

3.3V 4M x 64/72-Bit 1 BANK SDRAM Module HYS64(72)V4200GU-8/-10
3.3V 8M x 64/72-Bit 2 BANK SDRAM Module HYS64(72)V8220GU-8/-10

PC66 & PC100 168 pin unbuffered DIMM Modules

Preliminary Information

- 168 Pin unbuffered 8 Byte Dual-In-Line SDRAM Modules
- One bank 4M x 64, 4Mx72 and two bank 8M x 64, 8M x 72 organisation
- Optimized for byte-write non-parity and ECC applications
- JEDEC standard Synchronous DRAMs (SDRAM)
- Fully PC board layout compatible to INTEL's Rev. 1.0 module specification
- SDRAM Performance:

		-8	-10	
		PC100	PC66	Units
f _{CK}	Clock frequency (max.)	100	66	MHz
t _{AC}	Clock access time CAS latency = 2 & 3	6	8 / 7	ns

- Supported Latencies at 100 Mhz operation:

CL	tRCD	tRP	tRC	
3	2	2	8	CLK
2	2	2	7	CLK

- Single +3.3V(± 0.3V) power supply
- Programmable $\overline{\text{CAS}}$ Latency, Burst Length and Wrap Sequence (Sequential & Interleave)
- Auto Refresh (CBR) and Self Refresh
- Decoupling capacitors mounted on substrate
- All inputs, outputs are LVTTTL compatible
- Serial Presence Detect with E²PROM
- Utilizes 4M x16 SDRAMs in TSOPII-54 packages
- 4096 refresh cycles every 64 ms
- Gold contact pad
- Card Size: 133,35 mm x 31,75 mm x 4,00 mm

The HYS64(72)V4200 and HYB64(72)V8220 are an industry standard 168-pin 8-byte Dual in-line Memory Module (DIMM) which are organised as 4M x 64, 4M x 72 in an one bank and 8M x 64, 8M x 72 in two banks high speed memory arrays designed with 64Mbit Synchronous DRAMs (SDRAMs Die Rev.B) for non-parity and ECC application. The DIMMs use -8 speed sort 4M x 16 SDRAM devices in TSOP54 packages to meet the PC100 requirements and -10 parts for 66 MHz bus speed applications. Decoupling capacitors are mounted on the PC board. The PC board design is according to INTEL's module specification.

The DIMMs have a serial presence detect, implemented with a serial E²PROM using the two pin I²C protocol. The first 128 bytes are utilized by the DIMM manufacturer and the second 128 bytes are available to the end user.

All SIEMENS 168-pin DIMMs provide a high performance, flexible 8-byte interface in a 133,35 mm long footprint, with t.d.b. height.

Ordering Information

Type	Ordering Code	Package	Descriptions	Module Height
HYS 64V4200GU-8	PC100-222-620	L-DIM-168-31	100 Mhz 4M x 64 1 bank SDRAM module	1,15"
HYS 72V4200GU-8	PC100-222-620	L-DIM-168-31	100 MHz 4M x 72 1 bank SDRAM module	1,15"
HYS 64V8220GU-8	PC100-222-620	L-DIM-168-31	100 Mhz 8M x 64 2 bank SDRAM module	1,15"
HYS 64V8220GU-8	PC100-222-620	L-DIM-168-31	100 MHz 8M x 72 2 bank SDRAM module	1,15"
HYS 64V4200GU-10	PC66-222-620	L-DIM-168-31	66 Mhz 4M x 64 1 bank SDRAM module	1,15"
HYS 72V4200GU-10	PC66-222-620	L-DIM-168-31	66 MHz 4M x 72 1 bank SDRAM module	1,15"
HYS 64V8220GU-10	PC66-222-620	L-DIM-168-31	66 Mhz 8M x 64 2 bank SDRAM module	1,15"
HYS 64V8220GU-10	PC66-222-620	L-DIM-168-31	66 MHz 8M x 72 2 bank SDRAM module	1,15"

