SIEMENS

3.3 V 8M × 64/72-Bit 1 Bank SDRAM Module HYS 64/72V8200GU
3.3 V 16M × 64/72-Bit 2 Bank SDRAM Module HYS 64/72V16220GU

168 pin unbuffered DIMM Modules

- 168 Pin PC100-compatible unbuffered 8 Byte Dual-In-Line SDRAM Modules for PC main memory applications
- 1 bank 8M × 64, 8M × 72 and 2 bank 16M × 64, 16M × 72 organization
- Optimized for byte-write non-parity or ECC applications
- JEDEC standard Synchronous DRAMs (SDRAM)
- Fully PC board layout compatible to INTEL's Rev. 1.0 module specification
- SDRAM Performance

		-8	-8B	-10	Units
f_{CK}	Clock frequency (max.)	100	100	66	MHz
t_{AC}	Clock access time	6	6	8	ns

- Programmed Latencies

Product Speed		CL	t_{RCD}	t_{RP}
-8	PC100	2	2	2
-8B	PC100	3	2	3
-10	PC66	2	2	2

- Single + 3.3 V (± 0.3 V) power supply
- Programmable $\overline{CAS}$ Latency, Burst Length and Wrap Sequence (Sequential & Interleave)
- Auto Refresh (CBR) and Self Refresh
- Decoupling capacitors mounted on substrate
- All inputs, outputs are LVTTL compatible
- Serial Presence Detect with E^2PROM
- Utilizes 8M × 8 SDRAMs in TSOPII-54 packages
- 4096 refresh cycles every 64 ms
- 133.35 mm × 31.75 mm × 4.00 mm card size with gold contact pads

The HYS 64(72)8200 and HYS 64(72)16220 are industry standard 168-pin 8-byte Dual in-line Memory Modules (DIMMs) which are organized as 8M × 64, 8M × 72 in 1 bank and 16M × 64 and 16M × 72 in two banks high speed memory arrays designed with 64M Synchronous DRAMs (SDRAMs) for non-parity and ECC applications. The DIMMs use -8 and -8B speed sort 8M 8 SDRAM devices in TSOP-54 packages to meet the PC100 requirement. Modules which use -10 parts are suitable for PC66 applications only. Decoupling capacitors are mounted on the PC board. The PC board design is according to INTEL's PC SDRAM Rev. 1.0 module specification.

The DIMMs have a serial presence detect, implemented with a serial E^2PROM using the two pin I^2C 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 1.25" (31.75 mm) height.

Ordering Information

Type	Ordering Code	Package	Descriptions	Module Height
HYS 64V8200GU-8	PC100-222-620	L-DIM-168-30	100 MHz 8M × 64 1 bank SDRAM module	1.25"
HYS 72V8200GU-8	PC100-222-620	L-DIM-168-30	100 MHz 8M × 72 1 bank SDRAM module	1.25"
HYS 64V16220GU-8	PC100-222-620	L-DIM-168-30	100 MHz 16M × 64 2 bank SDRAM module	1.25"
HYS 72V16220GU-8	PC100-222-620	L-DIM-168-30	100 MHz 16M × 72 2 bank SDRAM module	1.25"
HYS 64V8200GU-8B	PC100-323-620	L-DIM-168-30	100 MHz 8M × 64 1 bank SDRAM module	1.25"
HYS 64V16220GU-8B	PC100-323-620	L-DIM-168-30	100 MHz 16M × 64 2 bank SDRAM module	1.25"
HYS 64V8200GU-10	PC66-222-920	L-DIM-168-30	66 MHz 8M × 64 1 bank SDRAM module	1.25"
HYS 72V8200GU-10	PC66-222-920	L-DIM-168-30	66 MHz 8M × 72 1 bank SDRAM module	1.25"
HYS 64V16220GU-10	PC66-222-920	L-DIM-168-30	66 MHz 16M × 64 2 bank SDRAM module	1.25"
HYS 72V16220GU-10	PC66-222-920	L-DIM-168-30	66 MHz 16M × 72 2 bank SDRAM module	1.25"

Pin Names

A0 - A11	Address Inputs	CLK0 - CLK3	Clock Input
BA0, BA1	Bank Selects	DQMB0 - DQMB7	Data Mask
DQ0 - DQ63	Data Input/Output	$\overline{CS0}$ - $\overline{CS3}$	Chip Select
CB0 - CB7	Check Bits ($\times$ 72 organization only)	V_{CC}	Power (+ 3.3 Volt)
$\overline{RAS}$	Row Address Strobe	V_{SS}	Ground
$\overline{CAS}$	Column Address Strobe	SCL	Clock for Presence Detect
$\overline{WE}$	Read/Write Input	SDA	Serial Data Out for Presence Detect
$\overline{CKE0}$, $\overline{CKE1}$	Clock Enable	N.C.	No Connection

