Transcend

Rev. 1.0

SDXC Card series

64GB Extended Capacity Secure Digital Card

Description

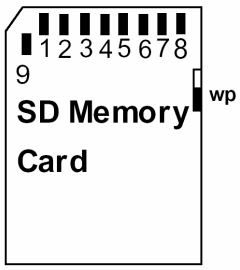
Transcend secured digital extended capacity Card series are specifically designed to meet the High Capacity, High Definition Audio and Full HD Video requirement for the latest Digital Cameras, DV Recorders, Mobile, etc,. The new defined Speed Class enables the host to support AV applications to perform real time recording to the SD memory card.

Features

- ROHS compliant product.
- Card Lid material: PC + ABS
- Operating Voltage: 2.7 ~ 3.6V
- Operating Temperature: -25 ~ 85℃
- Durability: 10,000 insertion/removal cycles
- Compatible with SD Specification Ver. 3.0
- Mechanical Write Protection Switch
- Supports Speed Class 10 Specification
- Supports Copy Protection for Recorded Media (CPRM) for SD-Audio
- Support exFAT file system
- Form Factor: 24mm x 32mm x 2.1mm

Placement

Front

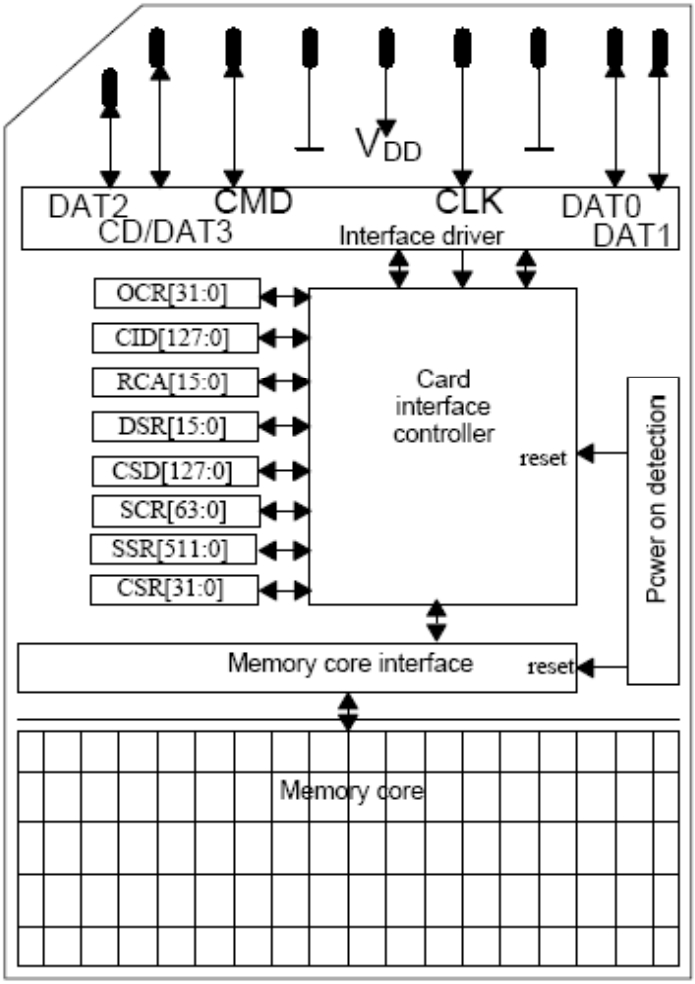


Back

Pin Definition

Pin No.	SD Mode			SPI Mode		
	Name	Type	Description	Name	Type	Description
1	CD/DAT	I/O/PP	Card Detect/Data Line [Bit3]	CS	I	Chip Select (neg true)
2	CMD	PP	Command/Response	DI	I	Data In
3	V_{SS1}	S	Supply voltage ground	VSS	S	Supply voltage ground
4	V_{DD}	S	Supply voltage	VDD	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	V_{SS2}	S	Supply voltage ground	VSS2	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		
9	DAT2	I/O/PP	Data Line [Bit2]	RSV		

1.0 Architecture



2.0 Hardware Interface

2.1 General

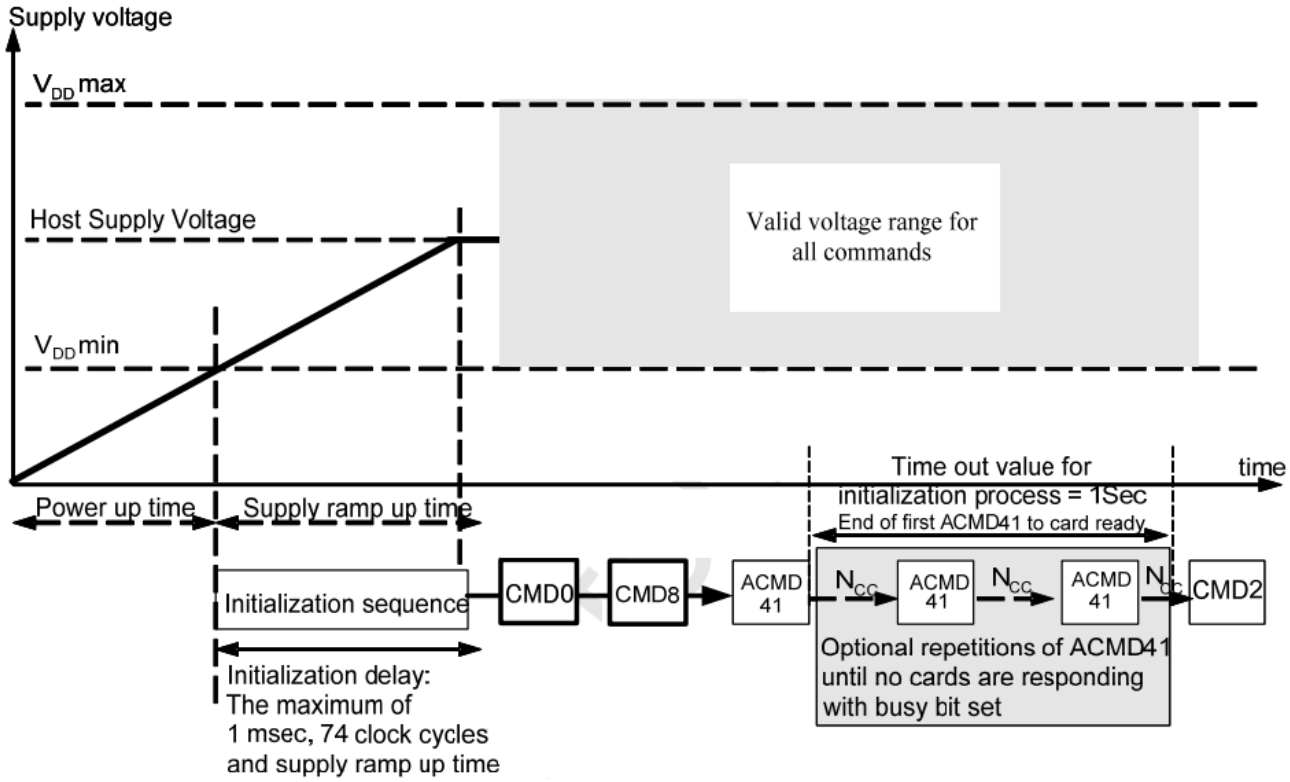
Parameter	Symbol	Min.	Max.	Unit	Remark
Peak voltage on all lines		-0.3	V_{DD}+0.3	V	
All Inputs					
Input Leakage Current		-10	10	µA	
All Outputs					
Output Leakage Current		-10	10	µA	

2.0 Power Supply Voltage

Parameter	Symbol	Min.	Max.	Unit	Remark
Supply voltage	V_{DD}	2.7	3.6	V	
Output High Voltage	V_{OH}	0.75* V_{DD}		V	I_{OH}=-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 V_{DD} Min.

