

SD Memory Card

Specification Sheet

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SD Memory Card Feature

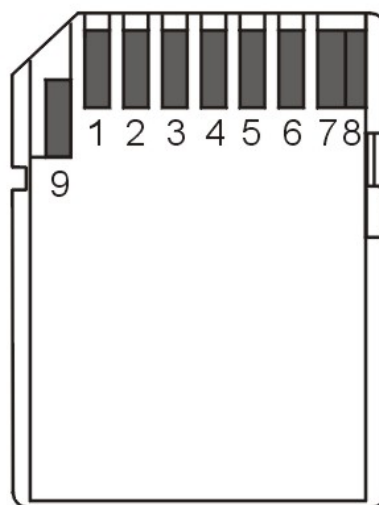
Contents	None (OEM Design Available)
SD Specification	SD Memory Card Specification Part1 Physical Layer Specification Ver.1.01 Compliant
Security Functions	SD Security Specification Ver.1.01 Compliant (CPRM Based) *CPRM: Contents Protection for Recording Media Specification
Logical Format	SD Files System Specification Ver.1.0 Compliant

Mechanical Write Protect Switch

A mechanical sliding tablet on the side of the card can use for write protect switch. The host system shall be responsible for this function.

The card is in a “Write Protected” status when the tablet is located on the “Lock position. The host system will not write nor format the card in this status.

SD Memory Card Pin Assignment



SD Memory Card - Pins Definition

SD Mode			
PIN NO	NAME	TYPE	DESCRIPTION
1	CD / DAT3	I/O/PP	Card Detect / DATA Line [Bit 3]
2	CMD	PP	Command / Response
3	VSS1	S	Supply voltage ground
4	VDD	S	Supply voltage
5	CLK	I	Clock
6	VSS2	S	Supply voltage ground
7	DAT0	I/O/PP	DATA Line [Bit 0]
8	DAT1	I/O/PP	DATA Line [Bit 1]
9	DAT2	I/O/PP	DATA Line [Bit 2]

SPI Mode			
PIN NO	NAME	TYPE	DESCRIPTION
1	CS	I	CHIP Select(Negative true)
2	DI	I	DATA IN
3	VSS1	S	Supply voltage ground
4	VDD	S	Supply voltage
5	SCLK	I	Clock
6	VSS2	S	Supply voltage ground
7	DO	O/PP	DATA OUT
8	--	--	Reserved (*)
9	--	--	Reserved (*)

- Note: 1) S: power supply ; I : input ; O : output ; PP : push-pull drivers
- 2) The DAT line for read - only cards is output only (The card stack initialization uses only the CMD channel and is therefore compatible for all cards.
- 3) *: Host side should pull up these signals with 10-100k ohm resistance in the SPI Mode

Maximum Durable Condition

Temperature	Operating	-25 ° ~ 85 °
	Storage	-40 ° ~ 85 °
Humidity	Operating	25 ° /95 % relative humidity
	Storage	40 ° /93 % relative humidity / 500h
ESD	Air Discharge	Above ± 15KV
	Coupling Plane Discharge	Above ± 8KV
Program/Erase cycles		100K Cycles

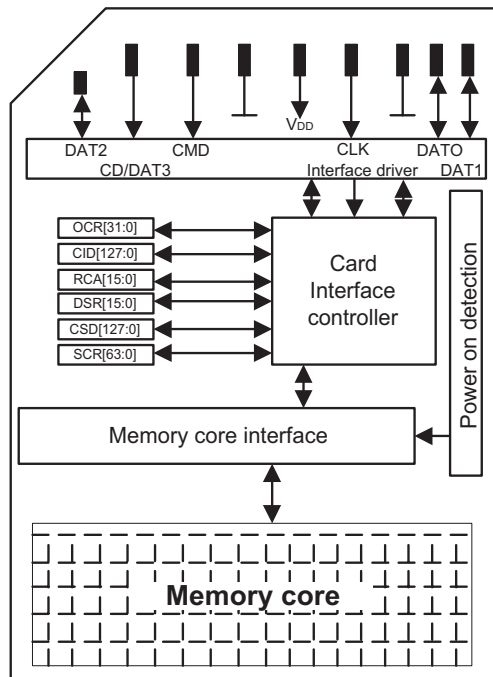
Note: 1) “This table shows the maximum range which can operate in some condition. However, it DOES NOT mean that products should operate this condition for a long time.

Memory Size

Product Code	Capacity	Typical Memory (k byte)
S32XXXX	32MB	30768
S64XXXX	64MB	62144
S28XXXX	128MB	124160
S56XXXX	256MB	248832
S12XXXX	512MB	498176
S1GXXXX	1GB	996864

Note: 1. “X” : do not care
 2. The really available memory size was decided by several important factors. This table only provides the memory size which was formatted under manufactory, and does not guarantee the value same as you read your SD card under you system.