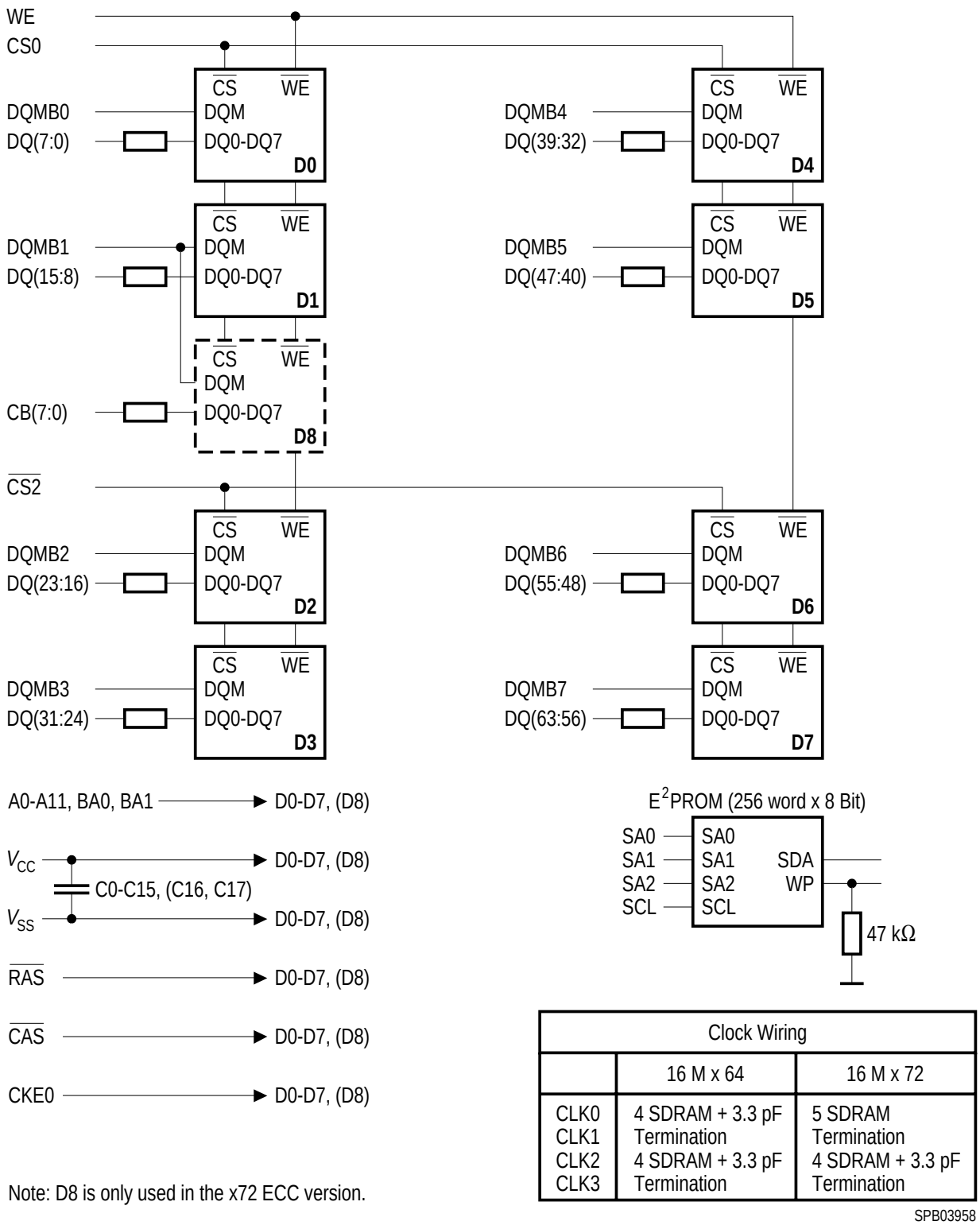
Address Format

	Part Number	**Rows**	**Columns**	**Bank Select**	**Refresh**	**Period**	**Interval**
8M $\times$ 64	HYS 64V8200GU	12	9	2	4k	64 ms	15.6 µs
8M $\times$ 72	HYS 72V8200GU	12	9	2	4k	64 ms	15.6 µs
16M $\times$ 64	HYS 64V16220GU	12	9	2	4k	64 ms	15.6 µs
16M $\times$ 72	HYS 72V16220GU	12	9	2	4k	64 ms	15.6 µs