3.0 Power Scheme

3.1 Power Up



Power-up Diagram

- Power up time is defined as voltage rising time from 0 volt to V_{DD}(min.) and depends on application parameters such as the maximum number of SD Cards, the bus length and the characteristic of the power supply unit.

- Supply ramp up time provides the time that the power is built up to the operating level (the host supply voltage) and the time to wait until the SD card can accept the first command,

- The host shall supply power to the card so that the voltage is reached to V_{DD}(min.) within 250ms and start to supply at least 74 SD clocks to the SD card with keeping CMD line to high. In case of SPI mode, CS shall be held to high during 74 clock cycles.

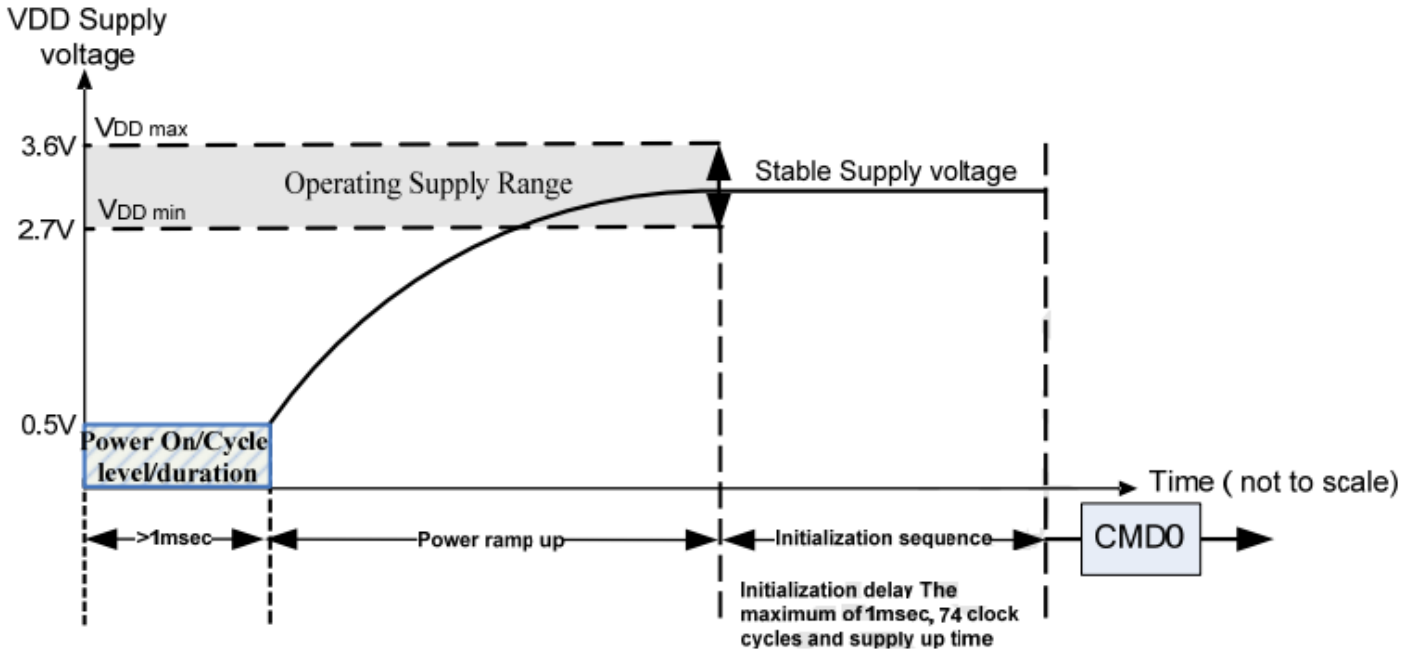
- After power up (including hot insertion, i.e. inserting a card when the bus is operating) the SD Card enters the idle state. In case of SD host, CMD0 is not necessary. In case of SPI host, CMD0 shall be the first command to send the card to SPI mode.

- CMD8 is added in the Physical Layer Specification Version 2.00 to support multiple voltage ranges and used to check whether the card supports supplied voltage. The version 3.00 host shall issue CMD8 and verify voltage before card initialization. The host that does not support CMD8 shall supply high voltage range.

- ACMD41 is a synchronization command used to negotiate the operation voltage range and to poll the cards until they are out of their power-up sequence. In case the host system connects multiple cards, the host shall check that all cards satisfy the supplied voltage. Otherwise, the host should select one of the cards and initialize

3.2 Power Up time

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



3.3 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.

3.4 Power Supply Ramp Up

The power ramp up time is defined from 0.5 V 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.

3.5 Power Down and Power Cycle

When the host shuts down the power, the card V_{DD} shall be lowered to less than 0.5 Volt 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 V_{DD} shall be once lowered to less than 0.5 Volt for a minimum period of 1ms).

3.6 Current Consumption

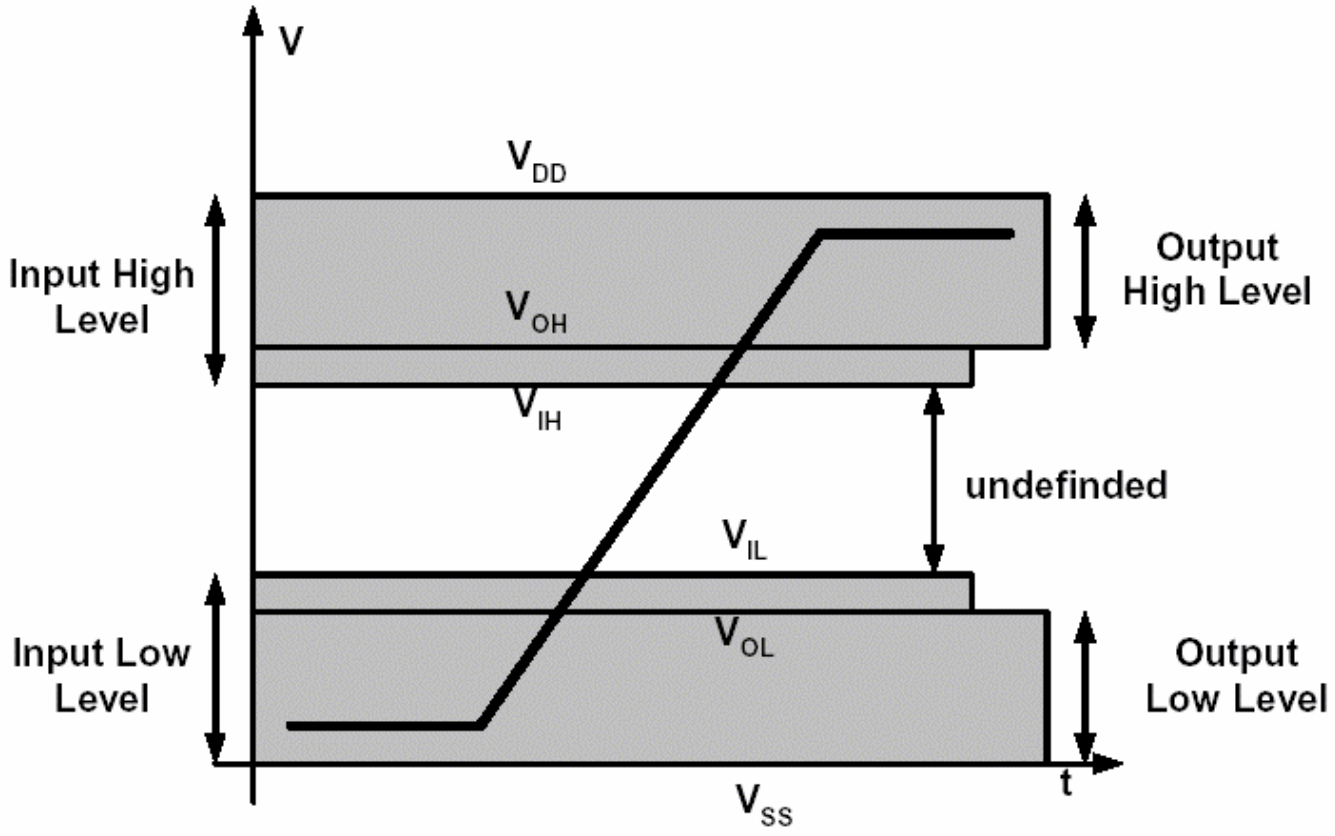
The current consumption is measured by averaging over 1 second.

