

NT512S72V4PA0GR

512MB : 64M x 72

Registered SDRAM Module



64Mx72 bit One Bank Registered SDRAM Module
based on 64Mx4, 4Banks, 8K Refresh, 3.3V Synchronous DRAMs with SPD

Features

- JEDEC-standard 168-pin, dual in-line memory module (DIMM)
- PC133- and PC100-compliant
- Registered inputs with one-clock delay
- Phase-lock loop (PLL) clock driver to reduce loading
- ECC-optimized pinout
- Inputs and outputs are LVTTTL (3.3V) compatible
- Single 3.3V $\pm$ 0.3V Power Supply
- Fully synchronous to positive edge
- Suspend Mode and Power Down Mode
- Auto Refresh (CBR) and Self Refresh
- Automatic and controlled Precharge commands
- SDRAMs have 4 internal banks (64Mx4 SDRAM)
- Module has 1 physical bank 512MB (64 Meg x 72)
- 8192 Refresh cycles distributed across 64ms
- DIMM CAS latency * (Registered mode) :

Speed grade	Frequency	CAS latency
-7K	133MHz	3
-75B	133MHz	4
-8B	100MHz	3
- * DIMM CAS latency = device CL + 1 for registered mode.
- Programmable Operation:
 - Burst Type: Sequential or Interleave
 - Burst Length: 1, 2, 4, and 8
 - Operation: Burst Read and Write or Multiple Burst Read with Single Write
- Gold contacts
- SDRAMs in TSOP Type II Package
- Serial Presence Detect (SPD) with Write Protect

Description

The NANYA NT512S72V4PA0GR is a registered 168-Pin Synchronous DRAM Dual In-Line Memory Module (DIMM) organized as a 64Mx72 high-speed memory array. The DIMM uses eighteen 64Mx4 SDRAMs in 400 mil TSOP packages. The DIMM achieves high-speed data-transfer rates of 100MHz and 133MHz by employing a prefetch/pipeline hybrid architecture that synchronizes the output data to a system clock.

The DIMM is intended for use in applications operating at 100MHz and 133MHz memory bus speeds. All control and address signals are re-driven through registers/buffers to the SDRAM devices. Operating in registered mode (REGE pin tied high), the control/address input signals are latched in the register on one rising clock edge and sent to the SDRAM devices on the following rising clock edge (data access is delayed by one clock).

A phase-lock loop (PLL) on the DIMM is used to re-drive the clock signals to both the SDRAM devices and the registers to minimize system clock loading. (CK0 is connected to the PLL, and CK1, CK2, and CK3 are terminated on the DIMM). A single clock enable (CKE0) controls all devices on the DIMM, enabling the use of SDRAM Power Down modes.

Prior to any access operation, the device CAS latency and burst type/length/operation type must be programmed into the DIMM by address inputs A0-A12 and I/O addresses BA0 and BA1 using the mode register set cycle. The DIMM CAS latency when operated in Registered mode is one clock later than the device CAS latency due to the address and control signals being clocked to the SDRAM devices.

The DIMM uses serial presence detects implemented via a serial EEPROM using the two-pin IIC protocol. The first 128 bytes of serial PD data are programmed and locked by the DIMM manufacturer. The last 128 bytes are available to the customer and may be write protected by providing a high level to pin 81 on the DIMM. An on-board pull-down resistor keeps this in the Write Enable mode.

All NANYA 168-pin DIMMs provide a high-performance, flexible 8-byte interface in a 5.25" long space-saving footprint.

