Netac P500 Series Memory Cards Specification

V1.0

Overview

- Capacity

- 2~256GB

- Flash Type

- TLC

-- Speed Class

- U1(C10)/U3(V30)

- Controller

- NT/AS/SMI

- Flash

- SAM/HY/MICRON/SANDISK

- Power consumption:

- Power Up Current < 250uA
- Standby Current < 1000uA
- Read Current < 400mA
- Write Current < 400mA

- Automatic power down and automatic wake up

- Smart power management.

- Damage free powered card insertion and removal

- Supply Voltage :2.7~3.6V

- Advanced Flash Management

- Static and Dynamic Wear Leveling
- Bad Block Management

- Write Protect with mechanical switch

- Temperature Range

- Operation: -25°C ~ 85°C
- Storage: -40°C ~ 85°C

- RoHS Compliant

- EMI Compliant

Performance

Capacity	Speed class	UHS-I	Controller	Flash	SLC/MLC/TLC	HD Bench(@1000MB)	
						Write (MB/s) up to	Read (MB/s) up to
2GB	C6	-	SMI/AS	Micron/HY	MLC	6	15
4GB	C6	-	SMI/AS	Micron/HY	MLC	6	15
8GB	C10	-	SMI/AS	Micron/HY	MLC	10	20
16GB	C10	U1	SMI/AS	Micron/HY	MLC	30	60
32GB	C10	U1	SMI/AS/NT	Micron/HY/SDK	MLC	20	90
64GB	C10	U1	SMI/AS	Micron/HY	TLC	20	80
128GB	C10	U1	SMI/AS	Micron/HY	TLC	20	80
256GB	C10	U1	SMI/AS	Micron/HY	TLC	30	90

Note1: The speed class specification classifies card performance by speed class number and offers a method to calculate performance. For more information, please refer to the SDS Physical Layer Specification, V3.00.

Note2: **Measurement based on HD Bench V3.40 software(@1000MB)**, 1 gigabyte (GB) = 1 billion bytes. Some capacity is not available for data storage.

Note3: The above performance test based on platform: Intel(R) Core(TM) i7-5820 CPU @3.30GHz.; RAM 8GB; OS: windows 10 64bit. Performance may differ according to flash type, test software,OS. platform and capacity.

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1.Introduction

Netac P500 series memory cards are highly integrated flash memories with serial and random access capability. It is accessible via a dedicated serial interface optimized for fast and reliable data transmission. This interface allows several cards to be staked by through connection their peripheral contacts. Netac P500 series memory cards are fully compatible to a new consumer standard, called SD cards system standard define in the micro SD card system specification.

The micro SD cards system is a new mass-storage system based on innovations in semiconductor technology. It has been developed to provide an inexpensive mechanically robust storage medium in card form for multimedia consumer applications. Netac P500 series memory cards allow the design of inexpensive players and drivers without moving parts. A low power consumption and a wide supply voltage range favors mobile, battery-powered application such as audio players, organizers, palmtops, electronic books, encyclopedia and dictionaries. Using very effective data compression schemes such as MPEG, Netac P500 series memory cards will deliver enough capacity for all kinds of multimedia data.

1.1 Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, Netac P500 series memory cards apply the BCH ECC Algorithm, which can detect and correct errors occur during Read process, ensure data been read correctly, as well as protect data from corruption.

1.2 Wear Leveling

NAND Flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some area get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling technique is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

Wear Leveling algorithm can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND Flash is greatly improved.

1.3 Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks” . Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks” . Netac implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

2. Product Specifications

- Card capacity of non-secure area and secure area support Specifications
- Support SD SPI mode
- Designed for read-only and read/write cards
- Bus Speed Mode (use 4 parallel data lines)
  - Non-UHS Mode
    - » Default speed mode: 3.3V signaling, frequency up to 25MHz, up to 12.5 MB/sec
    - » High speed mode: 3.3V signaling, frequency up to 50MHz, up to 25 MB/sec
  - UHS Mode
    - » SDR12: SDR up to 25MHz, 1.8V signaling
    - » SDR25: SDR up to 50MHz, 1.8V signaling
    - » SDR50: 1.8V signaling, frequency up to 100MHz, up to 50 MB/sec
    - » SDR104: 1.8V signaling, frequency up to 208MHz, up to 104MB/sec
    - » DDR50: 1.8V signaling, frequency up to 50MHz, sampled on both clock edges, up to 50 MB/sec

Note: 1. Timing in 1.8V signaling is different from that of 3.3V signaling.