Pin Configuration

PIN #	Symbol	PIN #	Symbol	PIN #	Symbol	PIN #	Symbol
1	V_{SS}	43	V_{SS}	85	V_{SS}	127	V_{SS}
2	DQ0	44	DU	86	DQ32	128	$\overline{CKE0}$
3	DQ1	45	$\overline{CS2}$	87	DQ33	129	$\overline{CS3}$
4	DQ2	46	DQMB2	88	DQ34	130	DQMB6
5	DQ3	47	DQMB3	89	DQ35	131	DQMB7
6	V_{CC}	48	DU	90	V_{CC}	132	NC
7	DQ4	49	V_{CC}	91	DQ36	133	V_{CC}
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	V_{SS}	54	V_{SS}	96	V_{SS}	138	V_{SS}
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	V_{CC}	101	DQ45	143	V_{CC}
18	V_{CC}	60	DQ20	102	V_{CC}	144	DQ52
19	DQ14	61	NC	103	DQ46	145	NC
20	DQ15	62	DU	104	DQ47	146	DU
21	NC (CB0)	63	$\overline{CKE1}$	105	NC (CB4)	147	NC
22	NC (CB1)	64	V_{SS}	106	NC (CB5)	148	V_{SS}
23	V_{SS}	65	DQ21	107	V_{SS}	149	DQ53
24	NC	66	DQ22	108	NC	150	DQ54
25	NC	67	DQ23	109	NC	151	DQ55
26	V_{CC}	68	V_{SS}	110	V_{CC}	152	V_{SS}
27	$\overline{WE}$	69	DQ24	111	$\overline{CAS}$	153	DQ56
28	DQMB0	70	DQ25	112	DQMB4	154	DQ57
29	DQMB1	71	DQ26	113	DQMB5	155	DQ58
30	$\overline{CS0}$	72	DQ27	114	$\overline{CS1}$	156	DQ59
31	DU	73	V_{CC}	115	$\overline{RAS}$	157	V_{CC}
32	V_{SS}	74	DQ28	116	V_{SS}	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	V_{SS}	120	A7	162	V_{SS}
37	A8	79	CLK2	121	A9	163	CLK3
38	A10	80	NC	122	BA0	164	NC
39	BA1	81	WP	123	A11	165	SA0
40	V_{CC}	82	SDA	124	V_{CC}	166	SA1
41	V_{CC}	83	SCL	125	CLK1	167	SA2
42	CLK0	84	V_{CC}	126	NC	168	V_{CC}