- Before first command: Maximum 15 mA
- During initialization: Maximum 100 mA
- Operation in Default Mode: Maximum 100 mA
- Operation in High Speed Mode: Maximum 200 mA
- Operation with other functions: Maximum 500 mA.

4.0 Bus Signal

4.1 Bus Signal Levels

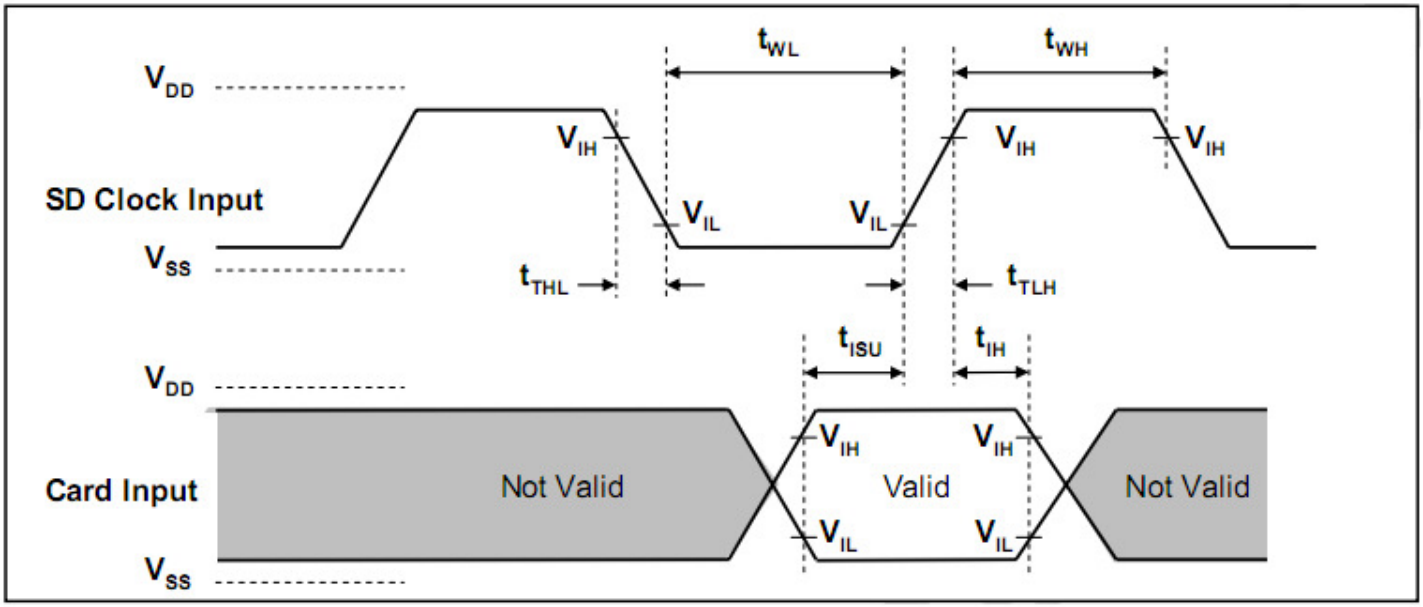
As the bus can be supplied with a variable supply voltage, all signal levels are related to the supply voltage.



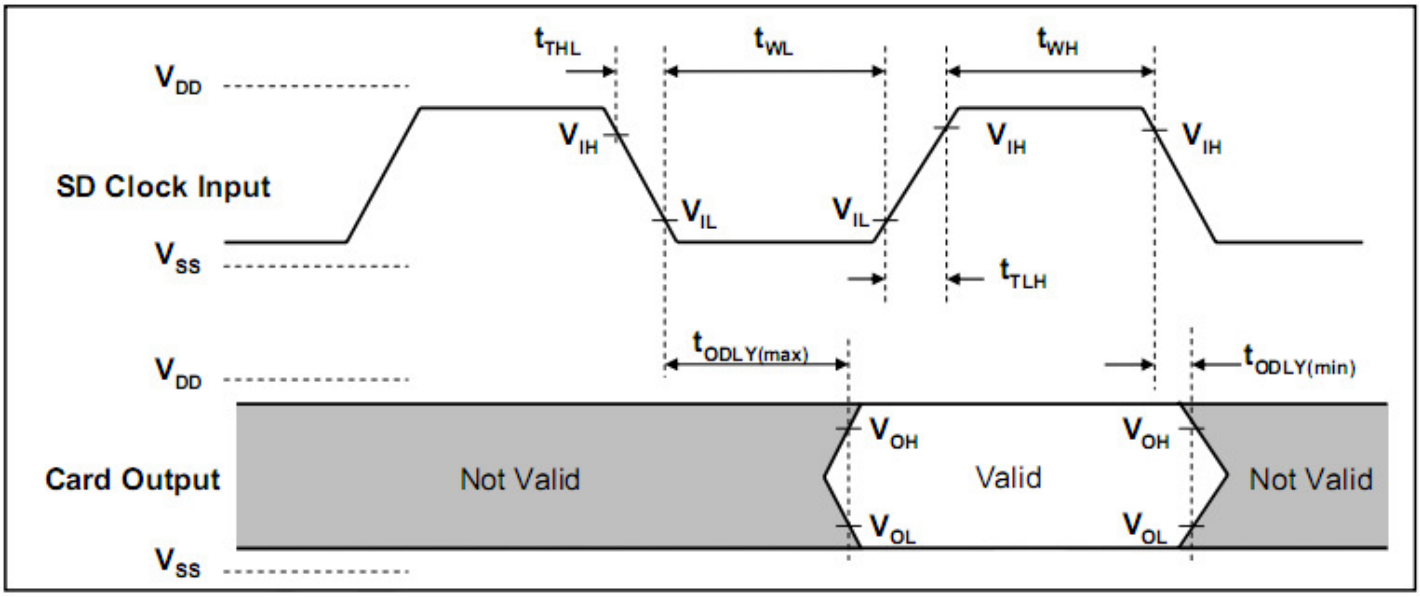
To meet the requirements of the JEDEC specification JESD8-1A and JESD8-7, the card input and output voltages shall be within the following specified ranges for any V_{DD} of the allowed voltage range:

Parameter	Symbol	Min.	Max.	Unit	Remark
Output HIGH voltage	V_{OH}	0.75* V_{DD}		V	I_{OH} = -100 µA @V_{DD} min
Output LOW voltage	V_{OL}		0.125* V_{DD}	V	I_{OL} = -100 µA @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	

4.2 Bus Timing (Default speed mode)



Card Input Timing (Default Speed Mode)