2. To properly run the UHS mode, please ensure the device supports UHS-I mode.

- The command list supports [Part 1 Physical Layer Specification Ver3.1 Final] definitions
- Copyrights Protection Mechanism
  - Compliant with the highest security of CPRM standard
- Support CPRM (Content Protection for Recordable Media) of SD Card
- Card removal during read operation will never harm the content
- Password Protection of cards (optional)
- Write Protect feature using mechanical switch

- Built-in write protection features (permanent and temporary)
- +4KV/-4KV ESD protection in contact pads
- Operation voltage range: 2.7 ~ 3.6V
- Support Dynamic and Static Wear Leveling
- Dimension: 15mm (L) x 11mm (W) x 1mm (H)

3. Environmental Specification

Temperature and Humidity

- Temperature Range
  - Operational: -25°C ~ 85°C
  - Storage: -40°C ~ 85°C

Note: We suggest that customer uses SD/micro SD card during the temperature range for better reliability.

- Humidity
  - Operational: RH = 95% under 25°C
  - Diamond grade: RH = 93% under 40°C

Table 3-1 High Temperature Test Condition

	Temperature	Humidity	Test Time	Result
Operation	85°C	0% RH	96 hours	No any abnormality is detected
Storage	85°C	0% RH	500 hours	

Table 3-2 LowTemperature Test Condition

	Temperature	Humidity	Test Time	Result
Operation	-25°C	0% RH	96 hours	No any abnormality is detected
Storage	-40°C	0% RH	168 hours	

Table 3-3 High Humidity Test Condition

	Temperature	Humidity	Test Time	Result
Operation	25°C	95% RH	1hours	No any abnormality is detected
Storage	40°C	93% RH	500 hours	

Table 3-4 Temperature Cycle Test

	Temperature	Test Time	Cycle	Result
Operation	-25°C	30 min	10 Cycles	No any abnormality is detected
	85°C	30 min		
Storage	-40°C	30 min	10 Cycles	No any abnormality is detected
	85°C	30 min		

Shock

Table 3-5 Shock Specification

	Acceleration Force	Half Sin Pulse Duration	Result
P500 Series	1500G	0.5ms	No any abnormality is detected when power on

Vibration

Table 3-6 Vibration Specification

	Condition		Vibration Orientation	Result
	Frequency/Displacement	Frequency/Acceleration		
P500 Series	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G	X, Y, Z axis/30 min for each	No any abnormality is detected when power on

Drop

Table 3-7 Vibration Specification

	Height of Drop	Number of Drop	Result
P500 Series	150cm free fall	6 face of each unit	No any abnormality is detected when power on

Bending

Table 3-8 Bending Specification

	Force	Action	Result
P500 Series	≥ 10N	Hold 1min/5 times	No any abnormality is detected when power on

Torque

Table 3-9 Torque Specification

	Force	Action	Result
P500 Series	0.1N-m or +/-2.5 deg	Hold 30 seconds/5 times	No any abnormality is detected when power on

Electrostatic Discharge(ESD)

Table 3-10 ESD Specification

	Condition	Result
P500 Series	Contact: +/- 4KV each item 5 times/Pin Air: +/- 8KV 5 times/ Pin	PASS

EMI Compliance

- FCC:CISPR22
- CE:EN55022
- BSMI:13438

4.Memory Cards Comparison

Table 4-1 Comparing UHS Speed Grade Symbols

	U1(UHS Speed Grade 1)	U3(UHS Speed Grade 3)
Operable Under	UHS-I Bus I/F, UHS-II Bus I/F	
SD Memory Card	SDHC UHS-I and UHS-II, SDXC UHS-I and UHS-II	
Mark		
Performance	10 MB/s minimum write speed	30 MB/s minimum write speed
Applications	Full higher potential of recording real-time broadcasts and capturing large-size HD videos.	Capable of recording 4K/2K video.