Ordering Information

Part Number	Device Timing				DIMM CAS latency	Organization	Leads	Power
	MHz.	CL	t RCD	t RP				
NT512S72V4PA0GR -7K	143MHz	3	3	3	4	64Mx72	Gold	3.3V
	133MHz	2	2	2	3			
NT512S72V4PA0GR -75B	133MHz	3	3	3	4			
	100MHz	2	2	2	3			
NT512S72V4PA0GR -8B	125MHz	3	3	3	4			
	100MHz	2	2	2	3			

* CL = CAS Latency

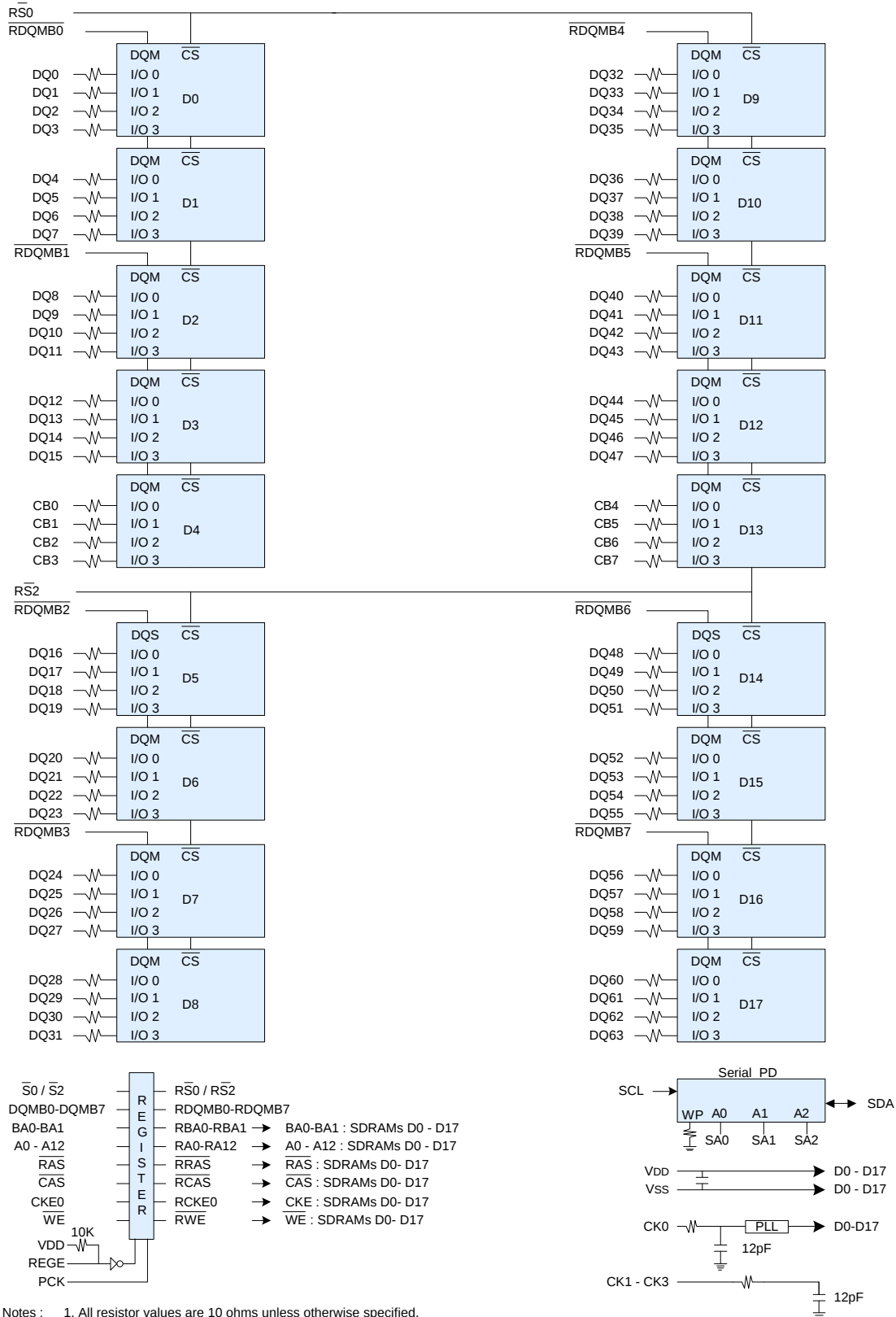
Pin Description

CK0 – CK3	Clock Inputs	CB0-CB7	Check Bit Data input/output
CKE0	Clock Enable	DQMB0-DQMB7	Data Mask
$\overline{\text{RAS}}$	Row Address Strobe	VDD	Power (3.3V)
$\overline{\text{CAS}}$	Column Address Strobe	VSS	Ground
$\overline{\text{WE}}$	Write Enable	NC	No Connect
$\overline{\text{S0}}$, $\overline{\text{S2}}$	Chip Selects	SCL	Serial Presence Detect Clock Input
A0-A9, A11, A12	Address Inputs	SDA	Serial Presence Detect Data input/output
A10 / AP	Address Input/Auto-precharge	SA0-2	Serial Presence Detect Address Inputs
BA0, BA1	SDRAM Bank Address Inputs	WP	Serial Presence Detect Write Protect Input
DQ0-DQ63	Data input/output	REGE	Register Enable

Pinout

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
1	VSS	85	VSS	29	DQMB1	113	DQMB5	57	DQ18	141	DQ50
2	DQ0	86	DQ32	30	$\overline{\text{S0}}$	114	NC	58	DQ19	142	DQ51
3	DQ1	87	DQ33	31	NC	115	$\overline{\text{RAS}}$	59	VDD	143	VDD