Function Architecture



Power Supply Voltage

(Operation Condition)

Parameter	Symbol	Min.	Max.	Unit	Remark
Supply voltage 1	V _{DD}	2.0	3.6	V	Please see:1)
Supply voltage 2	V _{DD}	2.7	3.6	V	Please see:2)
Supply voltage differentials	V _{SS1} , V _{SS2}	-0.3	0.3	V	
Power up time			250	ms	From 0v to V _{DD} min

Note: 1) "Supply voltage 1" means SD card under card initial status. This status allows that V_{DD} & command: CMD0, 15,55,ACMD41 have a wide operating voltage range

2) "Supply voltage 2" means SD card under normal operating status. The normal operating voltage range is written in OCR register.

DC Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Remark
Peak voltage on all lines		-0.3		$V_{DD} + 0.3$	V	
Input Leakage Current	I_{LI}			10	μA	
Output Leakage Current	I_{LO}			10	μA	
Standby Current	I_{SB}			150	μA	
Operating Current	I_{CC1}		40	50	mA	
Output HIGH voltage	V_{OH}	$0.75 * V_{DD}$			V	$I_{OH} = -100 \mu A @ V_{DD} \text{ min}$
Output LOW voltage	V_{OL}			$0.125 * V_{DD}$	V	$I_{OL} = 100 \mu A @ V_{DD} \text{ min}$
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	

Bus Signal Line Load

The total capacitance C_L the CLK line of the SD Memory Card bus is the sum of the bus master capacitance C_{HOST} , the bus capacitance C_{BUS} itself and the capacitance C_{CARD} of each card connected to this line:

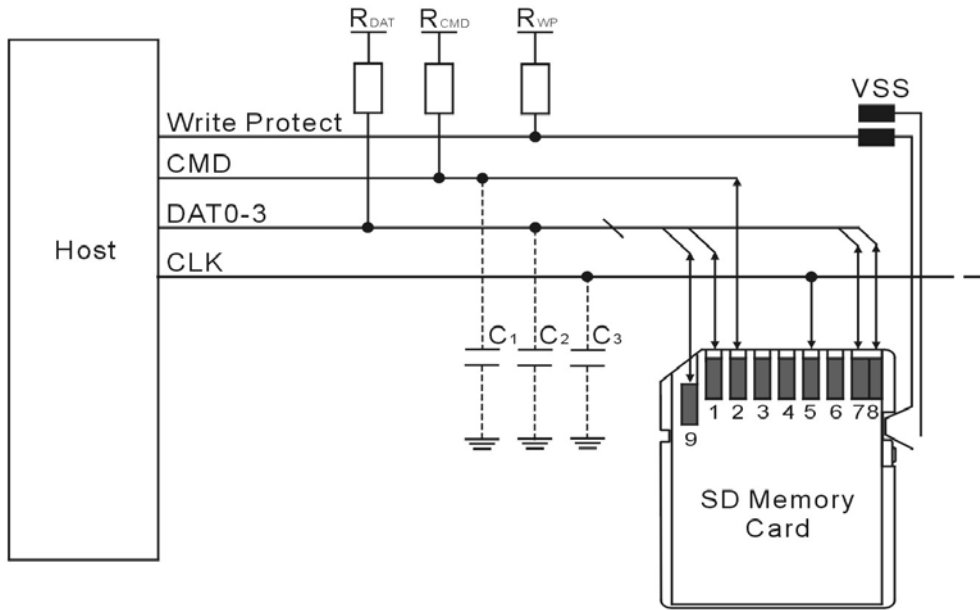
$$C_L = C_{HOST} + C_{BUS} + N * C_{CARD}$$

where N is the number of connected cards. Requiring the sum of the host and bus capacitances not to exceed 30 pF for up to 10 cards, and 40 pF for up to 30 cards, the following values must not be exceeded:

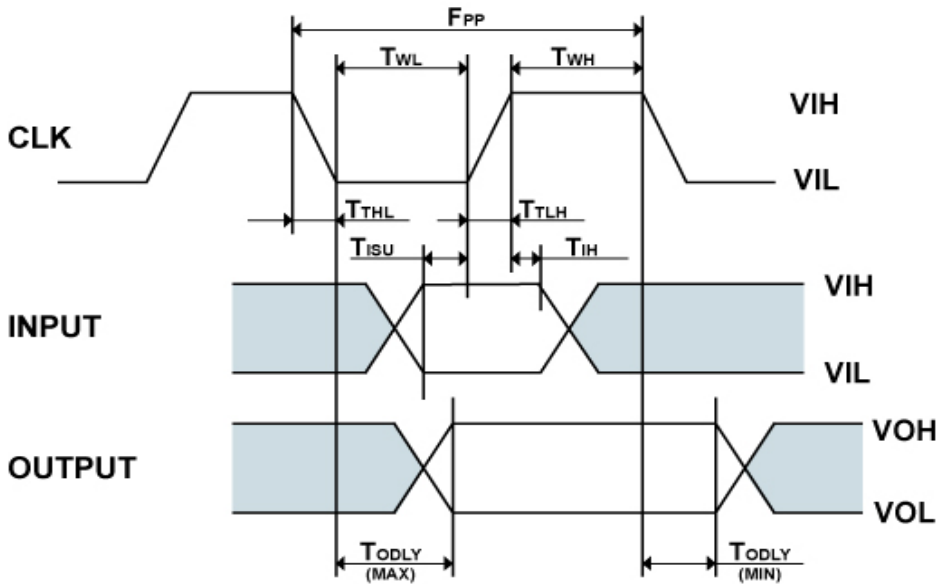
Parameter	Symbol	Min.	Max.	Unit	Remark
Pull-up resistance	R_{CMD} / R_{DAT}	10	100	K Ω	to prevent bus floating
Bus signal line capacitance	C_L		250	pF	$f_{PP} < 5 \text{ MHz}$, 21 cards
Bus signal line capacitance	C_L		100	pF	$f_{PP} < 20 \text{ MHz}$, 7 cards
Single card capacitance	C_{CARD}		10	pF	
Maximum signal line inductance			16	nH	$f_{PP} < 20 \text{ MHz}$
Pull-up resistance inside card (pin1)	R_{DAT3}	10	90	K Ω	May be used for card detection