Pin Names

A0-A11	Address Inputs (RA0~ RA11 / CA0 ~ CA7, CA10)	CLK0 - CLK3	Clock Input
BA0 , BA1	Bank Select	DQMB0 - DQMB7	Data Mask
DQ0 - DQ63	Data Input/Output	CS0 - CS3	Chip Select
CB0-CB7	Check Bits (x 72 organisation only)	Vcc	Power (+3.3 Volt)
RAS	Row Address Strobe	Vss	Ground
CAS	Column Address Strobe	SCL	Clock for Presence Detect
WE	Read / Write Input	SDA	Serial Data Out for Pres. Detect
CKE0, CKE1	Clock Enable	N.C.	No Connection

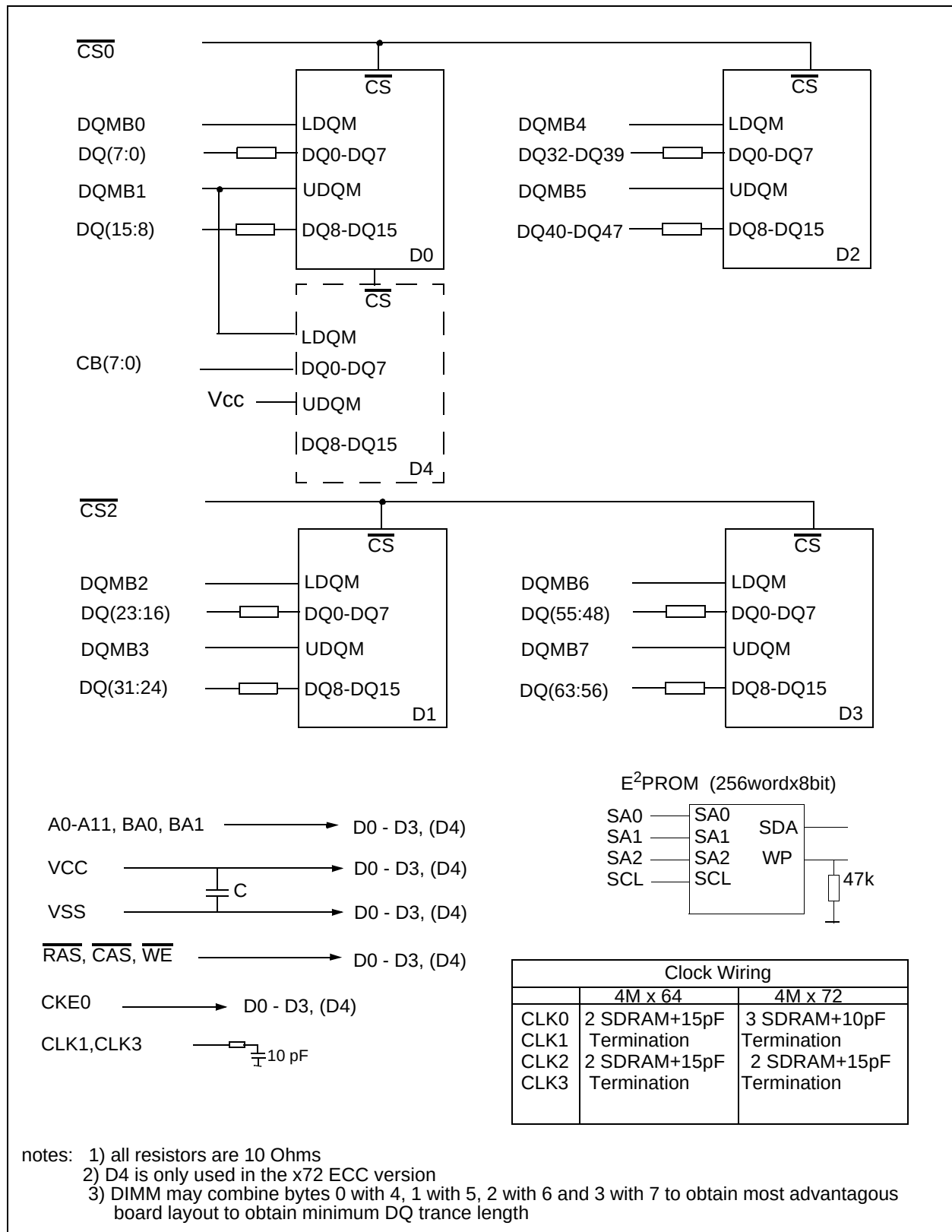
Address Format:

	Part Number	Rows	Columns	Bank Select	Refresh	Period	Interval
4M x 64	HYS64V4200GU	12	8	2	4k	64 ms	15,6 µs
4M x 72	HYS72V4200GU	12	8	2	4k	64 ms	15,6 µs
8M x 64	HYS64V8220GU	12	8	2	4k	64 ms	15,6 µs
8M x 72	HYS72V8220GU	12	8	2	4k	64 ms	15,6 µs

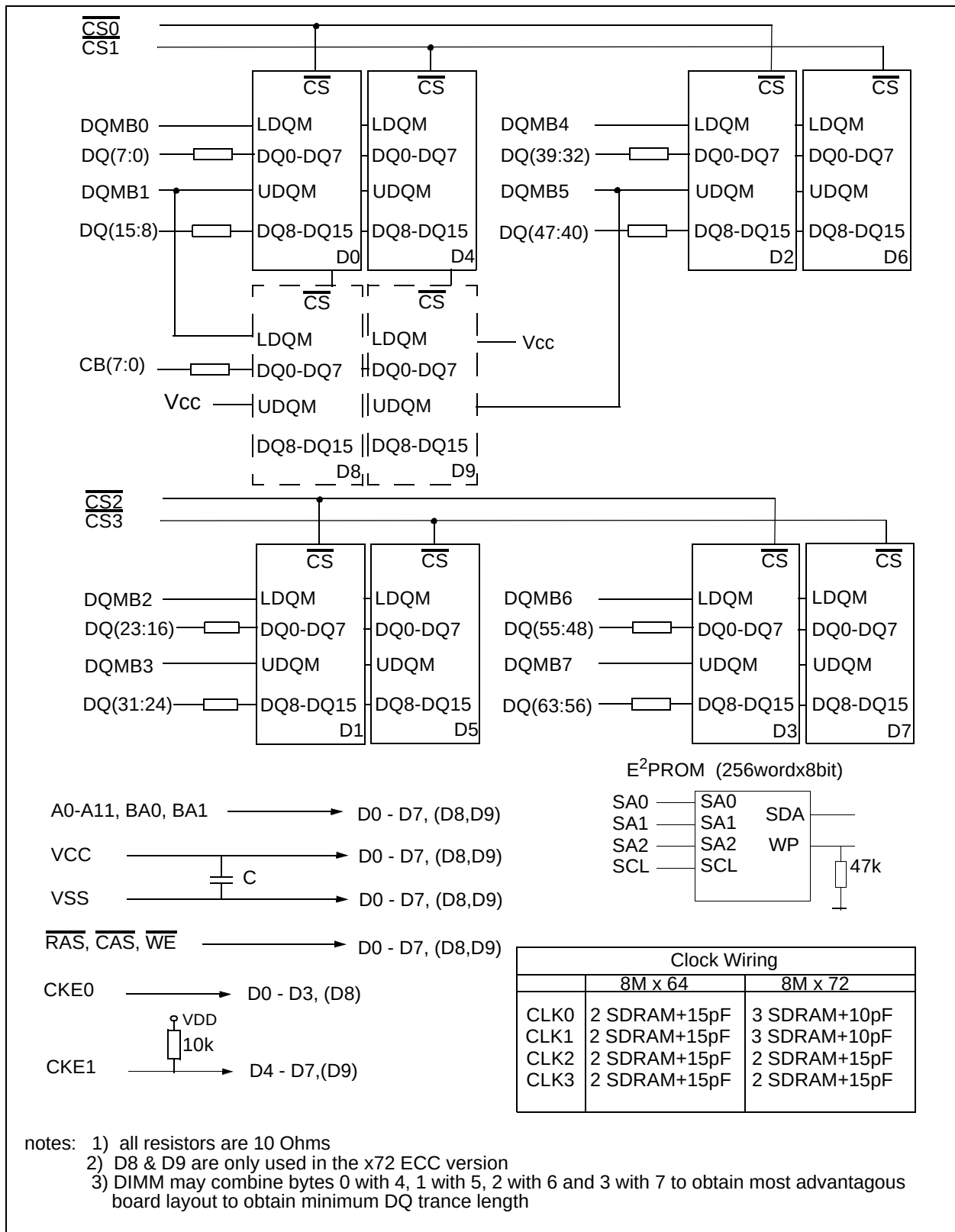
Pin Configuration

PIN #	Symbol	PIN #	Symbol	PIN #	Symbol	PIN #	Symbol
1	VSS	43	VSS	85	VSS	127	VSS
2	DQ0	44	DU	86	DQ32	128	CKE0
3	DQ1	45	CS2	87	DQ33	129	CS3
4	DQ2	46	DQMB2	88	DQ34	130	DQMB6
5	DQ3	47	DQMB3	89	DQ35	131	DQMB7
6	VCC	48	DU	90	VCC	132	NC
7	DQ4	49	VCC	91	DQ36	133	VCC
8	DQ5	50	NC	92	DQ37	134	NC
9	DQ6	51	NC	93	DQ38	135	NC
10	DQ7	52	NC (CB2)	94	DQ39	136	CB6
11	DQ8	53	NC (CB3)	95	DQ40	137	CB7
12	VSS	54	VSS	96	VSS	138	VSS
13	DQ9	55	DQ16	97	DQ41	139	DQ48
14	DQ10	56	DQ17	98	DQ42	140	DQ49
15	DQ11	57	DQ18	99	DQ43	141	DQ50
16	DQ12	58	DQ19	100	DQ44	142	DQ51
17	DQ13	59	VCC	101	DQ45	143	VCC
18	VCC	60	DQ20	102	VCC	144	DQ52
19	DQ14	61	NC	103	DQ46	145	NC
20	DQ15	62	DU	104	DQ47	146	DU
21	NC (CB0)	63	CKE1	105	NC (CB4)	147	NC
22	NC (CB1)	64	VSS	106	NC (CB5)	148	VSS
23	VSS	65	DQ21	107	VSS	149	DQ53
24	NC	66	DQ22	108	NC	150	DQ54
25	NC	67	DQ23	109	NC	151	DQ55
26	VCC	68	VSS	110	VCC	152	VSS
27	WE	69	DQ24	111	CAS	153	DQ56
