 10-2000Hz, 16.4G(X, Y, Z)
Burn-in Test	96 Hours
Drop Test	150cm free fall (Direction:6 face, 1time/each)
Max. Power Consumption	Sequential Reading 0.40W Sequential Writing 0.40W Idle 0.07W
MTBF	2,000,000 Hours
Bus Speed Mode	USH-I
Speed Class	Class 10
CPRM	Content Protection for Recordable Media
Write Protect	Support with mechanical switch
Access Time	0.1ms
Features	- Enhanced endurance by dynamic/static wear-leveling - Support dynamic power management - Support S.M.A.R.T function - Automatic Bad-block Management - Power Loss Protection - Auto Read Refresh - Class 10/UHS-1 - Water Proof - Embedded Mode
Data Retention	@25°C: 10 years
Certification	CE/FCC/RoHS

2. Overview

Terabit Industrial SD Card fully consists of semiconductor devices using original NAND Flash and Industrial Controller that provide high reliability and high performance for data storage. Terabit Industrial SD Card has standard 9PIN interfaces, fully conform to the same mechanical and mounting requirements as standard rotating disk drives. This series of products are designed for premium industrial applications that require both strong reliability such as GPS, Drive Recorder, Server, Medical Devices, Data Recording and Embedded Systems. With up to 512GB capacity, Terabit Industrial SD Card totally goes through a variety of proofing tests such as Shock Test, Vibration Test, Burn-in Test, and Bending Test. Well proved under -40~+85°C wide temperature, this series of products can work smoothly under severe environments.

3. Interface

Terabit Industrial SD Card Support SD system specification version 3.0

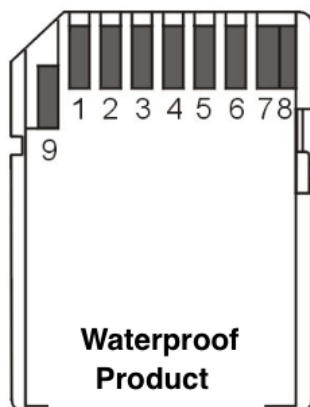．Support SD SPI mode

．Bus Speed Mode (use 4 parallel data lines)

4. Physical Dimension

Parameter	Value	Unit
Width	32.0	mm
Length	24.0	mm
Thickness	2.1	mm

● All the values are ±0.1mm

5. PIN Description

5.1 PIN Location

5.2 Signal Description

PIN#	Name	Type	Assignment
P1	CD/DAT3	I/O/PP	Card detect/DATA line [Bit3]
P2	CMD	PP	Command/Response
P3	VSS1	S	Supply voltage ground
P4	VDD	S	Supply voltage
P5	CLK	I	Clock
P6	VSS2	S	Supply voltage ground
P7	DAT0	I/O/PP	Data line [Bit0]
P8	DAT1	I/O/PP	Data line [Bit1]
P9	DAT2	I/O/PP	Data line [Bit2]

6. Power Consumption

Capacity	Idle	Read	Write	Unit
8GB	0.05	0.30	0.28	W
16GB	0.06	0.32	0.30	W
32GB	0.06	0.34	0.32	W
64GB	0.07	0.37	0.34	W
128GB	0.07	0.38	0.38	W
256GB	0.07	0.40	0.40	W
512GB	0.07	0.40	0.40	W

7. Product Reliability & AC Characteristic

NAND MLC Flash：

Capacity	*Endurance Total Bytes Written	Data Retention	MTBF	Warranty
8GB	Up to 15TB			
16GB	Up to 30TB			
32GB	Up to 60TB	@25°C >10 Years	2 Million Hours	3 Years Limited
64GB	Up to 120TB			
128GB	Up to 240TB			
256GB	Up to 490TB			
512GB	Up to 980TB			

NAND SLC Flash：

Capacity	*Endurance Total Bytes Written	Data Retention	MTBF	Warranty
8GB	Up to 450TB			
16GB	Up to 900TB	@25°C >10 Years	2 Million Hours	5 Years Limited
32GB	Up to 1800TB			
64GB	Up to 3600TB			

*Total Bytes Written= 【（Flash P/E cycle）x (number of bits in drive)】/WAI
  WAI=1.428704724

7.1 Bus Operation Conditions for 3.3V Signaling

Threshold Level for High Voltage Range

Parameter	Symbol	Min.	Max.	Unit	Condition
Supply voltage	V_{DD}	2.7	3.6	V	
Output high voltage	V_{OH}	$0.75*V_{DD}$		V	I_{OH}=-2mA V_{DD} Min
Output low voltage	V_{OL}		$0.125*V_{DD}$	V	I_{OL}=2mA 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 V_{DD} min