4	DQ2	88	DQ34	32	VSS	116	VSS	60	DQ20	144	DQ52
5	DQ3	89	DQ35	33	A0	117	A1	61	NC	145	NC
6	VDD	90	VDD	34	A2	118	A3	62	NC	146	NC
7	DQ4	91	DQ36	35	A4	119	A5	63	NC	147	REGE
8	DQ5	92	DQ37	36	A6	120	A7	64	VSS	148	VSS
9	DQ6	93	DQ38	37	A8	121	A9	65	DQ21	149	DQ53
10	DQ7	94	DQ39	38	A10/AP	122	BA0	66	DQ22	150	DQ54
11	DQ8	95	DQ40	39	BA1	123	A11	67	DQ23	151	DQ55
12	VSS	96	VSS	40	VDD	124	VDD	68	VSS	152	VSS
13	DQ9	97	DQ41	41	VDD	125	CK1	69	DQ24	153	DQ56
14	DQ10	98	DQ42	42	CK0	126	A12	70	DQ25	154	DQ57
15	DQ11	99	DQ43	43	VSS	127	VSS	71	DQ26	155	DQ58
16	DQ12	100	DQ44	44	NC	128	CKE0	72	DQ27	156	DQ59
17	DQ13	101	DQ45	45	$\overline{\text{S2}}$	129	NC	73	VDD	157	VDD
18	VDD	102	VDD	46	DQMB2	130	DQMB6	74	DQ28	158	DQ60
19	DQ14	103	DQ46	47	DQMB3	131	DQMB7	75	DQ29	159	DQ61
20	DQ15	104	DQ47	48	NC	132	NC	76	DQ30	160	DQ62
21	CB0	105	CB4	49	VDD	133	VDD	77	DQ31	161	DQ63
22	CB1	106	CB5	50	NC	134	NC	78	VSS	162	VSS
23	VSS	107	VSS	51	NC	135	NC	79	CK2	163	CK3
24	NC	108	NC	52	CB2	136	CB6	80	NC	164	NC
25	NC	109	NC	53	CB3	137	CB7	81	WP	165	SA0
26	VDD	110	VDD	54	VSS	138	VSS	82	SDA	166	SA1
27	$\overline{\text{WE}}$	111	$\overline{\text{CAS}}$	55	DQ16	139	DQ48	83	SCL	167	SA2
28	DQMB0	112	DQMB4	56	DQ17	140	DQ49	84	VDD	168	VDD

Block Diagram (1 Bank, 64Mx4 SDRAMs)