28	DQMB0	70	DQ25	112	DQMB4	154	DQ57
29	DQMB1	71	DQ26	113	DQMB5	155	DQ58
30	CS0	72	DQ27	114	CS1	156	DQ59
31	DU	73	VCC	115	RAS	157	VCC
32	VSS	74	DQ28	116	VSS	158	DQ60
33	A0	75	DQ29	117	A1	159	DQ61
34	A2	76	DQ30	118	A3	160	DQ62
35	A4	77	DQ31	119	A5	161	DQ63
36	A6	78	VSS	120	A7	162	VSS
37	A8	79	CLK2	121	A9	163	CLK3
38	A10	80	NC	122	BA0	164	NC
39	BA1	81	WP	123	NC	165	SA0
40	VCC	82	SDA	124	VCC	166	SA1
41	VCC	83	SCL	125	CLK1	167	SA2
42	CLK0	84	VCC	126	NC	168	VCC

Note : Pinnames in brackets are for the x72 ECC versions



Block Diagram for 4M x 64 and 4M x 72 1 bank SDRAM DIMM modules (HYS64V4200GU)



DC Characteristics
 $T_A = 0 \text{ to } 70 \text{ }^\circ\text{C}; V_{SS} = 0 \text{ V}; V_{DD}, V_{DDQ} = 3.3 \text{ V} \pm 0.3 \text{ V}$

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Input high voltage	V_{IH}	2.0	$V_{CC} + 0.3$	V
Input low voltage	V_{IL}	- 0.5	0.8	V
Output high voltage ($I_{OUT} = - 2.0 \text{ mA}$)	V_{OH}	2.4	-	V
Output low voltage ($I_{OUT} = 2.0 \text{ mA}$)	V_{OL}	-	0.4	V
Input leakage current, any input ($0 \text{ V} < V_{IN} < 3.6 \text{ V}$, all other inputs = 0 V)	$I_{I(L)}$	- 10	10	μA
Output leakage current (DQ is disabled, $0 \text{ V} < V_{OUT} < V_{CC}$)	$I_{O(L)}$	- 10	10	μA