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	

Threshold Level for 1.8V Signaling

Parameter	Symbol	Min.	Max.	Unit	Condition
Supply voltage	V_{DD}	2.7	3.6	V	
Output high voltage	V_{DDIO}	1.7	1.95	V	Generated by V_{DD}
Output low voltage	V_{OH}	1.4	-	V	I_{OH}=2mA
Input high voltage	V_{OL}	-	0.45	V	I_{OL}=2mA
Input low voltage	V_{IH}	1.27	2.00	V	
Power up time	V_{IL}	V_{SS}-0.3	0.58	ms	

Input Leakage Current for 1.8V Signaling

Parameter	Symbol	Min	Max.	Unit	Remarks
Input Leakage Current		-2	2	uA	DAT3 pull-up is disconnected

7.2 Bus Signal Line Load

Bus Circuitry Diagram
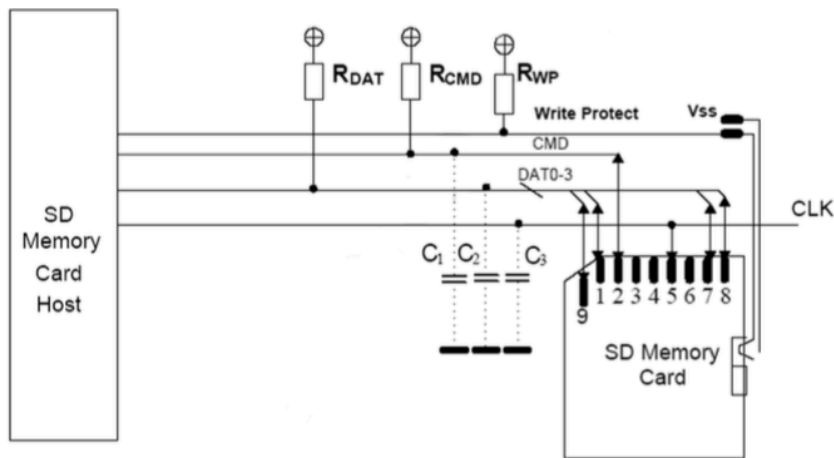
Bus Operation Conditions – Signal Line's Load

Total Bus Capacitance = $C_{Host} + C_{BUS} + N\, C_{Card}$

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 30pF
Card capacitance for each signal pin	C_{CARD}		10^1	pF	
Maximum signal line inductance			16	nH	
Pull-up resistance inside card 5(pin1)	R_{DAT3}	10	90	kΩ	Maybe used for card detection
Capacity Connected to power line	C_C		5	uF	To prevent inrush current

7.3 Power Up Time of Host

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 recommendations 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. (4) Host shall wait until VDD is stable. (5) After 1ms VDD stable time, host provides at least 74 clocks before issuing the first command.

Power Down and Power Cycle

(1) 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.

