



Double Top Technology Limited
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Confidential

Micro-SD Specification



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Micro-SD card specification

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A. General Description

The Micro Secure Digital (Micro-SD) card is fully compliant to the SD Memory Card Specification version 1.1 (backward compatible with 1.01). It provides the highest level of performance for Micro-SD supported consumer electronic devices. Micro-SD card is capable for storing up to 512MB of data.

The Micro-SD card is based on an advanced 8-pin interface, designed to operate at a maximum operating frequency of 50MHz and a low voltage range from 2.7V to 3.6V. It can alternate communication protocol between SD mode or SPI mode. It performs data error detection and correction with very low power consumption.

Micro Secure Digital card is one of the most popular cards today based on its high performance, good reliability and wide compatibility.

B. Features

Support SD system specification version 1.1

Support Capacity : 16MB / 32MB / 64MB / 128MB / 256MB / 512MB

Voltage range : Basic communication (CMD0, CMD15, CMD55, ACMD41) : 2.0 - 3.6V.

Other command and memory access : 2.7 - 3.6V.

Designed for read-only and read/write cards.

Default mode : Variable clock rate 0-25MHz, up to 12.5MB/sec interface speed(using 4 parallel data lines)

High-Speed mode : Variable clock rate 0-50MHz, up to 25MB/sec interface speed(using 4 parallel data lines)

Switch function command supports High-Speed.

Copyrights Protection Mechanism - Complies with highest security of SDMI standard.

Password Protection of cards (option).

Write Protect feature using mechanical switch.

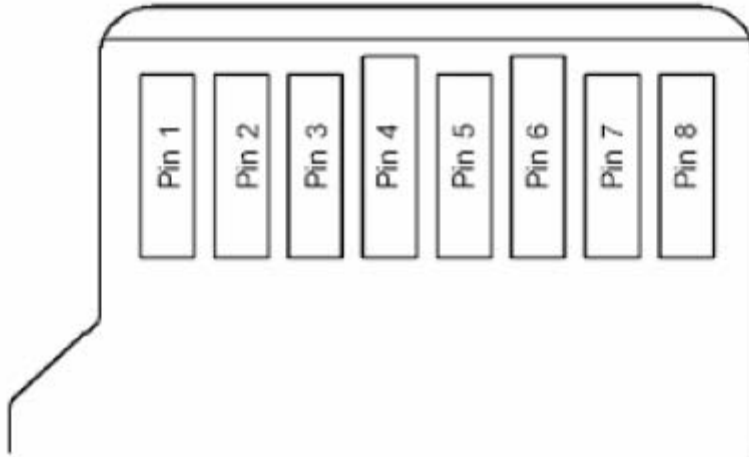
Built-in write protection features (permanent and temporary).

Support SD SPI mode

High transmission speed (refer to speed test section) +4KV/-4KV ESD protection in contact pads.

Dimension : 15mm(L) x 11mm(W) x 1mm(H)

C. Pin Assignment



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		
-						
-						
-						

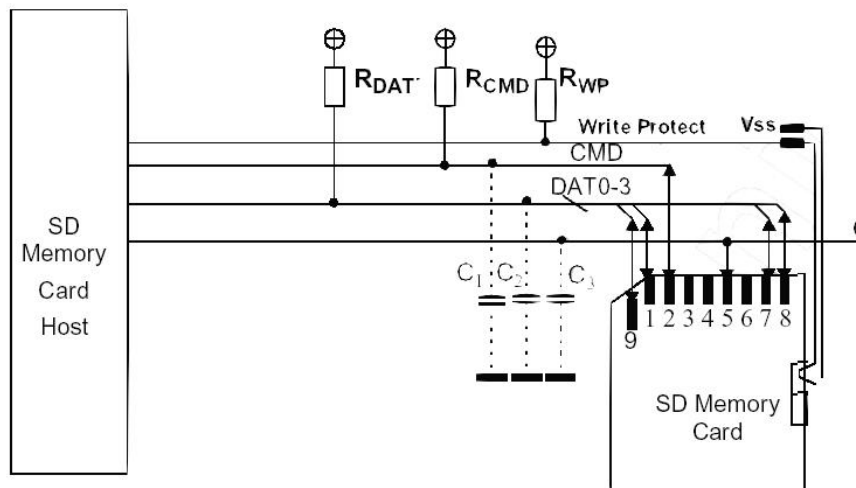
- (1) S: power supply, I:input; O:output using push-pull drivers; PP:I/O using push-pull drivers
- (2) The extended DAT lines(DAT1-DAT3)are input on power up. They start to operate as DAT lines after SET_BUS_WIDTH command. The Host shall keep its own DAT1-DAT3 lines in input mode, as well, while they 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 , with SET_CLR_CARD_DETECT(ACMD42) command.