Note: Pinnames in brackets are for the x72 ECC versions

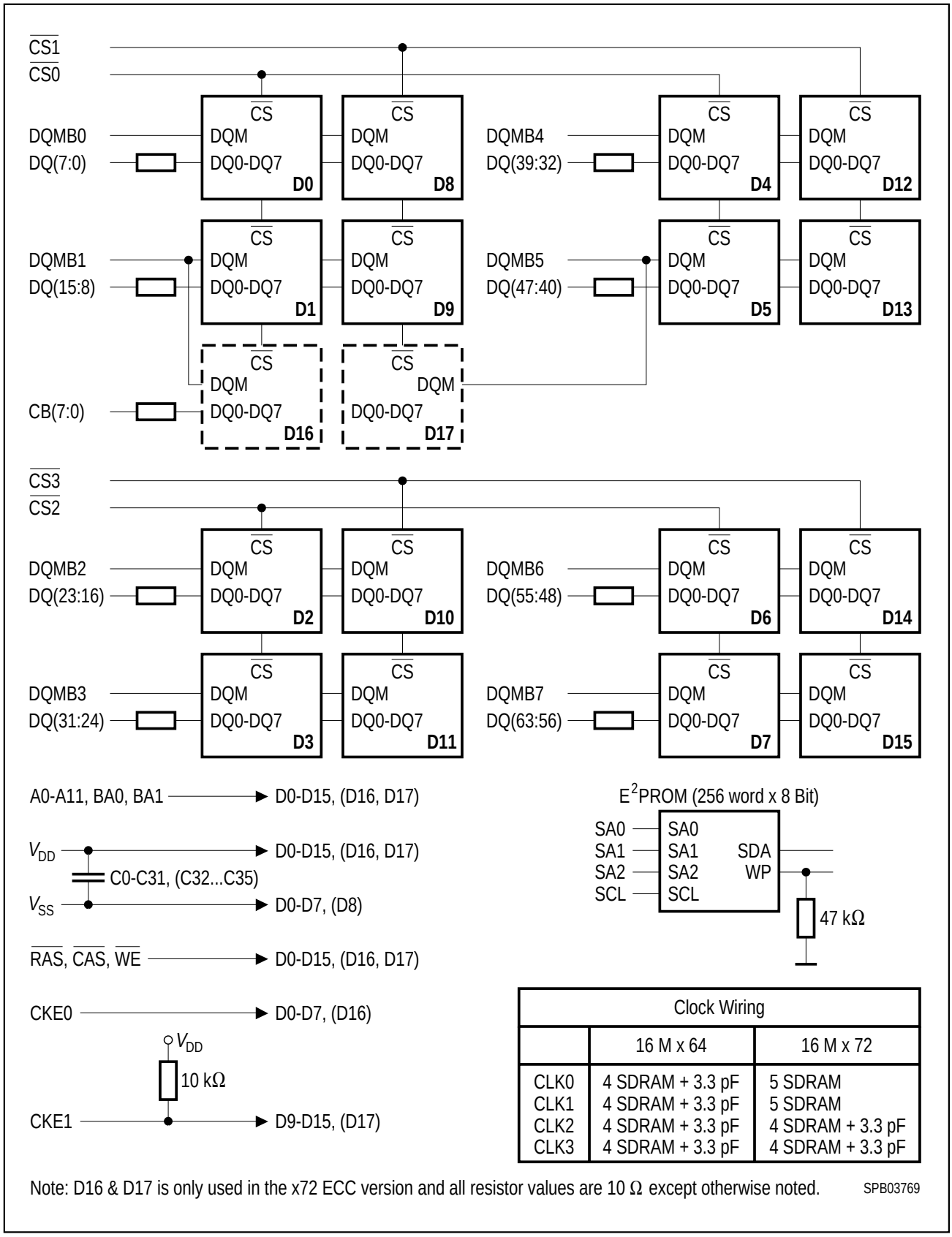


Clock Wiring		
	16 M x 64	16 M x 72
CLK0 CLK1 CLK2 CLK3	4 SDRAM + 3.3 pF Termination 4 SDRAM + 3.3 pF Termination	5 SDRAM Termination 4 SDRAM + 3.3 pF Termination

Note: D8 is only used in the x72 ECC version.

SPB03958

Block Diagram for 8M × 64/72 SDRAM DIMM Modules (HYS 64/72V8200GU)



Clock Wiring		
	16 M x 64	16 M x 72
CLK0	4 SDRAM + 3.3 pF	5 SDRAM
CLK1	4 SDRAM + 3.3 pF	5 SDRAM
CLK2	4 SDRAM + 3.3 pF	4 SDRAM + 3.3 pF
CLK3	4 SDRAM + 3.3 pF	4 SDRAM + 3.3 pF

Note: D16 & D17 is only used in the x72 ECC version and all resistor values are 10 Ω except otherwise noted. SPB03769

Block Diagram for 16M × 64/72 SDRAM DIMM Modules (HYS 64/72V1620GU)

DC Characteristics

T_A = 0 to 70 °C; V_{SS} = 0 V; V_{DD}, V_{DDQ} = 3.3 V ± 0.3 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 mA)	V_{OH}	2.4	–	V
Output low voltage (I_{OUT} = 2.0 mA)	V_{OL}	–	0.4	V
Input leakage current, any input (0 V < V_{IN} < 3.6 V, all other inputs = 0 V)	$I_{I(L)}$	– 40	40	µA
Output leakage current (DQ is disabled, 0 V < V_{OUT} < V_{CC})	$I_{O(L)}$	– 40	40	µA

Capacitance

T_A = 0 to 70 °C; V_{DD} = 3.3 V ± 0.3 V, f = 1 MHz

Parameter	Symbol	Limit Values				Unit
		max. 8M×64	max. 8M×72	max. 16M×64	max. 16M×72	
Input capacitance (A0 to A11, BA0, BA1, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$)	C_{I1}	45	55	70	80	pF
Input capacitance ($\overline{CS0}$ - $\overline{CS3}$)	C_{I2}	25	25	25	30	pF
Input capacitance (CLK0 - CLK3)	C_{ICL}	35	38	35	38	pF
Input capacitance ($\overline{CKE0}$, $\overline{CKE1}$)	C_{I3}	35	38	35	38	pF
Input capacitance (DQMB0 - DQMB7)	C_{I4}	13	13	20	20	pF
Input/Output capacitance (DQ0 - DQ63, CB0 - CB7)	C_{IO}	10	10	15	15	pF
Input Capacitance (SCL, SA0 - 2)	C_{SC}	8	8	8	8	pF
Input/Output capacitance	C_{SD}	10	10	10	10	pF

Operating Currents

T_A = 0 to 70 °C, V_{DD} = 3.3 V ± 0.3 V [1]

Recommended Operating Conditions unless otherwise noted

Parameter & Test Condition		Symb.	-8/-8B	-10	Unit	Note
			max.			
Operating Current $t_{RC} = t_{RC(MIN.)}$, $t_{CK} = t_{CK(MIN.)}$ Outputs open Burst length = 4, CL = 3 All banks operated in random access, all banks operated in ping-pong manner to maximize gapless data access		I_{CC1}	110	75	mA	1
Precharged Standby Current in Power Down Mode	t_{CK} = min.	I_{CC2P}	2	2	mA	1
$\overline{CS} = V_{IH(MIN.)}$, CKE ≤ $V_{IL(MAX.)}$	t_{CK} = infinity	I_{CC2PS}	1	1	mA	1
Precharged Standby Current in Non-power Down Mode	t_{CK} = min.	I_{CC2N}	35	30	mA	1
$\overline{CS} = V_{IH(MIN.)}$, CKE ≥ $V_{IH(MIN.)}$	t_{CK} = infinity	I_{CC2NS}	5	5		1
No operating current	CKE ≥ $V_{IH(MIN.)}$	I_{CC3N}	45	40	mA	1
t_{CK} = min., $\overline{CS} = V_{IH(MIN.)}$, active state (max. 4 banks)	CKE ≤ $V_{IL(MAX.)}$	I_{CC3P}	8	8	mA	1
Burst operating current t_{CK} = min., Read command cycling	–	I_{CC4}	70	50	mA	1, 2
Auto refresh current t_{CK} = min., Auto Refresh command cycling	–	I_{CC5}	130	90	mA	1
Self refresh current Self Refresh Mode, CKE = 0.2 V	standard version	I_{CC6}	1	1	mA	1