Capacitance
 $T_A = 0 \text{ to } 70 \text{ }^\circ\text{C}; V_{DD} = 3.3 \text{ V} \pm 0.3 \text{ V}, f = 1 \text{ MHz}$

Parameter	Symbol	Limit Values		Unit
		max. 4M x 72	max. 8M x 72	
Input capacitance (A0 to A11, $\overline{\text{RAS}}$, $\overline{\text{CAS}}$, $\overline{\text{WE}}$)	C_{I1}	tbd.	tbd.	pF
Input capacitance (CS0 -CS3,)	C_{I2}	tbd.	tbd.	pF
Input capacitance (CLK0 - CLK3)	C_{ICL}	tbd.	tbd.	pF
Input capacitance (CKE0, CKE1)	C_{I3}	tbd.	tbd.	pF
Input capacitance (DQMB0 - DQMB7)	C_{I4}	tbd.	tbd.	pF
Input / Output capacitance (DQ0-DQ63,CB0-CB7)	C_{IO}	tbd.	tbd.	pF
Input Capacitance (SCL,SA0-2)	C_{Sc}	8	8	pF
Input/Output Capacitance	C_{Sd}	10	10	pF

Standby and Refresh Currents ($T_a = 0$ to 70°C , $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$) ¹⁾

Parameter & Test Condition		Symb.	4Mx64	4Mx72	8Mx64	8Mx72	Note	
			max.					
OPERATING CURRENT trc=trcmin., tck=tckmin. Active-precharge command cycling, without burst operation	1 bank operation	ICC1	440	550	440	550	mA	1
PRECHARGE STANDBY CURRENT in Power Down Mode $\overline{CS} = V_{IH}(\text{min.})$, $CKE \leq V_{il}(\text{max})$	tck = min.	ICC2P	12	15	12	15	mA	1
	tck = Infinity	ICC2P S	8	10	8	10	mA	
PRECHARGE STANDBY CURRENT in Non-Power Down Mode $\overline{CS} = V_{IH}(\text{min.})$, $CKE \geq V_{ih}(\text{min})$	tck = min.	ICC2	200	250	200	250	mA	1
	tck = Infinity	ICC2S	20	25	20	25	mA	
NO OPERATING CURRENT tck = min., $\overline{CS} = V_{IH}(\text{min})$, active state (max. 4 banks)	$CKE \geq V_{IH}(\text{min.})$	ICC3	280	350	280	350	mA	
	$CKE \leq V_{IL}(\text{max.})$ (Power down mode)	ICC3P	32	40	32	40	mA	
BURST OPERATING CURRENT tck = min., Read/Write command cycling		ICC4	620	775	620	775	mA	1, 2
AUTO REFRESH CURRENT tck = min., Auto Refresh command cycling		ICC5	520	650	520	650	mA	1
SELF REFRESH CURRENT Self Refresh Mode, $CKE=0.2\text{V}$		ICC6	8	10	8	10	mA	

AC Characteristics 3)4)

$T_A = 0$ to $70\text{ }^{\circ}\text{C}$; $V_{SS} = 0\text{ V}$; $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$, $t_T = 1\text{ ns}$

Parameter	Symbol	Limit Values				Unit	Note
		-8		-10			
		min.	max.	min.	max.		

Clock and Clock Enable

Clock Cycle Time	t_{CK}						
						ns	
						ns	
System Frequency	f_{CK}						
						MHz	
						MHz	
Clock Access Time	t_{AC}						
						ns	2, 4
						ns	
Clock High Pulse Width	t_{CH}	3	–	3	–	ns	6
Clock Low Pulse Width	t_{CL}	3	–	3	–	ns	6
Input Setup time	t_{CS}	2	–	2.5	–	ns	7
Input Hold Time	t_{CH}	1	–	1	–	ns	7
CKE Setup Time (Power down mode)	t_{CKSP}	2	–	2.5	–	ns	8
CKE Setup Time (Self Refresh Exit)	t_{CKSR}	10	–	10	–	ns	9
Transition time (rise and fall)	t_T	1	–	1	–	ns	