(2) 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).
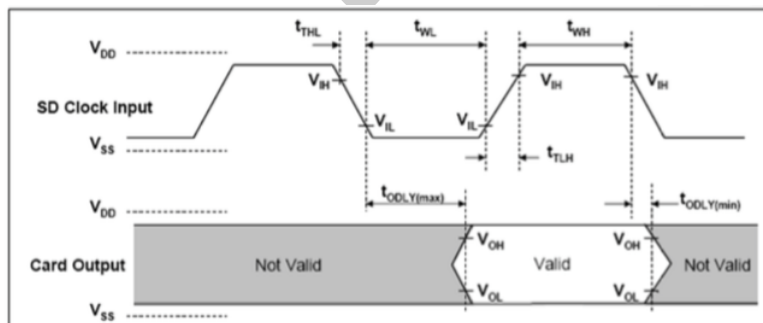
7.4 AC Characteristic
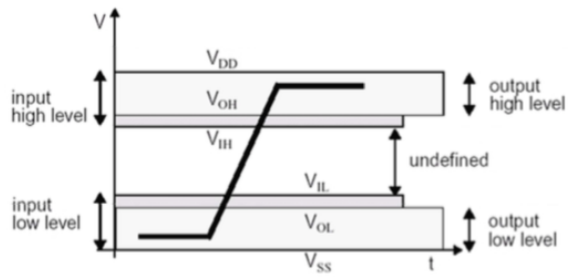
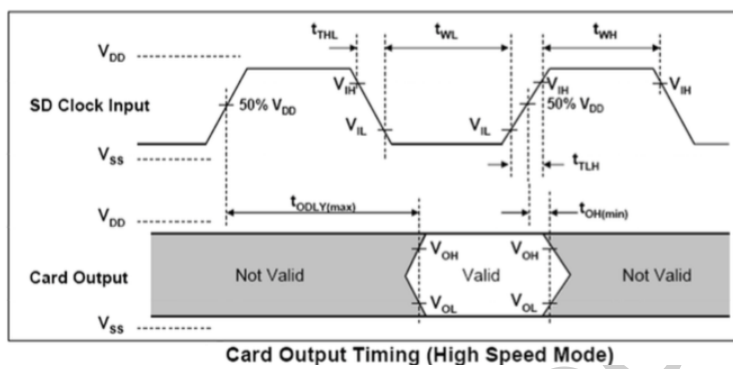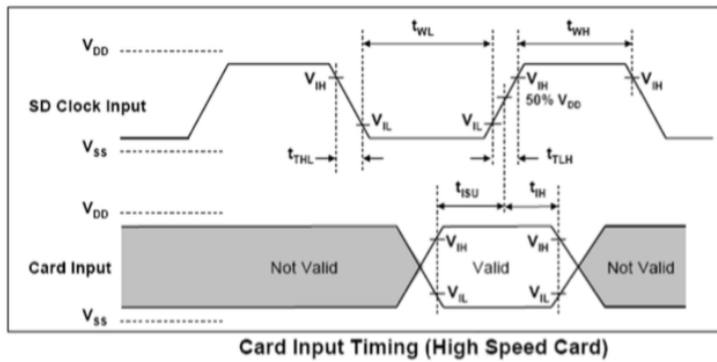## 7.5 SD interface Timing (Default)
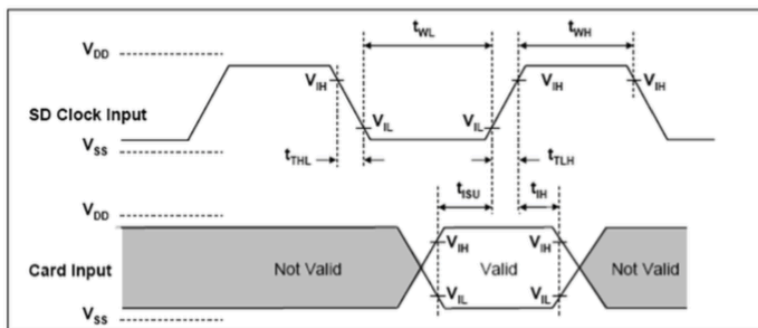
Card Input Timing (Default Speed Card)

Card Output Timing (Default Speed Mode)

7.6 SD Interface Timing (High-Speed Mode)

Card Input Timing (High Speed Card)

Card Output Timing (High Speed Mode)

8. Performance

Capacity	Sequential Read	Sequential Write	IOPS Read	IOPS Write
8GB	50 MB/s	38 MB/s	1000	900
16GB	75 MB/s	55 MB/s	1300	1000
32GB	80 MB/s	60 MB/s	1600	1200
64GB	83 MB/s	64 MB/s	1800	1500
128GB	89 MB/s	73 MB/s	2000	1700
256GB	90 MB/s	77 MB/s	2500	1800
512GB	94 MB/s	81 MB/s	2700	2000

9. Cache

Cache	DDR2	DDR3	Capacity
/	/	/	/

10. Thermal Sensor

Temperature Sensor	Yes	No
	Support	/

11．Certifications

EN 55022:2010

EN: 55024:2010

EN 61000-3-2:2013

EN 61000-3-3:2014

47 CFR, Part2, Part15, CISPR PUB.22

With reference to RoHS Directive 2011/65/EU recasting 2002/95/EC

12．Ordering information

Series	Model Name*	Capacity	*Flash
	TSD3XTMLC-008G	8GB	NAND MLC
	TSD3XTMLC-016G	16GB	NAND MLC
	TSD3XTMLC-032G	32GB	NAND MLC
Industrial SD 3.0 Card	TSD3XTMLC-064G	64GB	NAND MLC
	TSD3XTMLC-128G	128GB	NAND MLC
	TSD3XTMLC-256G	256GB	NAND MLC
	TSD3XTMLC-512G	512GB	NAND MLC

Series	Model Name	Capacity	Flash
	TSD3XTMLC-008G	8GB	NAND SLC
Industrial SD 3.0 Card	TSD3XTMLC-016G	16GB	NAND SLC
	TSD3XTMLC-032G	32GB	NAND SLC
	TSD3XTMLC-064G	64GB	NAND SLC

*XT refers to temperature range, CT refers to industrial temperature, KT refers to extended temperature.

*Industrial SD Card uses Toshiba original NAND Flash.

13. Contact Information

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