Input/Output Functional Description

Symbol	Type	Polarity	Function
CK0 - CK3	Input	Positive Edge	The system clock inputs. All of the SDRAM inputs are sampled on the rising edge of their associated clock. CK0 drives the PLL. CK1, CK2 and CK3 are terminated.
CKE0	Input	Active High	Activates the SDRAM CK signal when high and deactivates the CK signal when low. By deactivating the clocks, CKE low initiates the Power Down mode, Suspend mode, or the Self Refresh mode.
$\overline{S0}$, $\overline{S2}$	Input	Active Low	Enables the associated SDRAM command decoder when low and disables the command decoder when high. When the command decoder is disabled, new commands are ignored but previous operations continue.
$\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$	Input	Active Low	When sampled at the positive rising edge of the clock, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$ define the operation to be executed by the SDRAM.
BA0, BA1	Input	-	Selects which SDRAM bank is to be active.
A0 - A9 A10/AP A11, A12	Input	-	During a Bank Activate command cycle, A0-A12 defines the row address (RA0-RA12) when sampled at the rising clock edge. During a Read or Write command cycle, A0-A9, A11 defines the column address (CA0-CA9,A11) when sampled at the rising clock edge. In addition to the column address, AP is used to invoke Autoprecharge operation at the end of the Burst Read or Write cycle. If AP is high, autoprecharge is selected and BA0/BA1 define the bank to be precharged. If AP is low, autoprecharge is disabled. During a Precharge command cycle, AP is used in conjunction with BA0/BA1 to control which bank(s) to precharge. If AP is high all 4 banks will be precharged regardless of the state of BA0/BA1. If AP is low, then BA0/BA1 are used to define which bank to pre-charge.
DQ0 - DQ63, CB0 - CB7	Input /Output	-	Data and Check Bit input/output pins .
DQMB0 -DQMB7	Input	Active High	The Data Input/Output masks, associated with one data byte, place the DQ buffers in a high impedance state when sampled high. In Read mode, DQMB has a latency of three clock cycles in Registered mode, and controls the output buffers like an output enable. In Write mode, DQMB has a latency of one clock cycle in Registered mode. In this case, DQMB operates as a byte mask by allowing input data to be written if it is low but blocks the write operation if it is high.
REGE	Input	Active High (Register Mode Enable)	The Register Enable pin must be held high for proper registered mode operation (signals re-driven to the SDRAMs when the clock rises, and held valid until the next rising clock).
SA0 – SA2	Input	-	Address inputs. Connected to either VDD or VSS on the system board to configure the Serial Presence Detect EEPROM address.
SDA	Input /Output	-	This is a bidirectional pin used to transfer data into or out of the SPD EEPROM. A resistor must be connected from the SDA bus time to VDD to act as a pull up.
SCL	Input	-	This signal is used to clock data into and out of the SPD EEPROM. A resistor may be connected from the SCL bus time to VDD to act as a pull up.
WP	Input	Active High	This signal is pulled low on the DIMM to enable data to be written into the last 128 bytes of the SPD EEPROM.
VDD , VSS	Supply		Power and ground for the module.

Absolute Maximum Ratings

Symbol	Parameter	Rating	Units	Notes
V _{DD}	Power Supply Voltage	-0.3 to +4.6	V	1
V _{IN}	Input Voltage	-1.0 to 4.6		
V _{OUT}	Output Voltage	-1.0 to 4.6		
T _A	Operating Temperature (ambient)	0 to +70	°C	1
T _{STG}	Storage Temperature	-55 to +125	°C	1
P _D	Power Dissipation	10.3	W	1,2
I _{OUT}	Short Circuit Output Current	50	mA	1

- Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.
This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- Maximum power is calculated assuming the DIMM is Auto Refresh mode.