Common Parameters

RAS to CAS delay	t_{RCD}	20	–	24	–	ns	2 CLK
Cycle Time	t_{RC}	70	–	90	–	ns	7 CLK
Active Command Period	t_{RAS}	45	–	60	–	ns	5 CLK
Precharge Time	t_{RP}	20	–	24	–	ns	2 CLK
Bank to Bank Delay Time	t_{RRD}	16	–	20	–	ns	1 CLK
CAS to CAS delay time (same bank)	t_{CCD}	1	–	1	–	CLK	

Refresh Cycle

Self Refresh Exit Time	t_{SREX}	10	–			ns	9)
Refresh Period (4096 cycles)	t_{REF}	64	–			ms	8)

Parameter	Symbol	Limit Values				Unit	Note
		-8		-10			
		min.	max.	min.	max.		

Read Cycle

Data Out Hold Time	t_{OH}	3	–	3	–	ns	2, 4
Data Out to Low Impedance Time	t_{LZ}	0	–	0	–	ns	
Data Out to High Impedance Time	t_{HZ}	3	8	3	10	ns	10
DQM Data Out Disable Latency	t_{DQZ}	2	–	2		CLK	

Write Cycle

Write Recovery Time	t_{WR}	8	–	10	–	CLK	
DQM Write Mask Latency	t_{DQW}	0	–	0	–	CLK	

Notes:

1. The specified values are valid when addresses are changed no more than once during $t_{CK}(\text{min.})$ and when No Operation commands are registered on every rising clock edge during $t_{RC}(\text{min.})$. Values are shown per module bank.
2. The specified values are valid when data inputs (DQS) are stable during $t_{RC}(\text{min.})$.
3. All AC characteristics are shown for device level.
An initial pause of $100\mu\text{s}$ is required after power-up, then a Precharge All Banks command must be given followed by 8 Auto Refresh (CBR) cycles before the Mode Register Set Operation can begin.
4. AC timing tests have $V_{il} = 0.4\text{ V}$ and $V_{ih} = 2.4\text{ V}$ with the timing referenced to the 1.4 V crossover point. The transition time is measured between V_{ih} and V_{il} . All AC measurements assume $t_T = 1\text{ ns}$ with the AC output load circuit show. Specified t_{AC} and t_{OH} parameters are measured with a 50 pF only, without any resistive termination and with a input signal of 1 V / ns edge rate between 0.8 V and 2.0 V .