Name	Width	Description
CID	128bit	Card identification number; card individual number for identification. Mandatory
RCA	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
SDR	64bit	SD Configuration Register; information about the Micro SD Memory Card's Special Features capabilities. Mandatory
OCR	32bit	Operation condition register. Mandatory

D. Hardware Interface

The SD Memory Card has six communication lines and three supply lines:

- **CMD:** Command is a bidirectional signal. The host and card drivers are operating in push pull mode.
- **DAT0-3:** Data lines are bidirectional signals. Host and card drivers are operating in push pull mode
- **CLK:** Clock is a host to card signal. CLK operates in push pull mode.
- **VDD:** VDD is the power supply line for all cards.
- **VSS:** Ground lines.



Bus circuitry diagram

E. System Power Consumption

Table list as below is the power consumption of Micro SD card with the flash memory.
(PS4043 + Flash Memory)

Flash mode	Max Power up Current (uA)	Max Stand by Current (uA)	Max Read Current (mA)	Max Write Current (mA)
Single ⁽¹⁾ flash(1x8bit)	150	150	60@ 3.6V	60@ 3.6V
Parallel ⁽²⁾ flash(2x8bit)	200	200	80@ 3.6V	80@ 3.6V

(1) Data transfer mode is single channel.

(2) Data transfer mode is dual channel.

F. 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	T _a	Operating Temperature	-25	+85	°C
4	T _{st}	Storage Temperature	-40	+85	°C

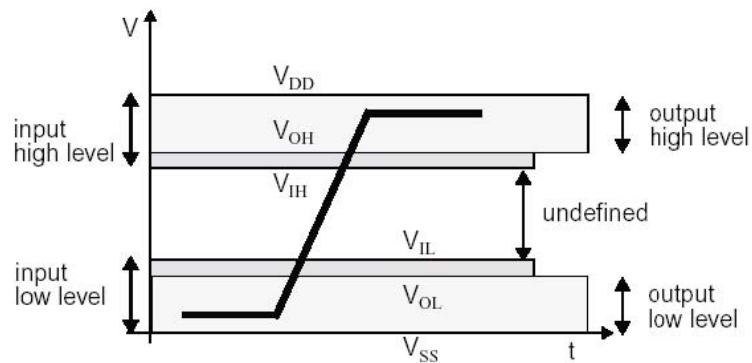
Parameter	Symbol	Min	MAX	Unit
Operating Temperature	T _a	-25	+85	°C
V _{DD} Voltage	V _{DD}	2.0	3.6	V

G. DC Characteristic

Micro SD Controller DC Characteristics

Parameter	Symbol	Min	Max.	Unit	
Peak voltage on all lines		-0.3	VDD+0.3	V	
All Inputs					
Input Leakage Current		-10	10	uA	
All Outputs					
Output Leakage Current		-10	10	uA	
Output High Voltage	VOH	0.75*VDD		V	IOH=-100uA @VDD Min
Output Low Voltage	VOL		0.125*VDD	V	IOL=100uA @VDD Min
Input High Voltage	VIH	0.625*VDD	VDD+0.3	V	
Input Low Voltage	VIL	VSS-0.3	0.25*VDD	V	

Bus Signal Levels



Bus signal levels

• Power Supply Voltage

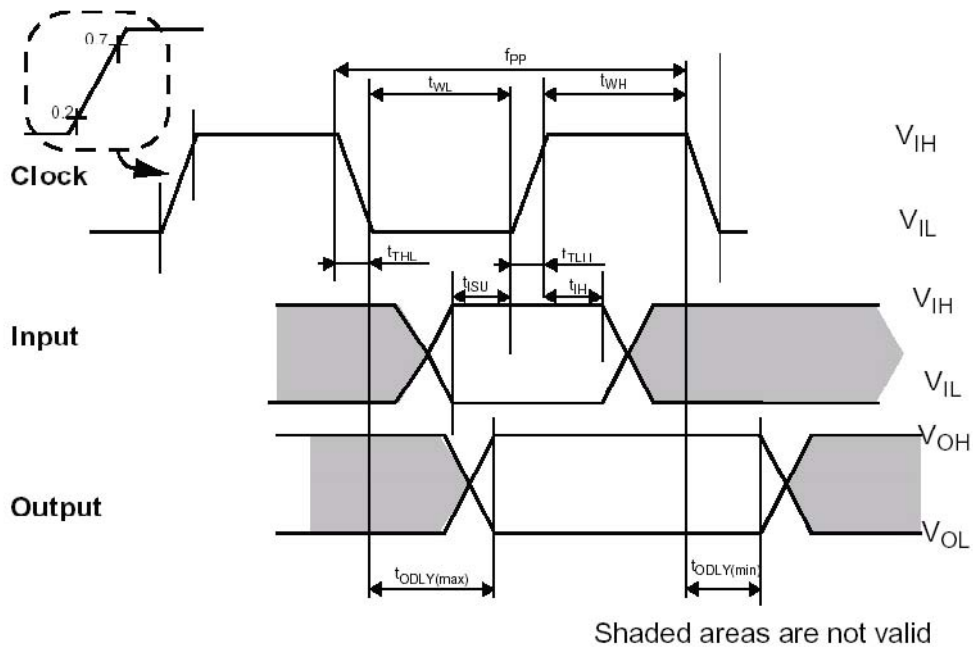
Parameter	symbol	Min	Max	Unit	
Supply voltage	V _{DD}	2.0	3.6	V	
Supply voltage differentials(V _{ss1} ,V _{ss2})		-0.3	0.3	V	
Power up time			250	mS	from 0v to V _{DD} Min.