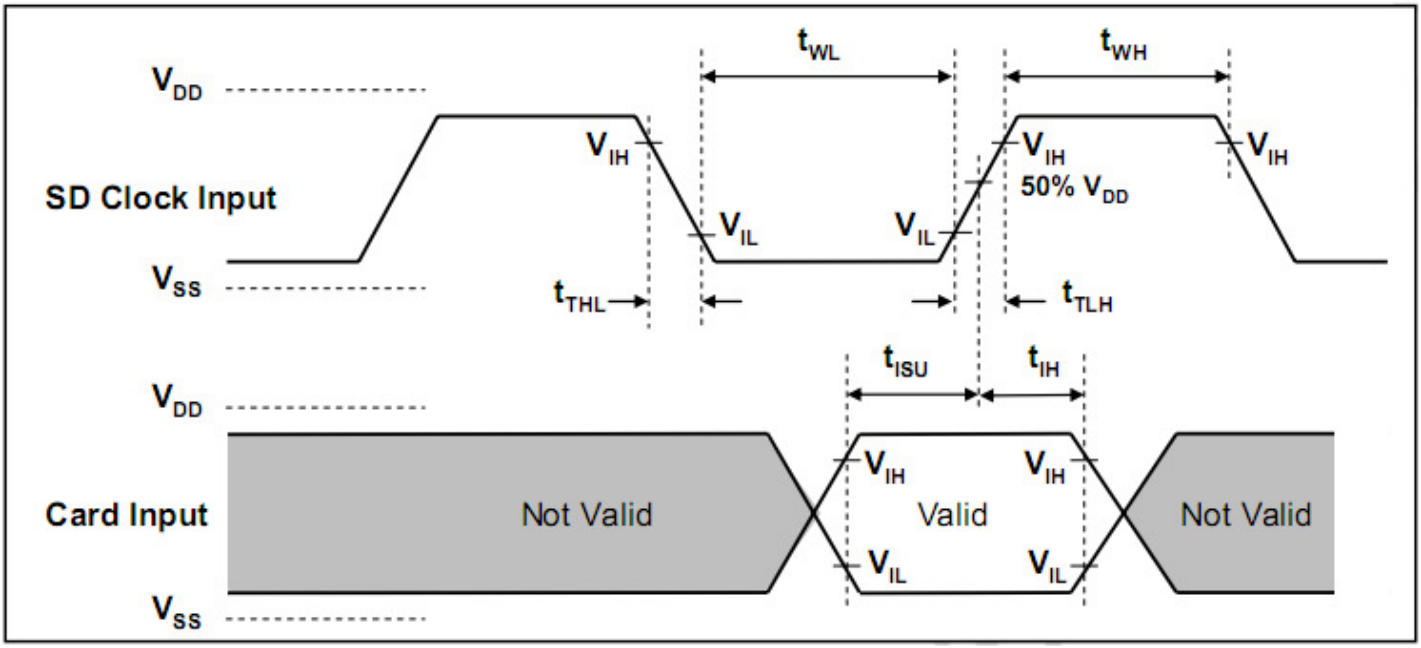


Card Output Timing (Default Speed Mode)

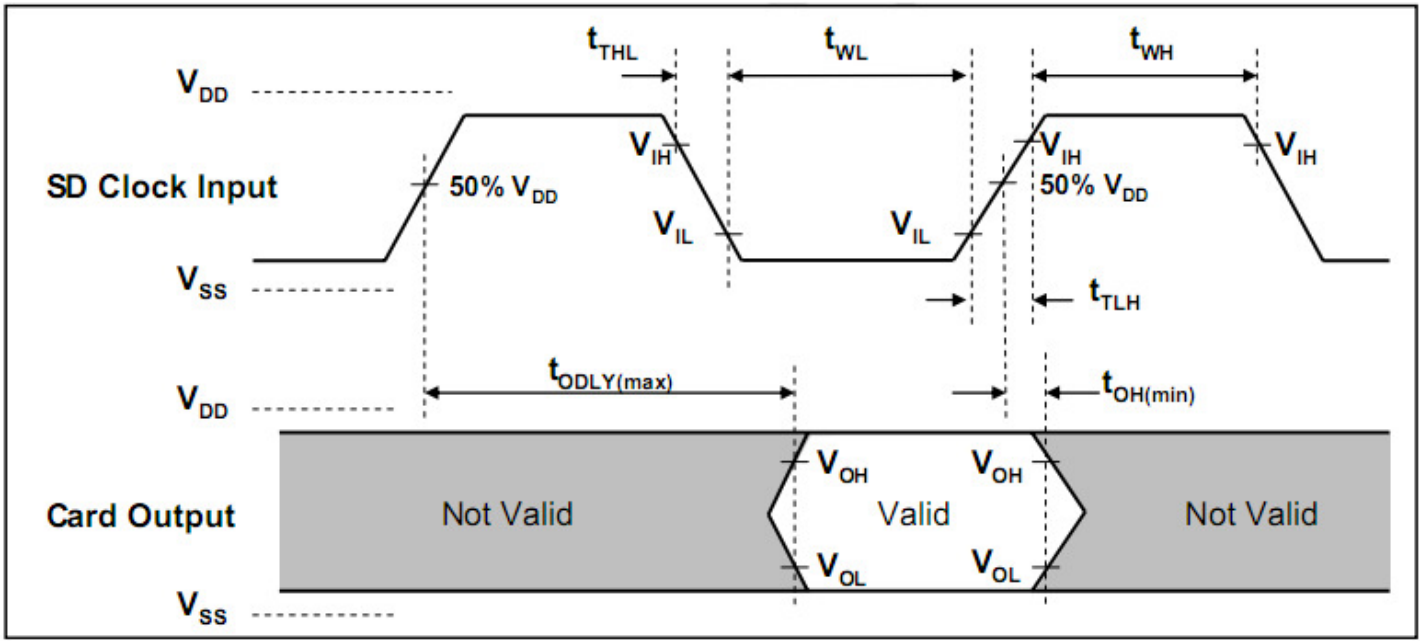
Parameter	Symbol	Min	Max.	Unit	Remark
Clock CLK (All values are referred to min (V_{IH}) and max (V_{IL})					
Clock frequency Data Transfer Mode	f_{PP}	0	25	MHz	$C_{CARD} \leq 10$ pF, (1 card)
Clock frequency Identification Mode	f_{OD}	$0_{(1)}$/100	400	KHz	$C_{CARD} \leq 10$ pF, (1 card)
Clock low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

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

4.3 Bus Timing (High Speed Mode)



Card Input Timing (High Speed Mode)



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 Transfer Mode	t_{ODLY}		14	ns	$C_L \leq 40$ pF, (1 card)
Output Hold time	t_{OH}	2.5		ns	$C_L \leq 40$ pF, (1 card)
Total System capacitance for each line[1]	C_L		40	pF	(1 card)

* In order to satisfy severe timing, host shall drive only one card.
* TS64GSDXC10 does not support UHS-I mode.

4.4 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.

Parameter	Symbol	Min.	Max.	Unit	Remark
Pull-up resistance	R_{CMD} R_{DAT}	10	100	kΩ	To prevent bus floating
Bus signal line capacitance	C_L		40	pF	1 card $C_{HOST}+C_{BUS}$ shall not exceed 30 pF
Single card capacitance	C_{CARD}		10	pF	
Maximum signal line inductance			16	nH	$f_{PP} \leq 20$ MHz
Pull-up resistance inside card (pin1)	R_{DAT3}	10	90	kΩ	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 because they are

connected separately to the SD Memory Card host.

Host should consider total bus capacitance for each signal as the sum of C_{HOST}, C_{BUS}, and C_{CARD}, these parameters are defined by per signal. The host can determine C_{HOST} and C_{BUS} so that total bus capacitance is less than the card estimated capacitance load (C_L=40 pF). The SD Memory Card guarantees its bus timing when total bus capacitance is less than maximum value of C_L (40 pF).

4.5 Timeout Condition

Access time	Timeout Condition
Read Access time	100ms (Maximum for Single/Multiple Read)
Write Access time	500ms (Maximum for Single/Multiple Write)
Erase Access time	250ms (Maximum for Erase)

5.0 Register Information

Within the card interface six registers are defined: OCR, CID, CSD, RCA, DSR and SCR. These can be accessed only by corresponding commands. The OCR, CID, CSD and SCR registers carry the card/content specific information, while the RCA and DSR registers are configuration registers storing actual configuration parameters.

