SD NAND SPECIFICATION

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1. Overview

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1.1 Product Description

Hanhai - tech SD NAND are highly i ntegrated flash memories with serial and random access capability. Can be use in the device which can support SD 3.0 standard. It is accessible via a dedicated serial interface optimized for fast and reliable data transmission.

The purpose of product develo pment is to make memory chips based on SD interface more stable and use scenarios more abundant. Han hai - tech SD NAND can match more MCUS with stable quality and strong compatibility, and can perfectly replace the previous storage products based on SDIO in terface. The low power consumption of the product itself is more suitable for handheld products, and the rigorous production process makes the product more suitable for diverse scenarios

1.2 Features Summary

- Capacity: 8GB/ 16GB /32GB
- Complies to SD Specif ication 3.0
- Supports SD SPI Mode
- Voltage range for communication: 2.7~3.6V
- Variable clock rate 0 - 25 MHz (standard), 0 - 50 MHz (high performance)
- Up to 25 MB/sec data transfer rate (using four parallel data lines)
- password protection (CMD42 - LOCK_UNLOCK)
- Sophisticated system for error recovery including a po(c)-19.TJ 0 Tc4 (v)-0.9 (n7.7 (O)u0 (c)-19 (

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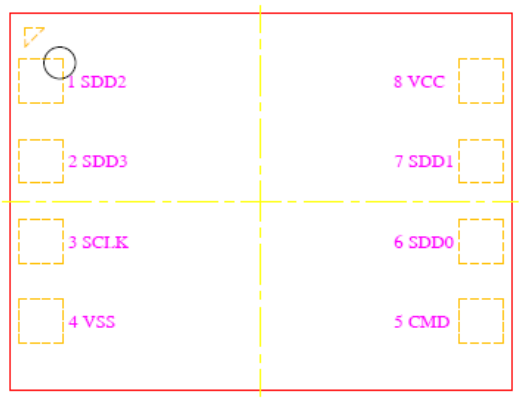


Figure 1:Top Vi ew

	SD Mo de	SPI Mode
Name	Tyte	Tyte

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3. Product List

Product model	Capacity	Actual Size	Sequential R/W	Package
HHW 64GS 90C-B1	8GB	7360MB	10/ 20MB/S	9* 13 (mm) PSLC
HHW 128GS 90C-B 1	16GB	14550MB	10/ 20MB/S	9* 13 (mm) TLC
HHW 256G S90C -B 1	32 GB	29810MB	10/20MB/S	9* 13 (mm) TLC

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Command Types

There are four kinds of commands defined to control the SD Memory Card:

• Broadcast commands (bc), no response - The broadcast feature is only if all the CMD lines are connect ed together in the host. If they are separated, then each card will accept it separately in its turn.

• Broadcast commands with response (bcr) response from all cards simultaneously - Since there is no Open Drain mode in SD Memory Card, this type of comman d shall be used only if all the CMD lines are separated - the command will be accepted and responded by every card separately.

• Addressed (point -to-point) commands (ac) no data transfer on DAT

• Addressed (point -to-point) data transfer commands (adtc) dat a transfer on DAT

All commands and responses are sent over the CMD line of the SD Memory Card. The command transmission always starts with the left bit of the bit string corresponding to the command codeword.

Command Format

All commands have a fixed code length of 48 bits, needing a transmission time of 1.92 µs @ 25 MHzand 0.96 µs @ 50 MHz.

Bit position	47	46	[45:40]	[39:8]	[7:1]	0
Width(bits)	1	1	6	32	7	1
Value	“0”	“1”	x	x	x	“1”
Description	Start bit	Transmission bit	Command index	Argument	CRC7	End bit

Command Classes

The command set of the SD Memory Card system is divided into several classes. Each class supports a set of card functionalities.determines the setting of CCC from the card supported commands. A CCC bit, which corresponds to a support ed command number, is set to 1. A class in CCC includes mandatory commands is always set to 1. Cards with specific functions may need to support some optional commands. For example, Combo Card shall support CMD5.