Recommended DC Operating Conditions (T_A = 0 to 70 °C)

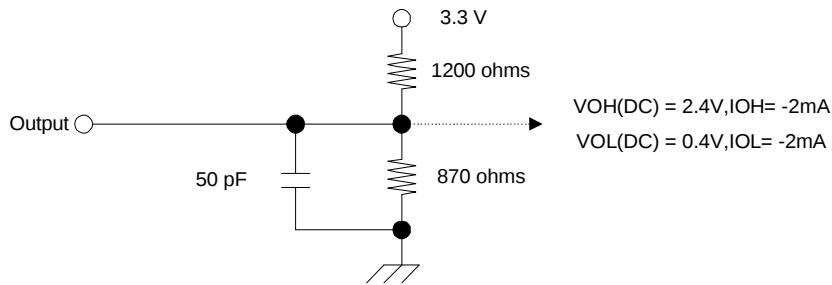
Symbol	Parameter	Rating			Units	Notes
		Min.	Typ.	Max.		
V _{DD}	Power Voltage	3.0	3.3	3.6	V	1
V _{IH}	Input High Voltage	2.0	-	V _{DD} + 0.3	V	1,2
V _{IL}	Input Low Voltage	-0.3	-	0.8	V	1,3
V _{OH}	Output High Voltage	2.4	-	-	V	
V _{OL}	Output Low Voltage	-	-	0.4	V	
I _{IL}	Input Leakage current	-10	-	10	uA	

- All voltages referenced to V_{SS}.
- V_{IH} (max) = V_{DD} / V_{DDQ} + 1.2V for pulse width ≤ 5ns
- V_{IL} (min) = V_{SS} / V_{SSQ} - 1.2V for pulse width ≤ 5ns.

Capacitance (T_A = 25 °C, f = 1MHz, V_{DD} = 3.3 ± 0.3V)

Symbol	Parameter	Max.	Unit
C _{I1}	Input Capacitance (A0-A9, A10/AP, A11, A12, BA0, BA1, CKE0, $\overline{\text{RAS}}$, $\overline{\text{CAS}}$, $\overline{\text{WE}}$)	19	pF
C _{I2}	Input Capacitance ($\overline{\text{S0}}$ - $\overline{\text{S2}}$)	15	
C _{I3}	Input Capacitance (DQMB0 - DQMB7)	14	
C _{I4}	Input Capacitance (REGE)	10	
C _{I5}	Input Capacitance (CK0)	28	
C _{I6}	Input Capacitance (CK1, CK2, CK3)	24	
C _{I7}	Input Capacitance (SA0 - SA2, SCL, WP)	9	
C _{IO1}	Input/Output Capacitance (DQ0 - DQ63, CB0 - CB7)	13	
C _{IO2}	Input/Output Capacitance (SDA)	11	

DC Output Load Circuit



Operating, Standby, and Refresh Currents ($T_A = 0$ to $70^\circ C$, $V_{DD} = 3.3 \pm 0.3V$)

Parameter	Symbol	Test condition	Speed			Unit	Note
			- 7K	- 75B	- 8B		
Operating current	I_{CC1}	1 bank operation, $t_{RC} = t_{RC}(min)$, $t_{CK} = min$ Active-Precharge Command cycling without burst operation	2600	2400	2300	mA	1
Precharge standby current in power-down mode	I_{CC2P}	$CKE0 \leq V_{IL}(max)$, $t_{CK} = min$, $\overline{S0}, \overline{S2} = V_{IH}(min)$	276	276	276	mA	1
	I_{CC2PS}	$CKE0 \leq V_{IL}(max)$, $t_{CK} = \infty$, $\overline{S0}, \overline{S2} = V_{IH}(min)$	51	51	51	mA	
Precharge standby current in non power-down mode	I_{CC2N}	$CKE0 \geq V_{IH}(min)$, $t_{CK} = min$ $\overline{S0}, \overline{S2} = V_{IH}(min)$	780	780	520	mA	
	I_{CC2NS}	$CKE0 \geq V_{IH}(min)$, $t_{CK} = \infty$ $\overline{S0}, \overline{S2} = V_{IH}(min)$	123	123	123	mA	
No Operating current (Active state : 4 bank)	I_{CC3P}	$CKE0 \leq V_{IL}(max)$, $t_{CK} = min$. $\overline{S0}, \overline{S2} = V_{IH}(min)$ (Power Down Mode)	348	348	348	mA	
	I_{CC3N}	$CKE0 \geq V_{IH}(min)$, $t_{CK} = min$ $\overline{S0}, \overline{S2} = V_{IH}(min)$	1320	1320	990	mA	1
Operating current (Burst mode)	I_{CC4}	$t_{CK} = min$, Read/ Write command cycling, Multiple banks active, gapless data, BL=4	2400	2400	1800	mA	1,2
Auto(CBR) refresh current	I_{CC5}	$t_{CK} = min$, CBR command cycling	2850	2850	2520	mA	1
Self refresh current	I_{CC6}	$CKE0 \leq 0.2V$	69	69	69	mA	