Note: UHS (Ultra High Speed), the fastest performance category available today, defines bus-interface speeds up to 312 Megabytes per second for greater device performance. It is available on SDXC and SDHC memory cards and devices.

5.Electrical Characteristics

5.1 General DC Characteristics

Table 5-1 General DC Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
Power Supply Votage	V_{CCAH}	2.7	3.3	3.6	V
Operating Temperture	—	0	—	70	℃
Storage Temperture	—	-25	—	85	℃
All Input Leakage Current	—	-10	—	10	uA
All Out Leakage Current	—	-10	—	10	UA

Table 5-2 Bus Operating Conditions-Signal Line's Load

Parameter	Symbol	Min	Typical	Max	Unit	Remark
Pull-up Resistance for CMD signal	R_{CMD}	10	_	100	K'Ω	To prevent bus floating
Pull-Up Resistance for DAT{3:0} Signals	R_{DAT}	10	_	100	K'Ω	To prevent bus floating
Card Capacitance for Eash Signal Pin	C_{CARD}	_	_	10	Pf	_
Pull-Up Resistance Inside Card {DAT(3)}	R_{DAT3}	10	_	90	K'Ω	May be used for card detection

Table 5-3 Open-Drain Mode Bus Signal Level

Parameter	Symbol	Min	Max	Unit	Condition
Output High Voltage	V_{OH}	_	_	V	I_{OH}=-100uA

Output Low Voltage	V_{OL}	–	0.3	V	I_{OL}=2 mA

Table 5-4 Push-Pull Mode Bus Signal Level- High Voltage 3.3V Signaling Mode

Parameter	Symbol	Min	Max	Unit	Condition
Output High Voltage	V_{OH}	2.4	—	V	V_{CC} I/ O = 3.3V
Output Low Voltage	V_{OL}	—	0.4	V	V_{CC} I/ O = 3.3V
Input High Voltage	V_{IH}	2	3.6	V	V_{CC} I/ O = 3.3V
Input Low Voltage	V_{IL}	-3.0	0.8	V	V_{CC} I/ O = 3.3V

The input levels are identical with the push-pull mode bus signal levels.

Note: VCC I/O =I /O buffer power.

Table 5-5 Push-Pull Mode Bus Signal Level- High Voltage 1.8V Signaling Mode

Parameter	Symbol	Min	Max	Unit	Condition
Output High Voltage	V_{OH}	1.4	—	V	V_{CC} I/ O = 1.8V
Output Low Voltage	V_{OL}	—	0.4	V	V_{CC} I/ O = 1.8V
Input High Voltage	V_{IH}	1.2	2.1	V	V_{CC} I/ O = 1.8V
Input Low Voltage	V_{IL}	-0.3	0.6	V	V_{CC} I/ O = 1.8V

5.2 Flash Interface AC Characteristics

Table 5-6 Flash Interface AC Timings

Parameter	Symbol	Min	Max	Unit
CLE Setup Time	t_{CLS}	10.0	—	ns
CLE Hold Time	t_{CLH}	5.0	—	ns
ALE Setup Time	t_{ALS}	10.0	—	ns
ALE Hold Time	t_{ALH}	5.0	—	ns
ALE Cycle Time	t_{WC}	20.0	—	ns
WE Pulse Width	t_{WP}	10.0	—	ns
WE High Hold Time	t_{WH}	7.0	—	ns
Write Data Output Setup Time	t_{DS}	7.0	—	ns
Write Data Output Setup Time	t_{DS}	7.0	—	ns
Write Data Output Hold Time	t_{DH}	5.0	—	ns
Read Cycle Time	t_{RC}	20.0	—	ns
RE Pulse Width	t_{RP}	10.0	—	ns
RE High Hold Time	t_{REH}	7.0	—	ns

5.3 Power Consumption

Table 5-7 Power Consumption of P500 Series

Bus Speed Mode		Max. Power Up Current(uA)	Max.Standby Currnet(uA)	Max.Read Currnet(uA)	Max.Write Currnet(uA)
Default Speed Mode		250	1000	150@3.6V	150@3.6V
High Speed Mode		250	1000	200@3.6V	200@3.6V
UHS-I Mode	UHS50/DDR50	250	1000	400@3.6V	400@3.6V
	UHS104	250	1000	400@3.6V	400@3.6V

Note: 1.Power consumption are measured at room temperature.