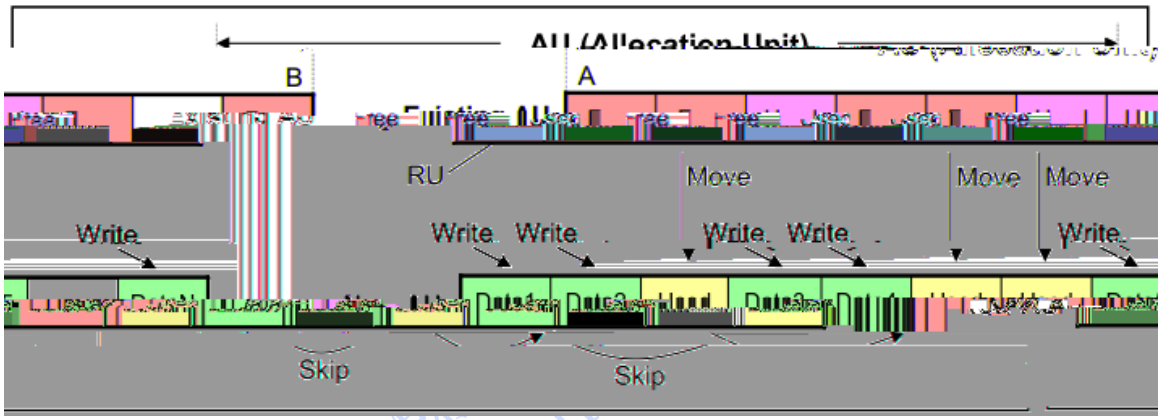
Class 0, 2, 4, 5 and 8 are mandatory and s hall be supported by all SD Memory Cards. Class 7 except CMD40 is mandatory for SDHC and SDXC. The other classes are optional. The supported Card Command Classes (CCC) are coded as a

parameter in the card specific data (CSD) register of each card, providin g the host with information on how to access the card.

Card Command Class (CCC)	0	1	2	3	4	5	6	7	8	9	10	11
description	basic	reserved	block read	reserved	block write	write erase	protection	applic. block cmd	I/O mode	switch	reserved	command
Mandatory	+											CMD0
Mandatory	+											CMD2
Mandatory	+											CMD3
Mandatory	+											CMD4
Optional									+			CMD5
Mandatory										+		CMD6[2]
								CMD7		Mandatory		+
								CMD8[3]		Mandatory		+
								CMD9		Mandatory		+
								CMD10		Mandatory		+
								CMD11[5]		Optional		+
								CMD12		Mandatory		+
CMD56	Mandatory								+			
CMD57[2]	Optional										+	
ACMD6	Mandatory								+			
ACMD13	Mandatory								+			

9. Write Performance

Below table shows the typical data management of the card when the host writes RUs of an AU. When the host writes to a fragmented AU, the card prepares a new AU by copying the used RUs and writing the new RUs.. The location A is at the start of the AU boundary and location B is at the end of the AU boundary. From A to B, the host shall write data to free RUs contiguously and skip used RUs (shall not skip any free RU). The card may indicate busy to the host, so the host can wait, during the time the card controller is writing and moving data. The total write time from A to B can be calculated by summing up the write time of free RUs and the moving time of the used RUs. The number of used RUs (Nu) is available by counting it over one AU and number of free RUs is expressed by (N RU – Nu).



Example of Writing Fragmented AU

The Performance Write (Pw) is defined as a minimum average write performance over an AU. It is calculated by taking the average of all sequential RU write operations to one complete AU, which is not fragmented.