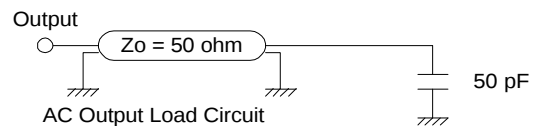
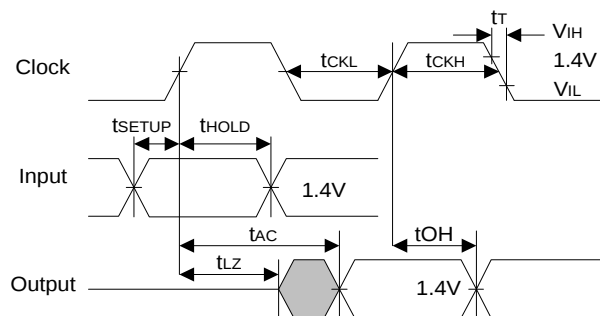
1. These parameters depend on the cycle rate and are measured with the cycle determined by the minimum value of t_{CK} and t_{RC} . Input signals are changed once during $t_{CK}(min)$. $t_{CK}(min) = 7.5ns$.

2. The specified values are obtained with the DIMM data outputs open.

AC Characteristics (TA = 0 to 70 °C , VDD = 3.3 ± 0.3V)

1. An initial pause of 200ms, with CKE0 held high, is required after power-up. A Precharge All Banks command must be given followed by a minimum of eight Auto (CBR) Refresh cycles before or after the Mode Register Set operation.
2. AC timing tests have VIL = 0.8V and VIH = 2.0V with the timing referenced to the 1.40V crossover point.
3. The Transition time is measured between VIH and VIL (or between VIL and VIH).
4. AC measurements assume tT = 1.2ns (1 Volt/ns rise time).
5. In addition to meeting the transition rate specification, the clock and CKE must transit between VIH and VIL (or between VIL and VIH) in a monotonic manner.
6. A 1ms stabilization time is required for the integrated PLL circuit to obtain phase lock of its feedback signal to its reference signal.
7. All timings are specified at the input receiver of the signal. This allows times to be specified at the end of a transmission line versus at the DIMM connector which may display significant reflections. Refer to the device specifications for non-skew adjusted timings.

AC Output Load Circuits



AC Timing Parameters *

(*Module AC timing parameters comply with PC100 and PC133 Design Specs, based on component parameters.)

Clock and Clock Enable Parameters

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tCK3	Clock Cycle Time, $\overline{\text{CAS}}$ Latency = 3	7	1000	7.5	1000	8	1000	ns	
tCK2	Clock Cycle Time, $\overline{\text{CAS}}$ Latency = 2	7.5	1000	10	1000	10	1000	ns	
tAC3(B)	Clock Access Time, $\overline{\text{CAS}}$ Latency = 3	-	5.4	-	5.4	-	6	ns	1
tAC2(B)	Clock Access Time, $\overline{\text{CAS}}$ Latency = 2	-	5.4	-	6	-	6	ns	1
tCKH	Clock High Pulse Width	2.5	-	2.5	-	3	-	ns	2
tCKL	Clock Low Pulse Width	2.5	-	2.5	-	3	-	ns	2
tCES	Clock Enable Set-up Time	1.5	-	1.5	-	2	-	ns	
tCEH	Clock Enable Hold Time	0.8	-	0.8	-	1	-	ns	
tSB	Power down mode Entry Time	0	7.5	0	7.5	0	12	ns	
tT	Transition Time (Rise and Fall)	0.5	10	0.5	10	0.5	10	ns	