AC Characteristics [3, 4]

T_A = 0 to 70 °C; V_{SS} = 0 V; V_{CC} = 3.3 V ± 0.3 V, t_T = 1 ns

Parameter	Symbol	Limit Values						Unit	Note
		-8 PC100-222		-8B PC100-323		-10 PC66			
		min.	max.	min.	max.	min.	max.		
Clock and Clock Enable									
Clock Cycle Time	t_{CK}								
$\overline{CAS}$ Latency = 3		10	–	10	–	10	–	ns	
$\overline{CAS}$ Latency = 2		10	–	12	–	15	–	ns	
System Frequency	f_{CK}								
$\overline{CAS}$ Latency = 3		–	100	–	100	–	100	MHz	
$\overline{CAS}$ Latency = 2		–	100	–	83	–	66	MHz	
Clock Access Time	t_{AC}								
$\overline{CAS}$ Latency = 3		–	6	–	6	–	8	ns	4, 5
$\overline{CAS}$ Latency = 2		–	6	–	7	–	9	ns	
Clock High Pulse Width	t_{CH}	3	–	3	–	3.5	–	ns	6
Clock Low Pulse Width	t_{CL}	3	–	3	–	3.5	–	ns	6
Input Setup Time	t_{CS}	2	–	2	–	3	–	ns	7
Input Hold Time	t_{CH}	1	–	1	–	1	–	ns	7
CKE Setup Time (Power down mode)	t_{CKSP}	2.5	–	2.5	–	3	–	ns	8
CKE Setup Time (Self Refresh Exit)	t_{CKSR}	8	–	10	–	8	–	ns	9
Transition Time (rise and fall)	t_T	1	–	1	–	1	–	ns	
Common Parameters									
$\overline{RAS}$ to $\overline{CAS}$ delay	t_{RCD}	20	–	20	–	30	–	ns	
Precharge Time	t_{RP}	20	–	30	–	30	–	ns	
Active Command Period	t_{RAS}	50	100k	60	100k	70	100k	ns	
Cycle Time	t_{RC}	70	–	80	–	80	–	ns	
Bank to Bank Delay Time	t_{RRD}	16	–	20	–	20	–	ns	
$\overline{CAS}$ to $\overline{CAS}$ Delay Time (same bank)	t_{CCD}	1	–	1	–	1	–	CLK	

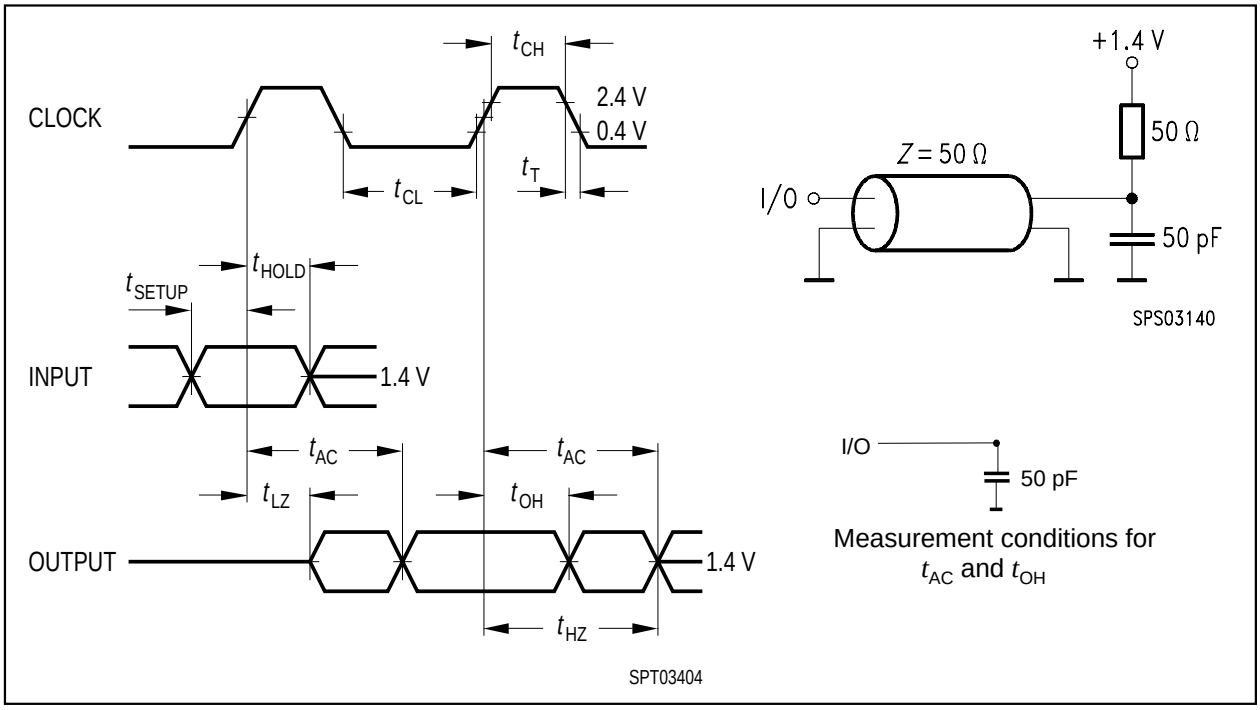
AC Characteristics (cont'd)[3, 4]