• Bus Signal Line Load

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

H. AC Characteristic

H1. Micro SD Interface timing (Default)

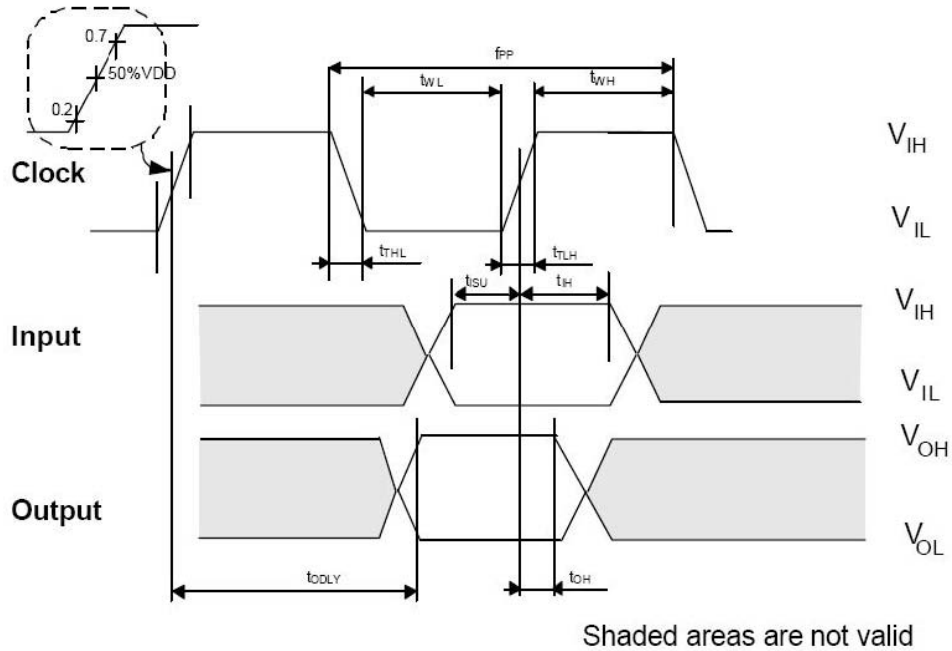




Parameter	Symbol	Min	Max.	Unit	Remark
Clock CLK (All values are referred to min(V _{IH}) and max(V _{IL}))					
Clock frequency Data Transfer Mode	f _{PP}	0	25	MHz	C _L ≤ 100 pF (7 cards)
Clock frequency Identification Mode (the low freq. is required for MultiMedia Card compatibility)	f _{OD}	0	400 0 ⁽¹⁾ /100KHz	KHz	C _L ≤ 250 pF (21 cards)
Clock low time	t _{WL}	10		ns	C _L ≤ 100 pF (7 cards)
Clock high time	t _{WH}	10		ns	C _L ≤ 100 pF (7 cards)
Clock rise time	t _{TLH}		10	ns	C _L ≤ 100 pF (7 cards)
Clock fall time	t _{THL}		10	ns	C _L ≤ 100 pF (7 cards)
Clock low time	t _{WL}	50		ns	C _L ≤ 250 pF (21 cards)
Clock high time	t _{WH}	50		ns	C _L ≤ 250 pF (21 cards)
Clock rise time	t _{TLH}		50	ns	C _L ≤ 250 pF (21 cards)
Clock fall time	t _{THL}		50	ns	C _L ≤ 250 pF (21 cards)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	t _{ISU}	5		ns	C _L ≤ 25 pF (1 cards)
Input hold time	t _{IH}	5		ns	C _L ≤ 25 pF (1 cards)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time	t _{ODLY}	0	14	ns	C _L ≤ 25 pF (1 cards)