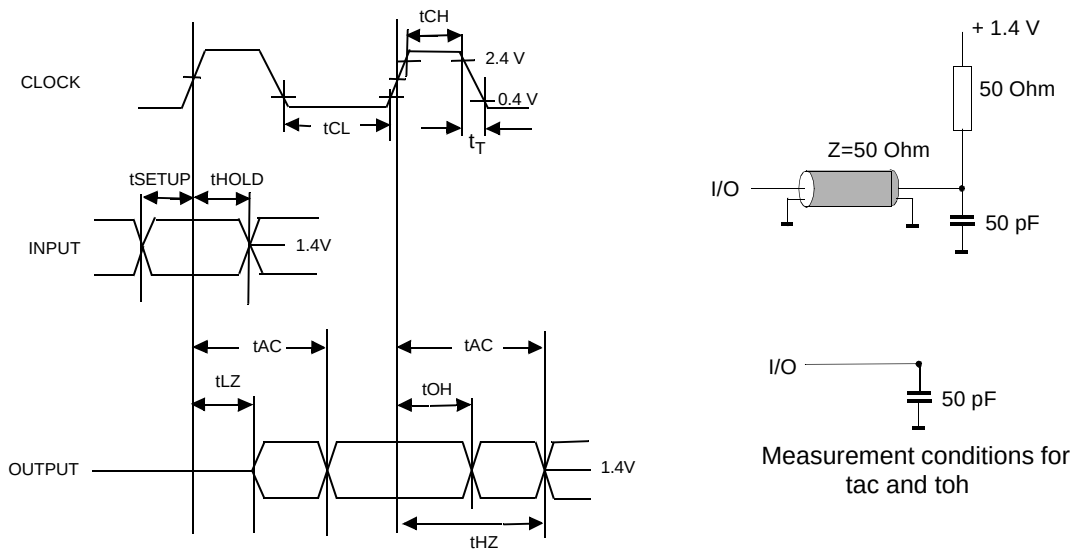


fig.1

5. If clock rising time is longer than 1 ns , a time $(t_T/2 - 0.5)\text{ ns}$ has to be added to this parameter.
6. Rated at 1.5 V
7. If t_T is longer than 1 ns , a time $(t_T - 1)\text{ ns}$ has to be added to this parameter.
8. Any time that the refresh Period has been exceeded, a minimum of two Auto (CBR) Refresh commands must be given to "wake-up" the device.
9. Self Refresh Exit is a synchronous operation and begins on the 2nd positive clock edge after CKE returns high. Self Refresh Exit is not complete until a time period equal to t_{RC} is satisfied once the Self Refresh Exit command is registered.
10. Referenced to the time which the output achieves the open circuit condition, not to output voltage levels.

A serial presence detect storage device - E²PROM - is assembled onto the module. Information about the module configuration, speed, etc. is written into the E²PROM device during module production using a serial presence detect protocol (I²C synchronous 2-wire bus)

PD-Table for -8 modules:

Byte#	Description	SPD Entry Value	Hex			
			4Mx64 -8	4Mx72 -8	8Mx64 -8	8Mx72 -8
0	Number of SPD bytes	128	80	80	80	80
1	Total bytes in Serial PD	256	08	08	08	08
2	Memory Type	SDRAM	04	04	04	04
3	Number of Row Addresses (without BS bits)	12	0C	0C	0C	0C
4	Number of Column Addresses (for x8 SDRAM)	8	08	08	08	08
5	Number of DIMM Banks	1	01	01	02	02
6	Module Data Width	64	40	48	40	48
7	Module Data Width (cont'd)	0	00	00	00	00
8	Module Interface Levels	LVTTTL	01	01	01	01
9	SDRAM Cycle Time at CL=3	10.0 ns	A0	A0	A0	A0
10	SDRAM Access time from Clock at CL=3	6.0 ns	60	60	60	60
11	Dimm Config (Error Det/Corr.)	none	00	02	00	02
12	Refresh Rate/Type	Self-Refresh, 15.6µs	80	80	80	80
13	SDRAM width, Primary	x16	10	10	10	10
14	Error Checking SDRAM data width	n/a / x8	00	08	00	08
15	Minimum clock delay for back-to-back random column address	t _{ccd} = 1 CLK	01	01	01	01
16	Burst Length supported	1, 2, 4, 8 & full page	8F	8F	8F	8F
17	Number of SDRAM banks	4	04	04	04	04
18	Supported CAS Latencies	CL = 2 & 3	06	06	06	06
19	CS Latencies	CS latency = 0	01	01	01	01
20	WE Latencies	WL = 0	01	01	01	01
21	SDRAM DIMM module attributes	non buffered/ non reg.	00	00	00	00
22	SDRAM Device Attributes :General	Vcc tol +/- 10%	06	06	06	06
23	Minimum Clock Cycle Time at CAS Latency = 2	10.0 ns	A0	A0	A0	A0
24	Maximum data access time from Clock for CL=2	6.0 ns	60	60	60	60
25	Minimum Clock Cycle Time at CL = 1	not supported	FF	FF	FF	FF
26	Maximum Data Access Time from Clock at CL=1	not supported	FF	FF	FF	FF
27	Minimum Row Precharge Time	20 ns	14	14	14	14
28	Minimum Row Active to Row Active delay tRRD	16 ns	10	10	10	10

SPD-Table (cont'd):