5.1 OCR register

The 32-bit operation conditions register stores the VDD voltage profile of the card. Additionally, this register includes status information bits. One status bit is set if the card power up procedure has been finished. This register includes another status bit indicating the card capacity status after set power up status bit. The OCR register shall be implemented by the cards. The 32-bit operation conditions register stores the VDD voltage profile of the card. Bit 7 of OCR is newly defined for Dual Voltage Card and set to 0 in default. If a Dual Voltage Card does not receive CMD8, OCR bit 7 in the response indicates 0, and the Dual Voltage Card which received CMD8, sets this bit to 1. Additionally, this register includes 2 more status information bits.

Bit 31 - Card power up status bit, this status bit is set if the card power up procedure has been finished.

Bit 30 - Card Capacity Status bit, 0 indicates that the card is SDSC. 1 indicates that the card is SDHC or SDXC. The Card Capacity Status bit is valid after the card power up procedure is completed and the card power up status

The OCR register shall be implemented by the cards.

OCR bit position	OCR Fields Definition	
0-3	reserved	
4	reserved	
5	reserved	
6	reserved	
7	Reserved for Low Voltage Range	
8	reserved	
9	reserved	
10	reserved	
11	reserved	
12	reserved	
13	reserved	VDD Voltage Window
14	reserved	
15	2.7-2.8	
16	2.8-2.9	
17	2.9-3.0	
18	3.0-3.1	
19	3.1-3.2	
20	3.2-3.3	
21	3.3-3.4	
22	3.4-3.5	
23	3.5-3.6	
24[3]	Switching to 1.8V Accepted (S18A)	
25-29	reserved	
30	Card Capacity Status (CCS)[1]	
31	Card power up status bit (busy)[2]	

OCR Register Definition

1) This bit is valid only when the card power up status bit is set.
2) This bit is set to LOW if the card has not finished the power up routine.
3) Only UHS-I card supports this bit.

A voltage range is not supported if the corresponding bit value is set to LOW. As long as the card is busy, the corresponding bit (31) is set to LOW.

5.2 CID Register

The Card Identification (CID) register is 128 bits wide. It contains the card identification information used during the card identification phase. Every individual flash card shall have a unique identification number. The structure of the CID register is defined in the following paragraphs:

Name	Field	Width	CID-slice
Manufacturer ID	MID	8	[127:120]
OEM/Application ID	OID	16	[119:104]
Product name	PNM	40	[103:64]
Product revision	PRV	8	[63:56]
Product serial number	PSN	32	[55:24]
reserved	--	4	[23:20]
Manufacturing date	MDT	12	[19:8]
CRC7 checksum	CRC	7	[7:1]
not used, always 1	-	1	[0:0]

The CID Fields

• MID

An 8-bit binary number that identifies the card manufacturer. The MID number is controlled, defined,and allocated to a SD Memory Card manufacturer by the SD-3C, LLC. This procedure is established to ensure uniqueness of the CID register.

• OID

A 2-character ASCII string that identifies the card OEM and/or the card contents (when used as a distribution media either on ROM or FLASH cards). The OID number is controlled, defined, and allocated to a SD Memory Card manufacturer by the SD-3C, LLC. This procedure is established to ensure uniqueness of the CID register.

Note: SD-3C, LLC licenses companies that wish to manufacture and/or sell SD Memory Cards, including but not limited to flash memory, ROM, OTP, RAM, and SDIO Combo Cards.

SD-3C, LLC is a limited liability company established by Matsushita Electric Industrial Co. Ltd., SanDisk Corporation and Toshiba Corporation.

• PNM

The product name is a string, 5 ASCII characters long.

• PRV

The product revision is composed of two Binary Coded Decimal (BCD) digits, four bits each, representing an “n.m” revision number. The “n” is the most significant nibble and “m” is the least significant nibble.

As an example, the PRV binary value field for product revision “6.2” will be: 0110 0010b

• PSN

The Serial Number is 32 bits of binary number.

• MDT

The manufacturing date composed of two hexadecimal digits, one is 8 bit representing the year(y) and the other is four bits representing the month(m).

The “m” field [11:8] is the month code. 1 = January.

The “y” field [19:12] is the year code. 0 = 2000.

As an example, the binary value of the Date field for production date “April 2001” will be:

00000001 0100.

• CRC

CRC7 checksum (7 bits).

5.3 CSD Register

The CSD Regsiter shows Definition of the CSD for the High Capacity SD Memory Card and Extended Capacity SD Memory Card (CSD Version 2.0). The following sections describe the CSD fields and the relevant data types for the High Capacity SD Memory Card.

CSD Version 2.0 is applied to SDHC and SDXC Cards. The field name in parenthesis is set to fixed value and indicates that the host is not necessary to refer these fields. The fixed values enables host,which refers to these fields, to keep compatibility to CSD Version 1.0. The Cell Type field is coded as follows: R = readable, W(1) = writable once, W = multiple writable.

Name	Field	Width	Value	Cell Type	CSD-slice
CSD structure	CSD_STRUCTURE	2	01b	R	[127:126]
reserved	-	6	00 0000b	R	[125:120]
data read access-time	(TAAC)	8	0Eh	R	[119:112]

data read access-time in CLK	(NSAC)	8	00h	R	[111:104]
max. data transfer rate	(TRAN_SPEED)	8	32h, 5Ah, 0Bh or 2Bh	R	[103:96]
card command classes	CCC	12	01x110110101b	R	[95:84]
max. read data block length	(READ_BL_LEN)	4	9	R	[83:80]
partial blocks for read allowed	(READ_BL_PARTIAL)	1	0	R	[79:79]
write block misalignment	(WRITE_BLK_MISALIGN)	1	0	R	[78:78]
read block misalignment	(READ_BLK_MISALIGN)	1	0	R	[77:77]
DSR implemented	DSR_IMP	1	x	R	[76:76]
reserved	-	6	00 0000b	R	[75:70]
device size	C_SIZE	22	xxxxxxh	R	[69:48]
reserved	-	1	0	R	[47:47]
erase single block enable	(ERASE_BLK_EN)	1	1	R	[46:46]
erase sector size	(SECTOR_SIZE)	7	7Fh	R	[45:39]
write protect group size	(WP_GRP_SIZE)	7	0000000b	R	[38:32]
write protect group enable	(WP_GRP_ENABLE)	1	0	R	[31:31]
reserved		2	00b	R	[30:29]
write speed factor	(R2W_FACTOR)	3	010b	R	[28:26]
max. write data block length	(WRITE_BL_LEN)	4	9	R	[25:22]
partial blocks for write allowed	(WRITE_BL_PARTIAL)	1	0	R	[21:21]
reserved	-	5	00000b	R	[20:16]
File format group	(FILE_FORMAT_GRP)	1	0	R	[15:15]
copy flag	COPY	1	x	R/W(1)	[14:14]
permanent write protection	PERM_WRITE_PROTECT	1	x	R/W(1)	[13:13]
temporary write protection	TMP_WRITE_PROTECT	1	x	R/W	[12:12]
File format	(FILE_FORMAT)	2	00b	R	[11:10]

reserved	-	2	00b	R	[9:8]
CRC	CRC	7	xxxxxxxb	R/W	[7:1]
not used, always'1'	-	1	1	-	[0:0]

The CSD Register Fields (CSD Version 2.0)

The following sections describe the CSD fields and the relevant data types. If not explicitly defined otherwise, all bit strings are interpreted as binary coded numbers starting with the left bit first.

• CSD_STRUCTURE

Field structures of the CSD register are different depend on the Physical Specification Version and Card Capacity.

The CSD_STRUCTURE field in the CSD register indicates its structure version.

The following table shows the version number of the related CSD structure.

CSD_STRUCTURE	CSD structure version	Card Capacity
0	CSD Version 1.0	Standard Capacity
1	CSD Version 2.0	High Capacity and Extended Capacity
2-3	reserved	

CSD Register Structure

• TAAC

This field is fixed to 0Eh, which indicates 1 ms. The host should not use TAAC, NSAC, and R2W_FACTOR to calculate timeout and should uses fixed timeout values for read and write operations.