T_A = 0 to 70 °C; V_{SS} = 0 V; V_{CC} = 3.3 V ± 0.3 V, t_T = 1 ns

Parameter	Symbol	Limit Values						Unit	Note
		-8 PC100-222		-8B PC100-323		-10 PC66			
		min.	max.	min.	max.	min.	max.		
Refresh Cycle									
Refresh Period (4096 cycles)	t_{REF}	–	64	–	64	–	64	ms	[8]
Self Refresh Exit Time	t_{SREX}	10	–	10	–	10	–	ns	[9]
Read Cycle									
Data Out Hold Time	t_{OH}	3	–	3	–	3	–	ns	[4]
Data Out to Low Impedance	t_{LZ}	0	–	0	–	0	–	ns	
Data Out to High Impedance	t_{HZ}	3	8	3	10	3	10	ns	[10]
DQM Data Out Disable Latency	t_{DQZ}	–	2	–	2	–	2	CLK	
Write Cycle									
Data input to Precharge (write recovery)	t_{DPL}	2	–	2	–	2	–	CLK	
Data In to Active/Refresh	t_{DAL}	5	–	5	–	5	–	CLK	
DQM Write Mask Latency	t_{DQW}	0	–	0	–	0	–	CLK	

Notes

1. The specified values are valid when addresses are changed no more than once during $t_{CK(MIN.)}$ and when No Operation commands are registered on every rising clock edge during $t_{RC(MIN.)}$. Values are shown per module bank.
2. The specified values are valid when data inputs (DQ's) are stable during $t_{RC(MIN.)}$.
3. All AC characteristics are shown for device level.
   An initial pause of 100 µs 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 V and V_{IH} = 2.4 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 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 1V/ns edge rate between 0.8 V and 2.0 V.



5. If clock rising time is longer than 1ns, a time (t_T/2 – 0.5) ns has to be added to this parameter.
6. Rated at 1.5 V
7. If t_T is longen than 1 ns, a time (t_T – 1) 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 - E^2PROM - is assembled onto the module. Information about the module configuration, speed, etc. is written into the E^2PROM device during module production using a serial presence detect protocol (I^2C synchronous 2-wire bus).

SPD-Table for PC100 Modules

Byte#	Description	SPD Entry Value	Hex					
			8M×64 -8	8M×64 -8B	8M×72 -8	16M×64 -8	16M×64 -8B	16M×72 -8
0	Number of SPD bytes	128	80	80	80	80	80	80
1	Total bytes in Serial PD	256	08	08	08	08	08	08
2	Memory Type	SDRAM	04	04	04	04	04	04
3	Number of Row Addresses (without BS bits)	12	0C	0C	0C	0C	0C	0C
4	Number of Column Addresses (for 8M × 8 SDRAMs)	9	09	09	09	09	09	09
5	Number of DIMM Banks	1/2	01	01	01	02	02	02
6	Module Data Width	64/72	40	40	48	40	40	48
7	Module Data Width (cont'd)	0	00	00	00	00	00	00
8	Module Interface Levels	LVTTL	01	01	01	01	01	01
9	SDRAM Cycle Time at CL= 3	10.0 ns	A0	A0	A0	A0	A0	A0
10	SDRAM Access time from Clock at CL = 3	6.0 ns	60	60	60	60	60	60
11	Dimm Config (Error Det/Corr.)	none/ECC	00	00	02	00	00	02
12	Refresh Rate/Type	Self Refresh15.6 µs	80	80	80	80	80	80
13	SDRAM width, Primary	× 8	08	08	08	08	08	08
14	Error Checking SDRAM data width	n/a /× 8	00	00	08	00	00	08

SPD-Table for PC100 Modules (cont'd)