2. Power consumption of Max. Standby Current is for P500 Series Memory Cards under and including 64GB only. For 128GB and 256GB, the power consumption is to be determined.

3. The table above is the power consumption of P500 Series Memory Cards with different bus speed modes. Power consumption may differ according to flash type, OS. platform and capacity.

6.Interface

6.1 Pad Assignment and Descriptions

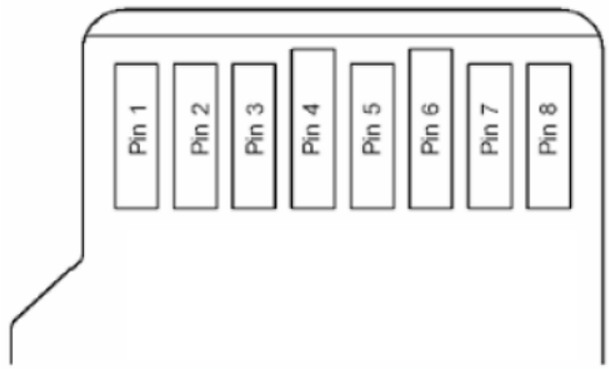


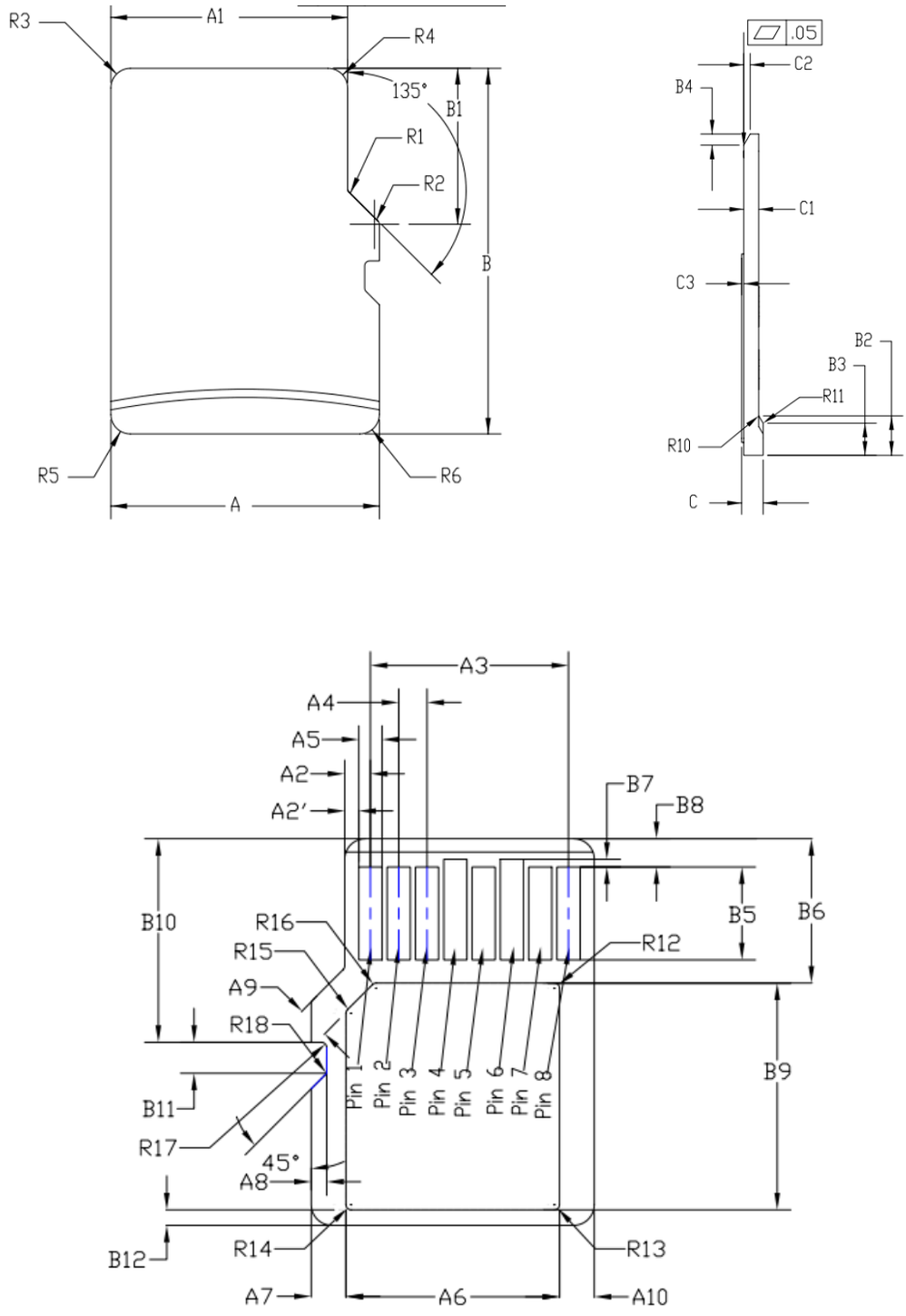
Table 6-1 P500 Series Memory Card Pad Addignment