TAAC bit position	code
2:0	time unit 0=1ns, 1=10ns, 2=100ns, 3=1µs, 4=10µs, 5=100µs, 6=1ms, 7=10ms

6:3	time value 0=reserved, 1=1.0, 2=1.2, 3=1.3, 4=1.5, 5=2.0, 6=2.5, 7=3.0, 8=3.5, 9=4.0, A=4.5, B=5.0, C=5.5, D=6.0, E=7.0, F=8.0
7	reserved

• NSAC

This field is fixed to 00h. NSAC should not be used to calculate time-out values.

• TRAN_SPEED

The following table defines the maximum data transfer rate per one data line - TRAN_SPEED:

TRAN_SPEED bit	code
2:0	transfer rate unit 0=100kbit/s, 1=1Mbit/s, 2=10Mbit/s, 3=100Mbit/s, 4... 7=reserved
6:3	time value 0=reserved, 1=1.0, 2=1.2, 3=1.3, 4=1.5, 5=2.0, 6=2.5, 7=3.0, 8=3.5, 9=4.0, A=4.5, B=5.0, C=5.5, D=6.0, E=7.0, F=8.0
7	reserved

Maximum Data Transfer Rate Definition

Note that for current SD Memory Cards that field must be always 0_0110_010b (032h) which is equal to 25MHz - the mandatory maximum operating frequency of SD Memory Card.

In High-Speed mode, that field must be always 0_1011_010b (05Ah) which is equal to 50MHz. And when the timing mode returns to the default by CMD6 or CMD0 command, its value will be 032h.

• CCC

The SD Memory Card command set is divided into subsets (command classes). The card command class register CCC defines which command classes are supported by this card. A value of '1' in a CCC bit means that the corresponding command class is supported.

CCC bit	Supported card command class
0	class 0
1	class 1
.....	
11	class 11

Supported Card Command Classes

• READ_BL_LEN
This field is fixed to 9h, which indicates READ_BL_LEN=512 Byte.

• READ_BL_PARTIAL
This field is fixed to 0, which indicates partial block read is inhibited and only unit of block access is allowed.

• WRITE_BLK_MISALIGN
This field is fixed to 0, which indicates that write access crossing physical block boundaries is always disabled in SDXC Cards.

• READ_BLK_MISALIGN
This field is fixed to 0, which indicates that read access crossing physical block boundaries is always disabled in SDXC Cards.

• DSR_IMP
Defines if the configurable driver stage is integrated on the card. If set, a driver stage register (DSR) must be implemented also

DSR_IMP	DSR type
0	no DSR implemented
1	DSR implemented

DSR Implementation Code Table

• C_SIZE
This field is expanded to 22 bits and can indicate up to 2 TBytes (It is the same as the maximum memory space

specified by a 32-bit block address.) This parameter is used to calculate the user data area capacity in the SD memory card (not include the protected area). The user data area capacity is calculated from C_SIZE as follows:

memory capacity = (C_SIZE+1) * 512K byte

The Minimum user area size of SDHC Card is 4,211,712 sectors (2GB + 8.5MB).
The Minimum value of C_SIZE for SDHC in CSD Version 2.0 is 001010h (4112).

The maximum user area size of SDHC Card is (32GB - 80MB)
The maximum value of C_SIZE for SDHC in CSD Version 2.0 is 00FF5Fh (65375).

The Minimum user area size of SDXC Card is 67,108,864 sectors (32GB).
The Minimum value of C_SIZE for SDXC in CSD Version 2.0 is 00FFFFh (65535).

• ERASE_BLK_EN
This field is fixed to 1, which means the host can erase one or multiple units of 512 bytes.

• SECTOR_SIZE
This field is fixed to 7Fh, which indicates 64 KBytes. This value is not related to erase operation. SDXC Cards indicate memory boundary by AU size and this field should not be used.

• WP_GRP_SIZE
This field is fixed to 00h. SDXC Cards do not support write protected groups.

• WP_GRP_ENABLE
This field is fixed to 0. SDXC Cards do not support write protected groups.

• R2W_FACTOR
This field is fixed to 2h, which indicates 4 multiples. Write timeout can be calculated by multiplying the read access time and R2W_FACTOR. However, the host should not use this factor and should use 250 ms for write timeout

• WRITE_BL_LEN
This field is fixed to 9h, which indicates WRITE_BL_LEN=512 Byte.

• WRITE_BL_PARTIAL
This field is fixed to 0, which indicates partial block read is inhibited and only unit of block access is allowed.

• FILE_FORMAT_GRP
This field is set to 0. Host should not use this field.

• COPY
Defines whether the contents is original (=0) or has been copied (=1). Setting this bit to 1 indicates that the card

content is a copy. The COPY bit is a one time programmable bit except ROM card.

• PERM_WRITE_PROTECT

Permanently protects the whole card content against overwriting or erasing (all write and erase commands for this card are permanently disabled). The default value is '0', i.e. not permanently write protected.

• TMP_WRITE_PROTECT

Temporarily protects the whole card content from being overwritten or erased (all write and erase commands for this card are temporarily disabled). This bit can be set and reset. The default value is '0', i.e. not write protected.

• FILE_FORMAT

This field is set to 0. Host should not use this field

• CRC

The CRC field carries the check sum for the CSD contents.

The checksum has to be recalculated by the host for any CSD modification. The default corresponds to the initial CSD contents.

The following table lists the correspondence between the CSD entries and the command classes. A '+' entry indicates that the CSD field affects the commands of the related command class.

5.4 RCA Register

The writable 16-bit relative card address register carries the card address that is published by the card during the card identification. This address is used for the addressed host-card communication after the card identification procedure. The default value of the RCA register is 0x0000. The value0x0000 is reserved to set all cards into the *Stand-by State* with CMD7.

5. DSR Register (Optional)

It can be optionally used to improve the bus performance for extended operating conditions (depending on parameters like bus length, transfer rate or number of cards). The CSD register carries the information about the DSR register usage. The default value of the DSR register is 0x404.

6. SCR Register

In addition to the CSD register there is another configuration register that named - SD CARD Configuration Register (SCR). SCR provides information on SD Memory Card's special features that were configured into the given card. The size of SCR register is 64 bit. This register shall be set in the factory by the SD Memory Card manufacturer.
The following table describes the SCR register content.

Description	Field	Width	Cell Type	SCR Slic
SCR Structure	SCR_STRUCTURE	4	R	[63:60]
SD Memory Card - Spec. Version	SD_SPEC	4	R	[59:56]
data_status_after erases	DATA_STAT_AFTER_ERASE	1	R	[55:55]
CPRM Security Support	SD_SECURITY	3	R	[54:52]
DAT Bus widths supported	SD_BUS_WIDTHS	4	R	[51:48]
Spec. Version 3.00 or higher	SD_SPEC3	1	R	[47]
Extended Security Support	EX_ SECURITY	4	R	[46:43]
Reserved		9	R	[42:34]
Command Support bits	CMD_SUPPORT	14	R	[33:32]
reserved for manufacturer usage	-	32	R	[31:0]

The SCR Fields

• SCR_STRUCTURE
Version number of the related SCR structure in the SD Memory Card Physical Layer Specification.

SCR_STRUCTURE	SCR structure version	SD Physical Layer Specification Version
0	SCR version 1.0	Version 1.01-3.00
1-15	reserved	

SCR Register Structure Version

• **SD_SPEC**

Describes the SD Memory Card Physical Layer Specification version supported by this card.