Byte#	Description	SPD Entry Value	Hex					
			8M×64 -8	8M×64 -8B	8M×72 -8	16M×64 -8	16M×64 -8B	16M×72 -8
15	Minimum clock delay for back-to-back random column address	t_{CCD} = 1 CLK	01	01	01	01	01	01
16	Burst Length supported	1, 2, 4, 8 & full page	8F	8F	8F	8F	8F	8F
17	Number of SDRAM banks	4	04	04	04	04	04	04
18	Supported $\overline{CAS}$ Latencies	$\overline{CAS}$ latency = 2 & 3	06	06	06	06	06	06
19	CS Latencies	CS latency = 0	01	01	01	01	01	01
20	$\overline{WE}$ Latencies	Write latency = 0	01	01	01	01	01	01
21	SDRAM DIMM module attributes	non buffered/ non reg.	00	00	00	00	00	00
22	SDRAM Device Attributes: General	V_{CC} tol ± 10%	06	06	06	06	06	06
23	Min. Clock Cycle Time at $\overline{CAS}$ Latency = 2	10.0/12.0 ns	A0	C0	A0	A0	C0	A0
24	Max. data access time from Clock for CL = 2	6.0/7.0 ns	60	70	60	60	60	60
25	Minimum Clock Cycle Time at CL = 1	not supported	FF	FF	FF	FF	FF	FF
26	Maximum Data Access Time from Clock at CL = 1	not supported	FF	FF	FF	FF	FF	FF
27	Minimum Row Precharge Time	20/30 ns	14	1E	14	14	1E	14
28	Minimum Row Active to Row Active delay t_{RRD}	16/20 ns	10	14	10	10	14	10

SPD-Table for PC100 Modules (cont'd)

Byte#	Description	SPD Entry Value	Hex					
			8M×64 -8	8M×64 -8B	8M×72 -8	16M×64 -8	16M×64 -8B	16M×72 -8
29	Minimum $\overline{RAS}$ to $\overline{CAS}$ delay t_{RCD}	20 ns	14	14	14	14	14	14
30	Minimum $\overline{RAS}$ pulse width t_{RAS}	45 ns	2D	2D	2D	2D	2D	2D
31	Module Bank Density (per bank)	64 MByte	10	10	10	10	10	10
32	SDRAM input setup time	2 ns	20	20	20	20	20	20
33	SDRAM input hold time	1 ns	10	10	10	10	10	10
34	SDRAM data input hold time	2 ns	20	20	20	20	20	20
35	SDRAM data input setup time	1 ns	10	10	10	10	10	10
62-61	Superset information (may be used in future)	–	FF	FF	FF	FF	FF	FF
62	SPD Revision	Revision 1.2	12	12	12	12	12	12
63	Checksum for bytes 0 - 62	–	D8	16	EA	D9	17	EB
64-125	Manufacturers information (optional) (FF_H if not used)	–	XX	XX	XX	XX	XX	XX
126	Frequency Specification	100 MHz	64	64	64	64	64	64
127	100 MHz support details	–	AF	AD	AF	FF	FD	FF
128+	Unused storage locations	–	FF	FF	FF	FF	FF	FF