- Access time is measured at 1.4V. In AC Characteristics section, see notes.
- t_{CKH} is the pulse width of CLK measured from the positive edge to the negative edge referenced to V_{IH} (min). t_{CKL} is the pulse width of CLK measured from the negative edge to the positive edge referenced to V_{IL} (max).

Common Parameters

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tCS	Command Setup Time	1.5	-	1.5	-	2	-	ns	
tCH	Command Hold Time	0.8	-	0.8	-	1	-	ns	
tAS	Address and Bank Select Set-up Time	1.5	-	1.5	-	2	-	ns	
tAH	Address and Bank Select Hold Time	0.8	-	0.8	-	1	-	ns	
tRCD	$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Delay	20	-	20	-	20	-	ns	1
tRC	Bank Cycle Time	60	-	67.5	-	70	-	ns	1
tRFC	Auto Refresh to Active/Auto Refresh	60	-	67.5	-	70	-		
tRAS	Active Command Period	45	100K	45	100K	50	100K	ns	1
tRP	Precharge Time	20	-	20	-	20	-	ns	1
tRRD	Bank to Bank Delay Time	15	-	15	-	20	-	ns	1
tCCD	$\overline{\text{CAS}}$ to $\overline{\text{CAS}}$ Delay Time	1	-	1	-	1	-	CLK	

- These parameters account for the number of clock cycle and depend on the operating frequency of the clock, as follows:
the number of clock cycles = specified value of timing / clock period (count fractions as a whole number).

Mode Register Set Cycle

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tRSC	Mode Register Set Cycle Time	2	-	2	-	2	-	CLK	1

- These parameters account for the number of clock cycle and depend on the operating frequency of the clock, as follows:
the number of clock cycles = specified value of timing / clock period (count fractions as a whole number).

Read Cycle

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tOH	Data Out Hold Time	-	-	-	-	2.5	-	ns	
		2.7	-	2.7	-	3	-	ns	
tLZ	Data Out to Low Impedance Time	0	-	0	-	0	-	ns	
tHZ3	Data Out to High Impedance Time	3	5.4	3	5.4	3	6	ns	1
tDQZ	DQM Data Out Disable Latency	2	-	2	-	2	-	CLK	

1. Referenced to the time at which the output achieves the open circuit condition, not to output voltage levels.

Refresh Cycle

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tREF	Refresh Period	-	64	-	64	-	64	ms	
tSREX	Self Refresh Exit Time	10	-	10	-	10	-	ns	

Write Cycle

Symbol	Parameter	- 7K		- 75B		- 8B		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
tDS	Data In Set-up Time	1.5	-	1.5	-	2	-	ns	
tDH	Data In Hold Time	0.8	-	0.8	-	1	-	ns	
tDPL	Data input to Precharge	15	-	15	-	15	-	ns	
tDAL3	Data In to Active Delay CAS Latency = 3	5	-	5	-	5	-	CLK	
tDAL2	Data In to Active Delay CAS Latency = 2	5	-	-	-	-	-	CLK	
tDQW	DQM Write Mask Latency	0	-	0	-	0	-	ns	