SD_SPEC	Physical Layer Specification Version Number
0	Version 1.0-1.01
1	Version 1.10
2	Version 2.00 or Version 3.00 (Refer to SD_SPEC3)
3-15	reserved

Physical Layer Specification Version

• **SD_SPEC3**

SD_SPEC	SD_SPEC3	Physical Layer Specification Version Number
2	0	Version 2.00
2	1	Version 3.00

The card manufacturer determines SD_SPEC value by conditions indicated below. All conditions shall be satisfied for each version. The other combination of conditions is not allowed.

Essential conditions to indicate Version 3.00 Card (SD_SPEC=2 and SD_SPEC3=1)

(1) The card shall support CMD6
(2) The card shall support CMD8
(3) The card shall support CMD42
(4) User area capacity shall be up to 2GB (SDSC) or 32GB (SDHC) User area capacity shall be more than or equal to 32GB and up to 2TB (SDXC)
(5) Speed Class shall be supported (SDHC or SDXC)

Application Notes:

When checking SD_SPEC version in SCR, the host shall not forget that higher SD_SPEC version may be specified in future. It is important to keep compatibility for future version.

• DATA_STAT_AFTER_ERASE

Defines the data status after erase, whether it is '0' or '1' (the status is card vendor dependent).

• SD_SECURITY

This field indicates CPRM Security Specification Version for each capacity card. The definition of Protected Area is different in each capacity card.

SD_SECURITY	CPRM Security Version
0	No Security
1	Not Used
2	SDSC Card (Security Version 1.01)
3	SDHC Card (Security Version 2.00)
4	SDXC Card (Security Version 3.xx)
5 - 7	Reserved

CPRM Security Version

The basic rule of setting this field:

SDSC Card sets this field to 2 (Version 1.01)
SDHC Card sets this field to 3 (Version 2.00).
SDXC Card sets this field to 4 (Version 3.xx).

Note that it is mandatory for a regular writable SD Memory Card to support Security Protocol. For ROM (Read Only) and OTP (One Time Programmable) types of the SD Memory Card, the security feature is optional.

• SD_BUS_WIDTHS

Describes all the DAT bus widths that are supported by this card.

SD_BUS_WIDTHS	Supported Bus Widths
Bit 0	1 bit (DAT0)
Bit 1	reserved
Bit 2	4 bit (DAT0-3)
Bit 3	reserved