Note: That the total capacitance of CMD and DAT lines will be consist of C_{HOST} , C_{BUS} and one C_{CARD} only since they are connected separately to the SD Memory Card host.

SD Memory Card Hardware interface



Timing Waveform



AC Characteristics

Parameter	Symbol	Min.	Max.	Unit	Remark
Clock CLK (All values are referred to min (VIH) and max (VIL))					
Clock frequency in any state	F _{STY}	0	25	MHz	CL < 100 pF, (7 cards)
Clock frequency Data Transfer Mode	F _{PP}	0.1	25	MHz	CL < 100 pF, (7 cards)
Clock frequency Card Identification Mode	F _{OD}	100K	400K	KHz	CL < 250 pF, (21 cards)
Clock low time	T _{WL}	10		ns	CL < 100 pF, (7 cards)
Clock high time	T _{WH}	10		ns	CL < 100 pF, (7 cards)
Clock rise time	T _{TLH}		10	ns	CL < 100 pF, (7 cards)
Clock fall time	T _{THL}		10	ns	CL < 100 pF, (7 cards)
Clock low time	T _{WL}	50		ns	CL < 250 pF, (21 cards)
Clock high time	T _{WH}	50		ns	CL < 250 pF, (21 cards)
Clock rise time	T _{TLH}		50	ns	CL < 250 pF, (21 cards)
Clock fall time	T _{THL}		50	ns	CL < 250 pF, (21 cards)
Inputs CMD, DAT (referenced to CLK)					
Input setup time	T _{ISU}	5		ns	CL < 25 pF (1 card)
Input hold time	T _{IH}	5		ns	CL < 25 pF (1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay Time Data Transfer Mode	T _{ODLY}	0	14	ns	CL < 25 pF (1 card)
Output Delay Time Card Identification Mode	T _{ODLY}	0	50	ns	CL < 25 pF (1 card)

Note: 1) Rise and fall times are measured from 10%-90% of voltage level

Card Registers

The SD card has six registers and SD Status information: CID, OCR, CSD, RCA, DSR, SCR. The detail definition as follow table:

Resister Name	Bit Width	Description
CID	128	Card Identification information
OCR	32	Operation Conditions Registers
CSD	128	Card specific information
SCR	64	SD Memory Card's Special features
RCA	16	Relative Card Address
DSR	16	Driver Stage Register

CID Register

The Card Identification (CID) register is 128-bit width. It contains the card identification information used during the Card Identification phase.

OCR Register

This 32-bit register describes operating voltage range and status bit in the power supply.

CSD Register

The Card-Specific Data (CID) register provides information on how to access the cards contents. Some field of this register can be writable by PROGRAM_CSD(CMD27). This register is 128bit width

SCR Register

The SD Card Configuration (SCR) register provides information on SD Memory Card's special features. This register is 64bit width.

RCA Register

The writable 16bit relative card address register carries the card address in SD Card mode.

DSR Register

The Driver Stage Register (DSR) register provides an optional function for output driver condition. This register is 16bit width.

System Performance (for reference only)

(under SD bus mode)

Density	Sequential Read	Sequential Write	Random Read	Random Write
32MB	3521K	1452K	3504K	654K
64MB	4396K	2206K	4366K	869K
128MB	7895K	5368K	8082K	1502K
256MB	7981K	6297K	8088K	2356K
512MB	8082K	5158K	8400K	1915K
1GB	8088K	6895K	8082K	2444K

- Note: 1. The test value is measured by the following condition.
 2. The different Flash memory and test condition will impact the result of system performance. This test performance table is just for reference.

Testing Environment:	
OS	Windows XP
Hardware	Pentium4 2.6GHz
Motherboard	ASUS P4P800
Software	HD Bench 340 B6

Mechanical Descriptions

Length	32 mm ± 0.1 mm
Width	24 mm ± 0.1 mm
Thickness	2.1 mm ± 0.15 mm
Mass	< 3.0 g