Pin	SD Mode			SPI Mode		
	Name	Type	Description	Name	Type	Description
1	DAT2	I/O/PP	Data Line [bit2]	RSV	—	—
2	CD/DAT3	I/O/PP	Card Detect/Data Line [bit3]	CS	I	Chip Select (net true)
3	CMD	PP	Command/Response	DI	I	Data In
4	VDD	S	Supply voltage	VDD	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	VSS	S	Supply voltage ground	VSS	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	—	—

Note: S: power supply, I: input; O: output using push-pull drivers; PP: I/O using push-pull drivers.

7.Physical Dimension

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



COMMON DIMENSIONS				
SYMBOL	MIN	NOM	MAX	REF. SHEET
A	10.90	11.00	11.10	1
A1	9.60	9.70	9.80	1
A2	0.90	1.00	1.10	2
A2″	0.425	0.550	0.675	2
A3	7.60	7.70	7.80	2
A4	1.05	1.10	1.15	2
A5	0.85	0.90	0.95	2
A6	8.10	8.30	8.50	2
A7	-	-	1.88	2
A8	0.50	0.60	0.70	2
A9	0.80	-	-	2
A10	-	-	1.50	2
B	14.90	15.00	15.10	1
B1	6.30	6.40	6.50	1
B2	1.74	1.84	1.94	1
B3	1.40	4.50	1.60	1
B4	0.42	0.52	0.62	1
B5	3.50	3.60	3.70	2
B6	5.50	-	-	2
B7	0.20	0.30	0.40	2
B8	1.00	1.10	1.10	2
B9	8.60	8.80	9.00	2
B10	7.80	7.90	8.00	2
B11	1.10	1.20	1.30	2
B12	-	-	0.89	2
C	0.90	1.00	1.10	1
C1	0.65	0.70	0.75	1
C2	0.20	0.30	0.40	1
C3	0.00	0.10	0.20	1

COMMON DIMENSIONS				
SYMBOL	MIN	NOM	MAX	REF. SHEET
R1	0.10	0.20	0.30	1
R2	0.10	0.20	0.30	1
R3	0.70	0.80	0.90	1
R4	0.70	0.80	0.90	1
R5	0.70	0.80	0.90	1
R6	0.70	0.80	0.90	1
R7	29.90	30.00	30.10	1
R10	0.10	0.20	0.30	1
R11	0.10	0.20	0.30	1
R12	0.10	0.20	0.40	1
R13	0.10	0.20	0.40	1
R14	0.10	0.20	0.40	1
R15	0.10	0.20	0.40	1
R16	0.10	0.20	0.40	1
R17	0.10	0.20	0.30	1
R18	0.10	0.20	0.30	1

Note:

1, Dimensions are in millimeter.

Pin NO.	PIN NAME(SD MODE)	Critical Dimensions to be monitored in Production Before Label Attach: A, A″, B, B8, B10 After Label Attach: A10, A7, B12, C3
1	DAT2	
2	CE/DAT3	
3	CMD	
4	VDD	
5	CLK	
6	VSS2	
7	DATA0	
8	DATA1	

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