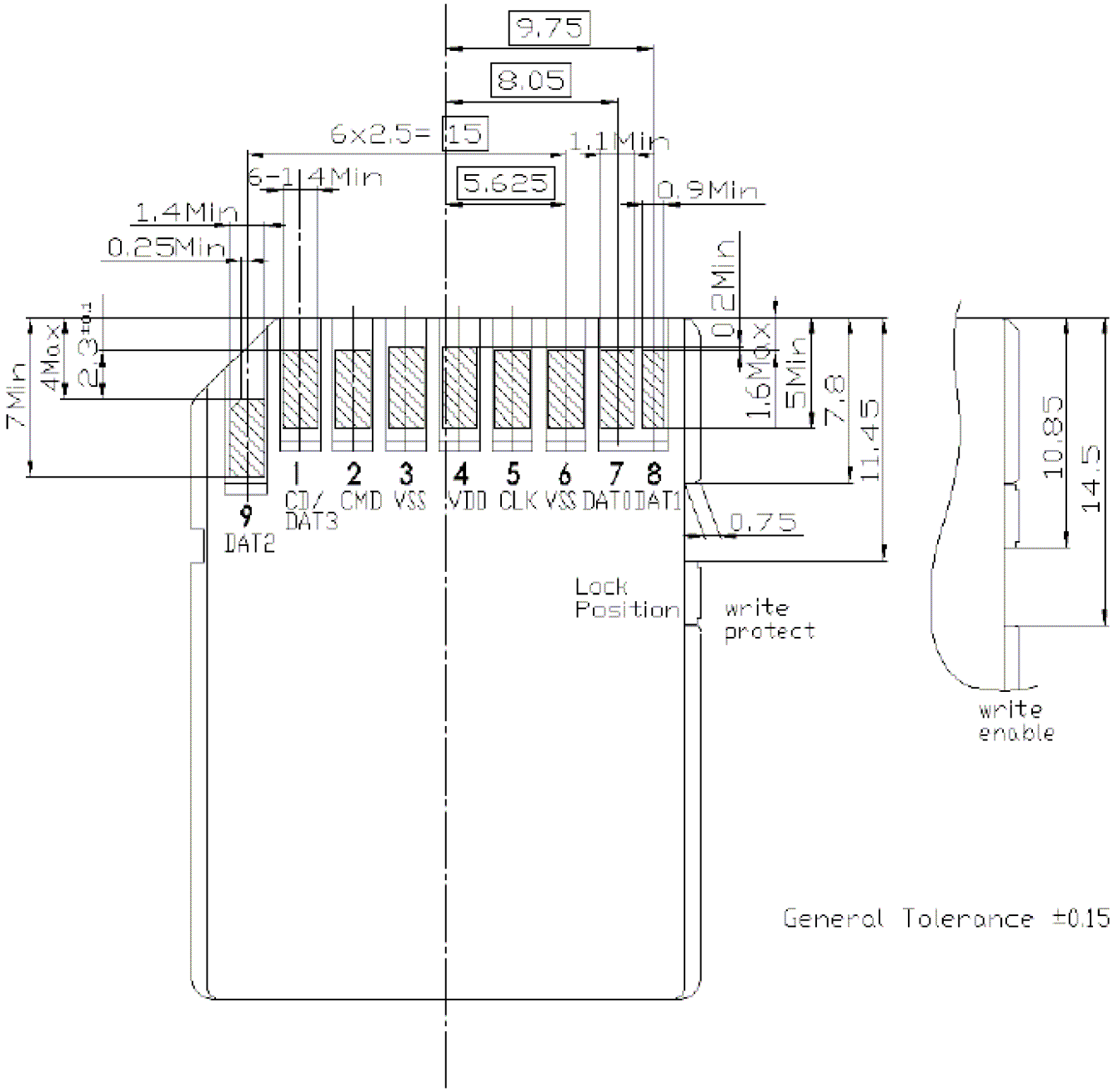
SD Memory Card Supported Bus Widths

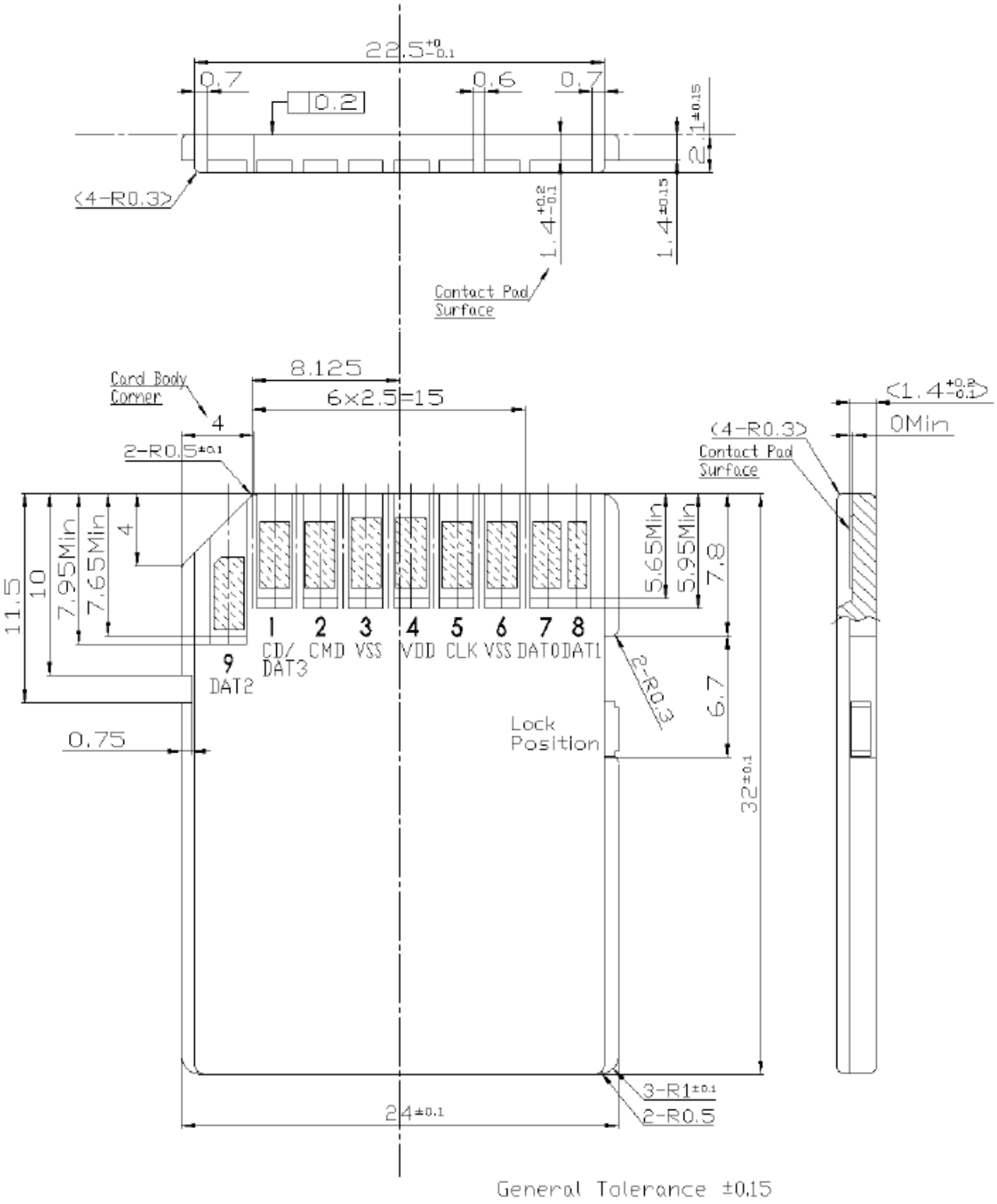
Since SD Memory Card shall support at least the two bus modes 1bit or 4bit width then any SD Card shall set at least bits 0 and 2 (SD_BUS_WIDTH="0101").

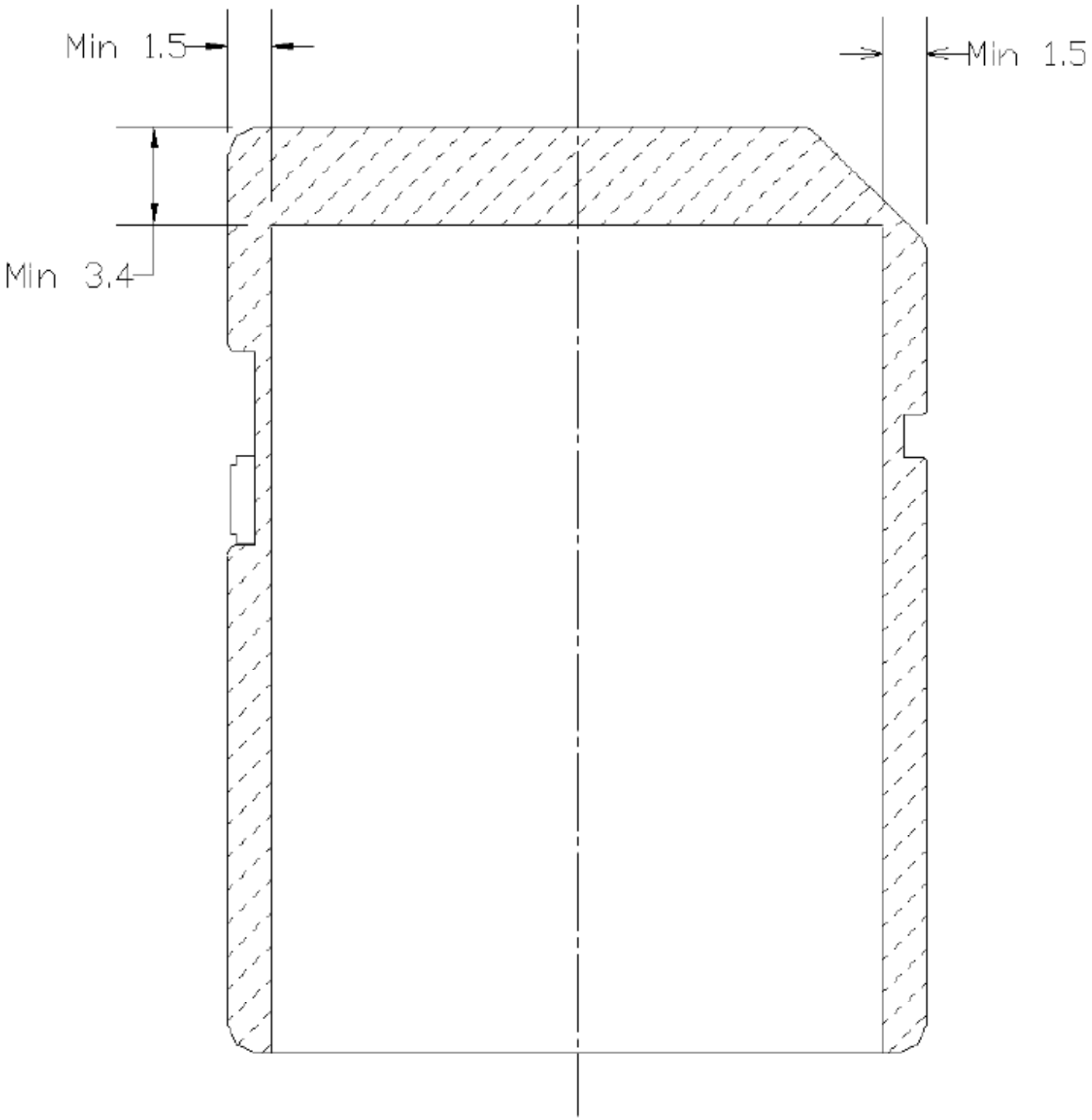
6.0 Reliability and Durability

Temperature	Operation: -25℃ / 85℃ Storage: -40℃ (168h) / 85℃ (500h) Junction temperature: max. 95℃
Moisture and corrosion	Operation: 25℃ / 95% rel. humidity Storage: 40℃ / 93% rel. hum./500h Salt Water Spray: 3% NaCl/35C; 24h acc. MIL STD Method 1009
Durability	10.000 mating cycles; test procedure: tbd.
Bending	10N
Torque	0.15N.m or +/-2.5 deg
Drop test	1.5m free fall
Visual inspection Shape and form	No warp page; no mold skin; complete form; no cavities surface smoothness <= -0.1 mm/cm² within contour; no cracks; no pollution (fat, oil dust, etc.)
Minimum moving force of WP witch	40gf (Ensures that the WP switch will not slide while it is inserted to the connector.)
WP Switch cycles	minimum 1000 Cycles(@Slide force 0.4N to 5N)

7.0 Mechanical Dimension




22.5+0 -0.1
0.7
0.6
0.7
0.2
2.1±0.15
(4-R0.3)
1.4+0.2 -0.1
1.4±0.15
Contact Pad Surface
Card Body Corner
8.125
6×2.5=15
4
2-R0.5±0.1
(4-R0.3)
Contact Pad Surface
(1.4+0.2 -0.1)
0Min
11.5
10
7.95Min
7.65Min
4
5.65Min
5.95Min
7.8
1 CD/DAT3
2 CMD
3 VSS
4 VDD
5 CLK
6 VSS
7 DAT0
8 DAT1
9 DAT2
2-R0.3
6.7
Lock Position
0.75
32±0.1
3-R1±0.1
2-R0.5
24±0.1
General Tolerance ±0.15


Min 1.5
Min 1.5
Min 3.4