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

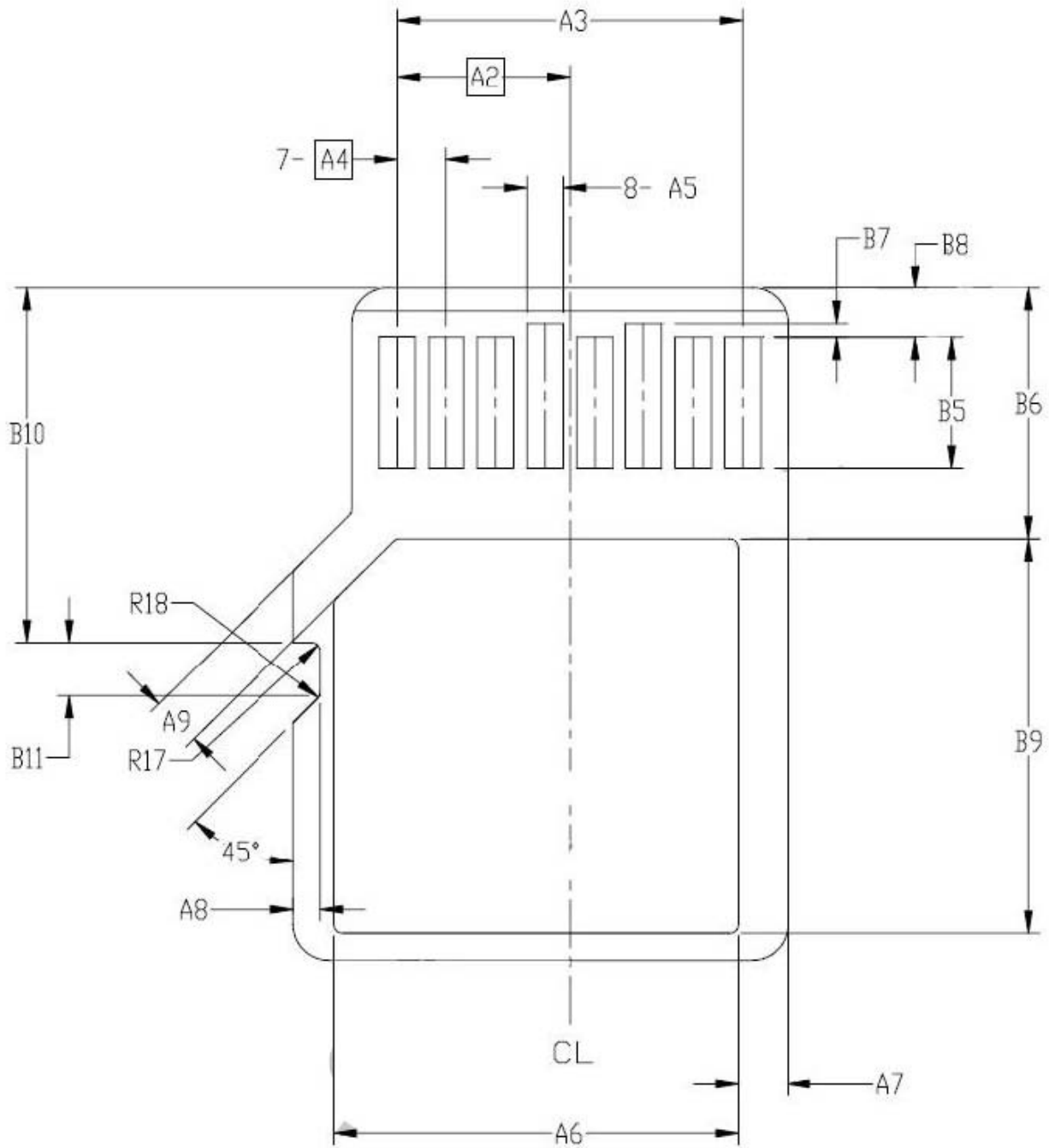
H2. Micro SD Interface timing (High-speed Mode)



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	
Clock low time	t_{WL}	7		ns	
Clock high time	t_{WH}	7		ns	
Clock rise time	t_{TLH}		3	ns	
Clock fall time	t_{THL}		3	ns	
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	t_{ISU}	6		ns	
Input hold time	t_{IH}	2		ns	
Outputs CMD, DAT (referenced to CLK)					
Output Delay time	t_{ODLY}	0	14	ns	
Output Hold time	t_{OH}	2.5		ns	
Total System Capacitance for each line ₁	C_L		40	pF	

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


I. Physical Outline Dimension





SYMBOL	COMMON DIMENSIONS			NOTE
	MIN	NOM	MAX	
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	-	-	
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	
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	

Notes:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3.  COPLANARITY IS ADDITIVE TO C1 MAX THICKNESS.