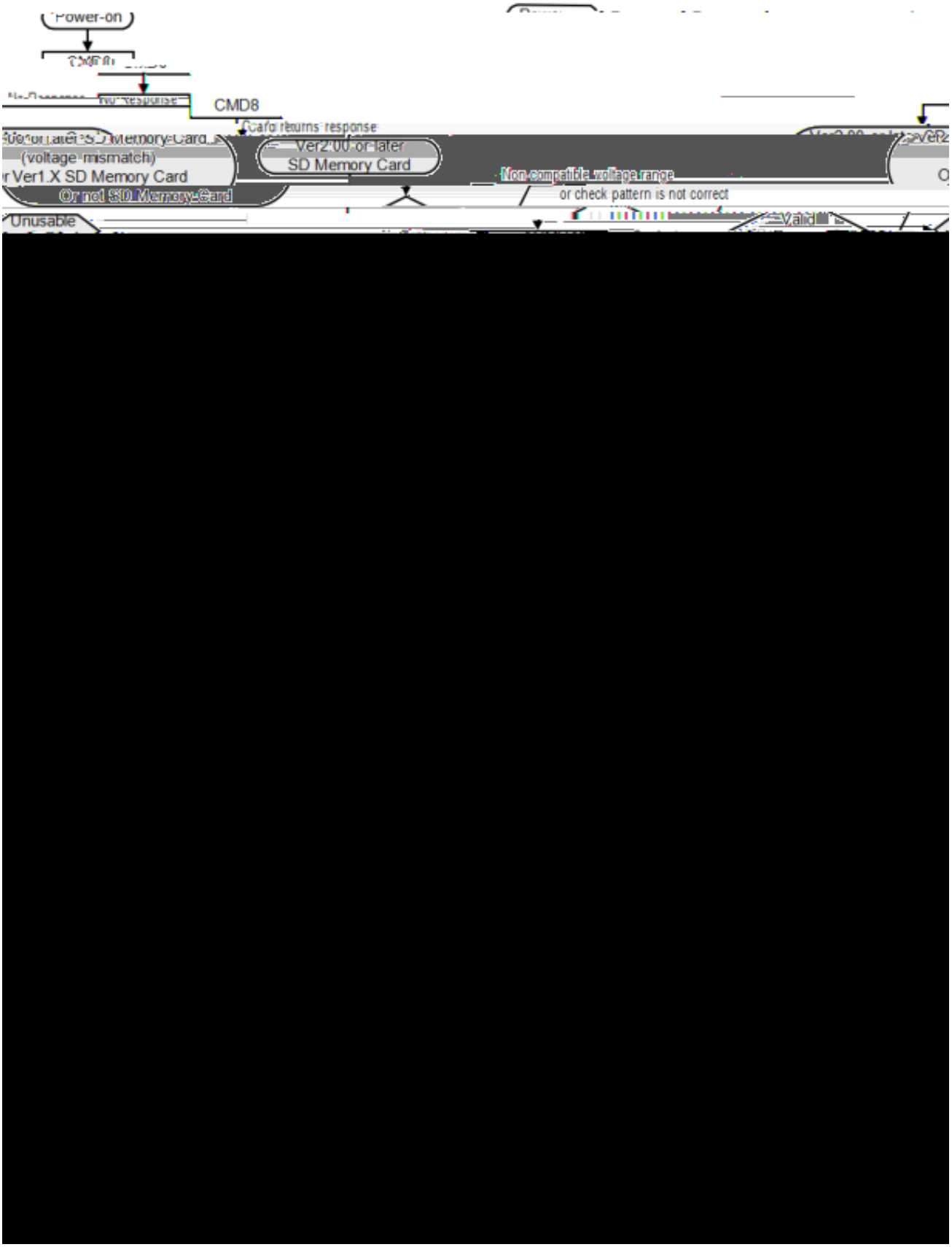
The Performance Move (Pm) is defined as a minimum average move performance. It is calculated by taking the average over sequential RU move operations to one complete AU. A move is an internal operation of the card, so SD clock frequency does not affect the time of the move operation. In case the card does not have to move RU, Pm should be considered as infinity (1/Pm = 0).