Byte#	Description	SPD Entry Value	Hex			
			4Mx64 -8	4Mx72 -8	8Mx72 -8	8Mx72 -8
29	Minimum RAS to CAS delay tRCD	20 ns	14	14	14	14
30	Minimum RAS pulse width tRAS	45 ns	2D	2D	2D	2D
31	Module Bank Density (per bank)	32 MByte	08	08	08	08
32	SDRAM input setup time	2 ns	20	20	20	20
33	SDRAM input hold time	1 ns	10	10	10	10
34	SDRAM data input setup time	2 ns	20	20	20	20
35	SDRAM data input hold time	1 ns	10	10	10	10
62-61	Superset information (may be used in future)		FF	FF	FF	FF
62	SPD Revision	Revision 1	12	12	12	12
63	Checksum for bytes 0 - 62		D7	E9	D8	EA
64-125	Manufacturer's information (optional) (FFh if not used)		XX	XX	XX	XX
126	Max. Frequency Specification	100 MHz	64	64	64	64
127	100 Mhz support details		AF	AF	FF	FF
128+	Unused storage locations		FF	FF	FF	FF

PD-Table for -10 modules:

Byte#	Description	SPD Entry Value	Hex			
			4Mx64 -10	4Mx72 -10	8Mx64 -10	8Mx72 -10
0	Number of SPD bytes	128	80	80	80	80
1	Total bytes in Serial PD	256	08	08	08	08
2	Memory Type	SDRAM	04	04	04	04
3	Number of Row Addresses (without BS bits)	12	0C	0C	0C	0C
4	Number of Column Addresses (for x8 SDRAM)	8	08	08	08	08
5	Number of DIMM Banks	1	01	01	02	02
6	Module Data Width	64	40	48	40	48
7	Module Data Width (cont'd)	0	00	00	00	00
8	Module Interface Levels	LVTTL	01	01	01	01
9	SDRAM Cycle Time at CL=3	10.0 ns	A0	A0	A0	A0
10	SDRAM Access time from Clock at CL=3	7.0 ns	70	70	70	70
11	Dimm Config (Error Det/Corr.)	none	00	02	00	02
12	Refresh Rate/Type	Self-Refresh, 15.6µs	80	80	80	80
13	SDRAM width, Primary	x16	10	10	10	10
14	Error Checking SDRAM data width	n/a / x8	00	08	00	08
15	Minimum clock delay for back-to-back random column address	t _{ccd} = 1 CLK	01	01	01	01
16	Burst Length supported	1, 2, 4, 8 & full page	8F	8F	8F	8F

:SPD-Table (cont'd):

Byte#	Description	SPD Entry Value	Hex			
			4Mx64 -10	4Mx72 -10	8Mx64 -10	8Mx72 -10
17	Number of SDRAM banks	4	04	04	04	04
18	Supported CAS Latencies	CL = 2 & 3	06	06	06	06
19	CS Latencies	CS latency = 0	01	01	01	01
20	WE Latencies	WL = 0	01	01	01	01
21	SDRAM DIMM module attributes	non buffered/ non reg.	00	00	00	00
22	SDRAM Device Attributes :General	Vcc tol +/- 10%	06	06	06	06
23	Minimum Clock Cycle Time at CAS Latency = 2	15.0 ns	F0	F0	F0	F0
24	Maximum data access time from Clock for CL=2	8.0 ns	80	80	80	80
25	Minimum Clock Cycle Time at CL = 1	not supported	FF	FF	FF	FF
26	Maximum Data Access Time from Clock at CL=1	not supported	FF	FF	FF	FF
27	Minimum Row Precharge Time	24 ns	18	18	18	18
28	Minimum Row Active to Row Active delay tRRD	20 ns	14	14	14	14
29	Minimum RAS to CAS delay tRCD	24 ns	18	18	18	18
30	Minimum RAS pulse width tRAS	60 ns	3C	3C	3C	3C
31	Module Bank Density (per bank)	32 MByte	08	08	08	08
32	SDRAM input setup time	2.5 ns	25	25	25	25
33	SDRAM input hold time	1 ns	10	10	10	10
34	SDRAM data input setup time	2.5 ns	25	25	25	25
35	SDRAM data input hold time	1 ns	10	10	10	10
32-61	Superset information (may be used in future)		FF	FF	FF	FF
62	SPD Revision	Revision 1	01	01	01	01
63	Checksum for bytes 0 - 62					
64-125	Manufacturers information (optional) (FFh if not used)		XX	XX	XX	XX
126	Max. Frequency Specification	100 MHz	66	66	66	66
127	Support details		AF	AF	FF	FF
128+	Unused storage locations		FF	FF	FF	FF

L-DIM-168-31
SDRAM DIMM Module package