Serial Presence Detect -- Part 1 of 2

64Mx72 SDRAM Registered DIMM based on 64Mx4, 4Banks, 8K Refresh, 3.3v SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-7K	-75B	-8B	-7K	-75	-8B	
0	Number of Serial PD Bytes Written during Production	128			80			
1	Total Number of Bytes in Serial PD device	256			08			
2	Fundamental Memory Type	SDRAM			04			
3	Number of Row Addresses on Assembly	13			0D			
4	Number of Column Addresses on Assembly	11			0B			
5	Number of DIMM Bank	1			01			
6	Data Width of Assembly	X72			48			
7	Data Width of Assembly (cont')	X72			00			
8	Voltage Interface Level of this Assembly	LVTTL			01			
9	SDRAM Device Cycle Time at CL=3	7ns	7.5ns	8ns	70	75	80	
10	SDRAM Device Access Time from Clock at CL=3	5.4ns	5.4ns	6ns	54	54	60	
11	DIMM Configuration Type	ECC			02			
12	Refresh Rate/Type	SR/1x(7.8us)			82			
13	Primary SDRAM Width	X4			04			
14	Error Checking SDRAM Device Width	X4			04			
15	SDRAM Device Attributes: Min CLK Delay, Random Col Access	1 Clock			01			
16	SDRAM Device Attributes: Burst Length Supported	1,2,4,8			0F			
17	SDRAM Device Attributes: Number of Device Banks	4			04			
18	SDRAM Device Attributes: CAS Latencies Supported	2/3	2/3	2/3	06	06	06	
19	SDRAM Device Attributes: CS Latency	0			01			
20	SDRAM Device Attributes: WE Latency	0			01			
21	SDRAM Device Attributes	Registered, Buffered, PLL			1F			
22	SDRAM Device Attributes: General	Wr-1/Rd Burst, Precharge All, Auto-Precharge, VDD +/- 10%			0E			
23	Minimum Clock Cycle at CL=2	7.5ns	10ns	10ns	75	A0	A0	
24	Maximum Data Access Time from Clock at CL=2	5.4ns	6ns	6ns	54	60	60	
25	Minimum Clock Cycle Time at CL=1	N/A			00			
26	Maximum Data Access Time from Clock at CL=1	N/A			00			
27	Minimum Row Precharge Time (trp)	15ns	20ns	20ns	0F	14	14	
28	Minimum Row Active to Row Active delay (trrd)	15ns	15ns	20ns	0F	0F	14	
29	Minimum RAS to CAS delay (trcd)	15ns	20ns	20ns	0F	14	14	
30	Minimum RAS Pulse Width (trast)	45ns	45ns	50ns	2D	2D	32	
31	Module Bank Density	512MB			80			
32	Address and Command Setup Time Before Clock	1.5ns	1.5ns	2ns	15	15	20	
33	Address and Command Hold Time After Clock	0.8ns	0.8ns	1ns	08	08	10	
34	Data Input Setup Time Before Clock	1.5ns	1.5ns	2ns	15	15	20	
35	Data Input Hold Time After Clock	0.8ns	0.8ns	1ns	08	08	10	
36-61	Reserved	Undefined			00			
62	SPD Revision	1.2A	1.2A	1.2A	12	12	12	
63	Checksum for byte 0 - 62	Checksum Data			75	BB	02	

Serial Presence Detect -- Part 2 of 2

64Mx72 SDRAM Registered DIMM based on 64Mx4, 4Banks, 8K Refresh, 3.3v SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-7K	-75B	-8B	-7K	-75B	-8B	
64-71	Manufacturer's JEDED ID Code	0B hex.			7F7F7F0B00000000			3
72	Module Manufacturing Location	N/A			00			
73-90	Module Part number	N/A	N/A	N/A	00	00	00	
91-92	Module Revision Code	N/A			00			
93-94	Module Manufacturing Data	Year/Week Code			yy/ww			1,2
95-98	Module Serial Number	Serial Number			00			
99-125	Reserved	Undefined			00			
126	Modules Supports this Clock Frequency	100MHz			64			
127	Attributes for Clock Frequency defined in byte 126				F5	F5	FF	
128-255	Open for customer Use	Undefined			00			
1. yy= Binary coded decimal year code, 0-99(Decimal), 00-63(Hex)								
2. ww= Binary coded decimal year code, 01-52(Decimal), 01-34(Hex)								
3. NANYA 11decimal (bank four) 0000 1011 binary 0B Hex.								

Unit : Millimeters
Inches