Note that a Speed Class that supports Class10 shall not use the Pm value stored in the SD Status to calculate performance in any fragmented AU. Class 10 performance is defined only for entirely free AUs.

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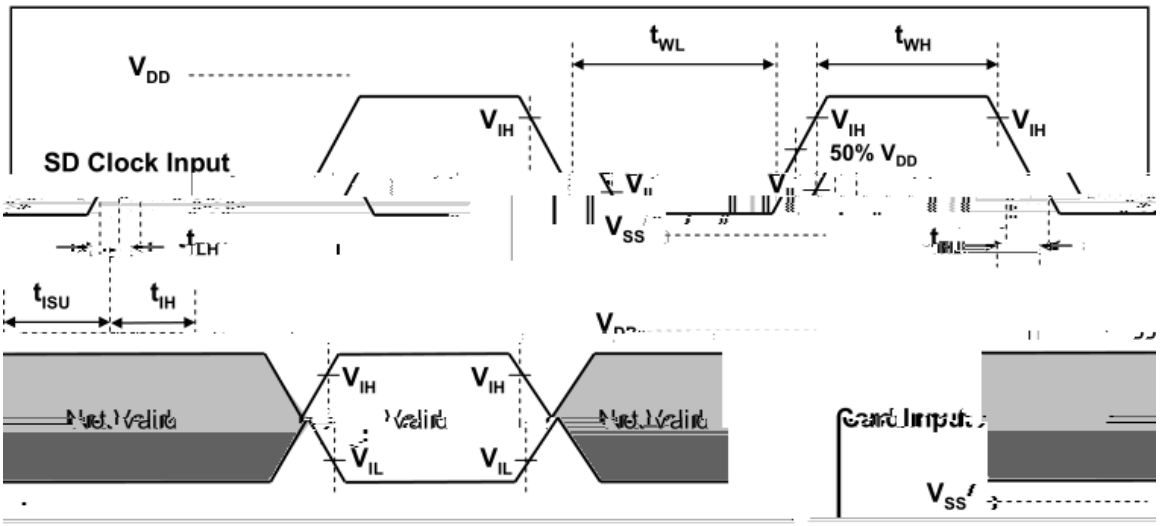
12. SD Mode


Power-on
CMD8
Card returns response
Ver2.00 or later
SD Memory Card
(voltage mismatch)
Ver1.X SD Memory Card
or not SD Memory Card
Unusable
Non compatible voltage range
or check pattern is not correct