SPD-Table for PC66 Modules

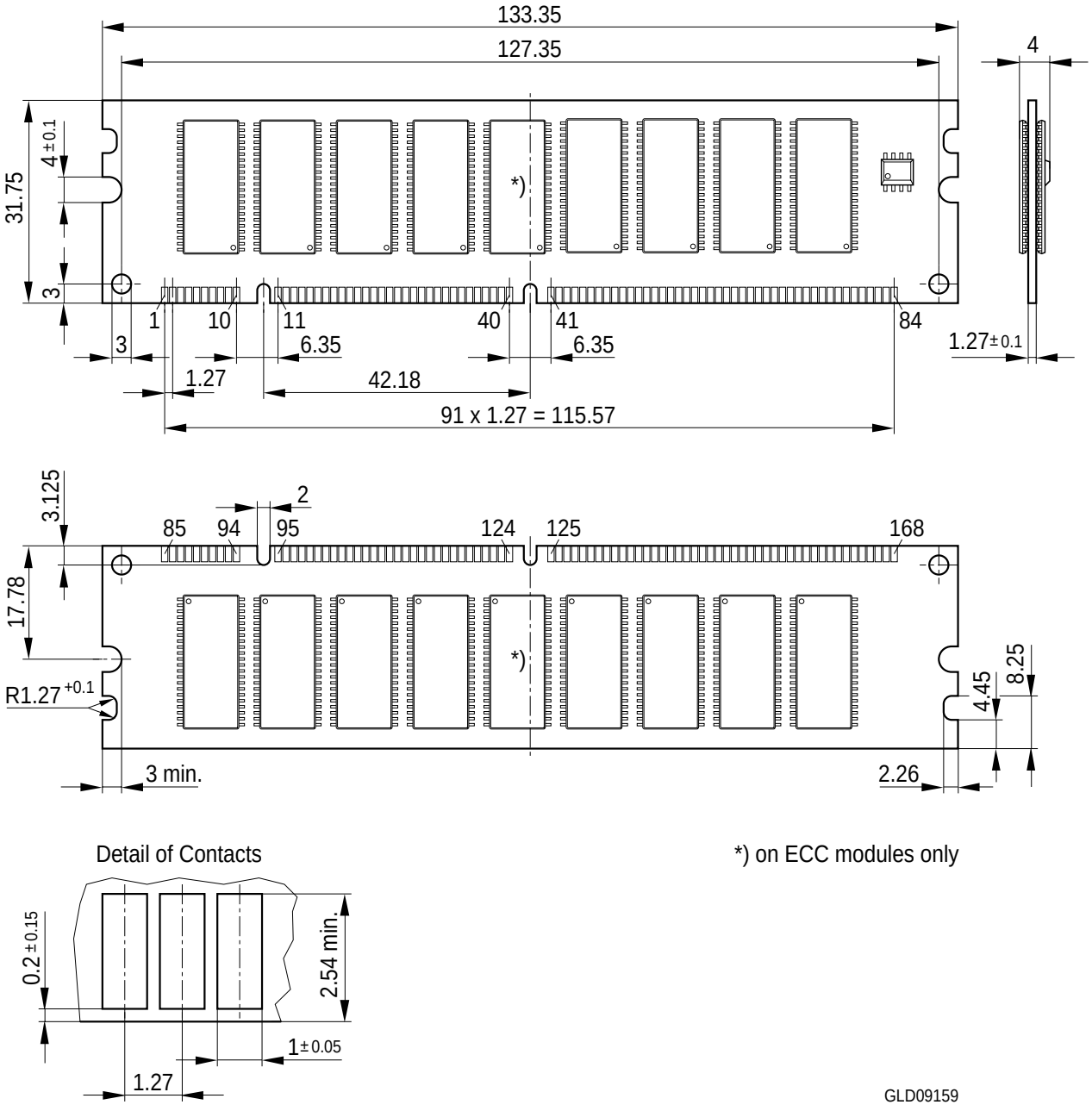
Byte#	Description	SPD Entry Value	Hex			
			8M×64 -10	8M×72 -10	16M×64 -10	16M×72 -10
0	Number of SPD bytes	128	80	80	80	80
1	Total bytes in Serial PD	256	08	08	08	08
2	Memory Type	SDRAM	04	04	04	04
3	Number of Row Addresses (without BS bits)	12	0C	0C	0C	0C
4	Number of Column Addresses (for x8 SDRAM)	9	09	09	09	09
5	Number of DIMM Banks	1/2	01	01	02	02
6	Module Data Width	64/72	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 C L= 3	8.0 ns	80	80	80	80
11	Dimm Config (Error Det/Corr.)	none/ECC	00	02	00	02
12	Refresh Rate/Type	Self Refresh 15.6 µs	80	80	80	80
13	SDRAMwidth,Primary	×8	08	08	08	08
14	Error Checking SDRAM data width	n/a/×8	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 $\overline{CAS}$ Latencies	$\overline{CAS}$ latency = 2 & 3	06	06	06	06
19	CS Latencies	CS latency = 0	01	01	01	01
20	$\overline{WE}$ Latencies	Write latency = 0	01	01	01	01
21	SDRAM DIMM module attributes	non buffered/ non reg.	00	00	00	00

SPD-Table for PC66 Modules (cont'd)

Byte#	Description	SPD Entry Value	Hex			
			8M×64 -10	8M×72 -10	16M×64 -10	16M×72 -10
22	SDRAM Device Attributes: General	V_{CC} tol ± 10%	06	06	06	06
23	Min. Clock Cycle Time at $\overline{CAS}$ Latency = 2	15.0 ns	F0	F0	F0	F0
24	Max. data access time from Clock for CL= 2	9.0 ns	90	90	90	90
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	30 ns	1E	1E	1E	1E
28	Minimum Row Active to Row Active delay t_{RRD}	20 ns	14	14	14	14
29	Minimum $\overline{RAS}$ to $\overline{CAS}$ delay t_{RCD}	30 ns	1E	1E	1E	1E
30	Minimum $\overline{RAS}$ pulse width t_{RAS}	45 ns	2D	2D	2D	2D
31	Module Bank Density (per bank)	64 MByte	10	10	10	10
32	SDRAM input setup time	3 ns	30	30	30	30
33	SDRAM input hold time	1 ns	10	10	10	10
34	SDRAM data input hold time	3 ns	30	30	30	30
35	SDRAM data input setup time	1 ns	10	10	10	10
62-61	Superset information (may be used in future)		FF	FF	FF	FF
62	SPD Revision	Revision 1.2	12	12	12	12
63	Checksum for bytes 0 - 62		B0	C2	B1	C3
64-125	Manufacturers information (optional) (FF_H if not used)		XX	XX	XX	XX
126	Frequency Specification	66 MHz	66	66	66	66
127	Details		AF	AF	FF	FF
128+	Unused storage locations		FF	FF	FF	FF

Package Outlines

L-DIM-168-30
SDRAM DIMM Module Package



Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.
SMD = Surface Mounted Device

Dimensions in mm