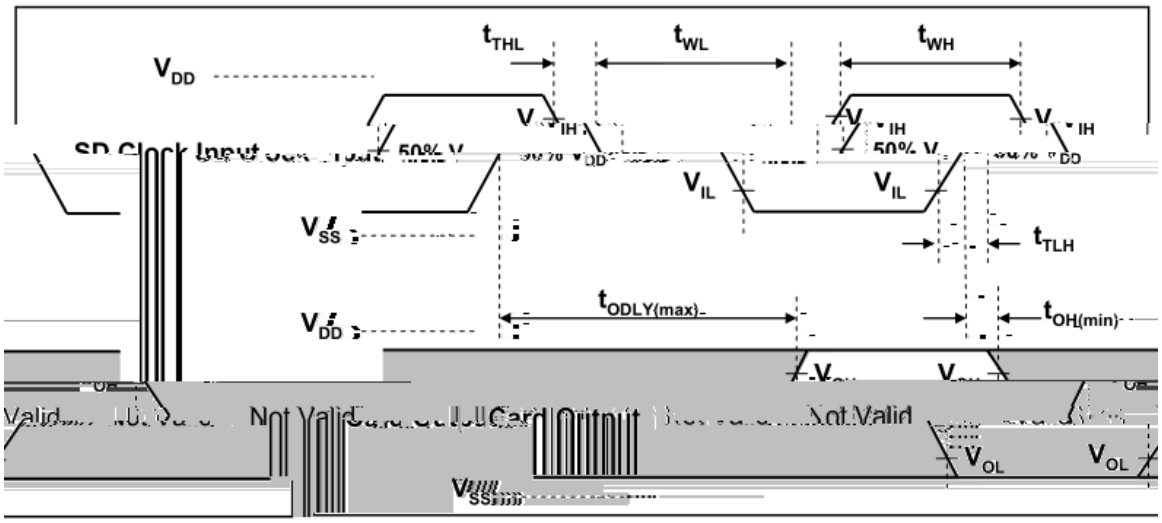
13. DC Characteristics

Symbol	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IL}	Input low voltage		VSS-0.3		0.25VCC	V
V_{IH}	Input high voltage		0.625VCC		VCC+0.3	V
V_{OL}	Output low voltage	IOL=100μA @VCC_min			0.125VCC	V
		@VCC_min				
						current
	3.3V@clock					
						Standby current
I_{OP}	Operation current	3.3v@50MHz (Write)			15	25	mA
		(Read)				

14. Bus Timing (High - Speed Mode)

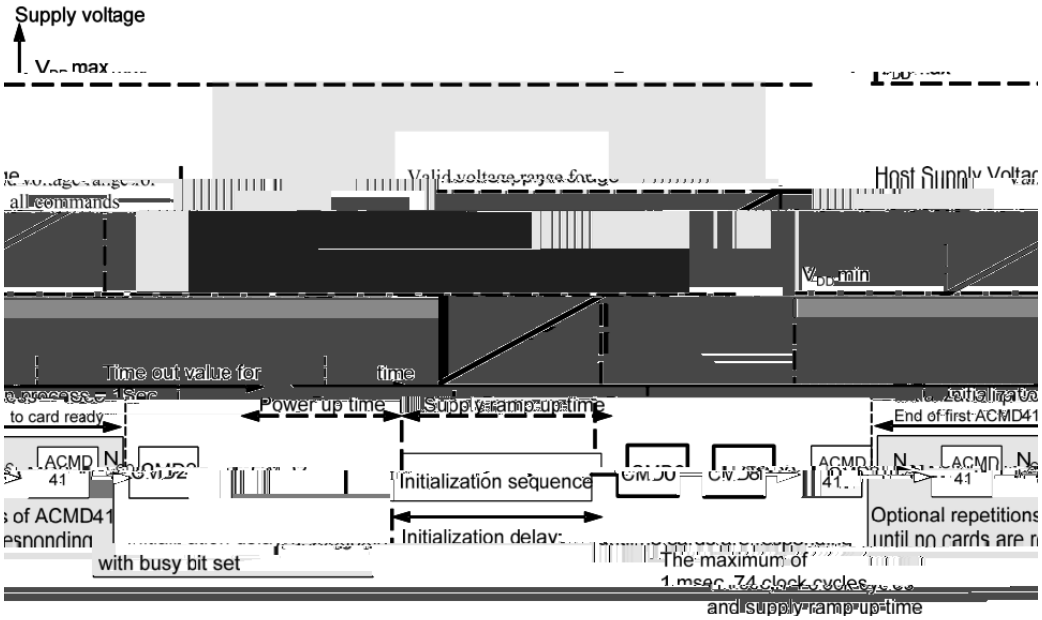


Card Input Timing (High Speed Card)



Card Output Timing (High Speed Mode)

15. Power Up



Power -up Diagram

'Power up time' is defined as voltage rising time from 0 volt to Vop min (refer to 6.6) 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 (Host Suppl 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 Vdd 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 SPl 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, CMDO is not necessary. In case of SPl host, CMDO shall be the first command to send the card to SPI mode.

CMD8 is newly added in the Physical Layer Specif ication Version 2.00 to support multiple voltage ranges and used to check whether the card supports supplied voltage. The version 2.00 or later 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 seauence, 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.

Power Up Time

