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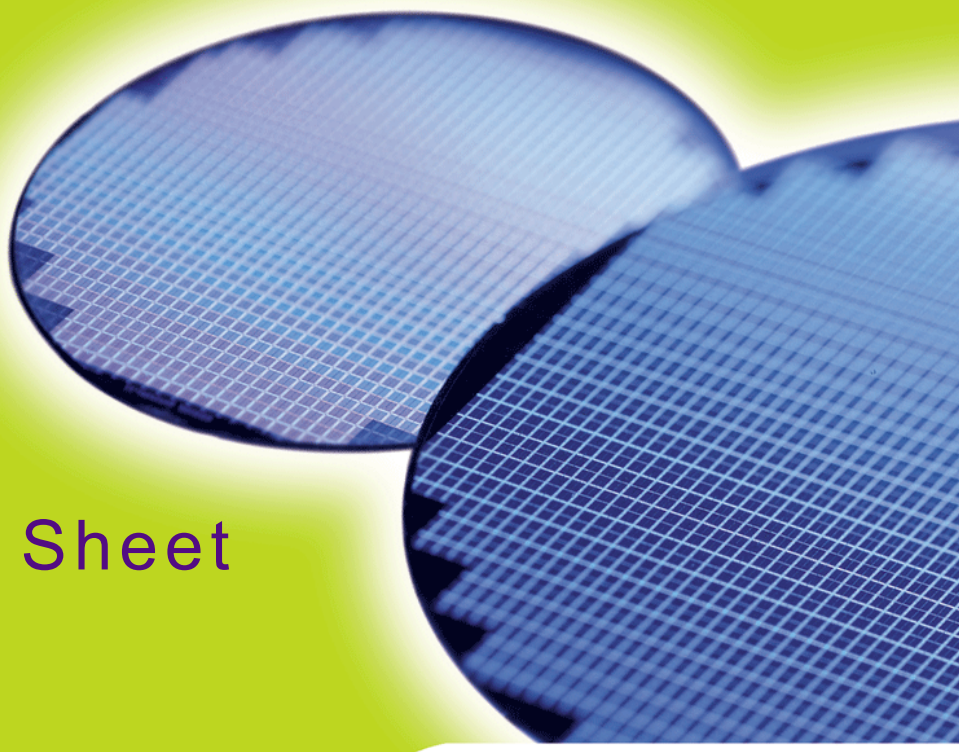
HYS72D32300[G/H]BR–[5/6/7]–C
HYS72D64300[G/H]BR–[5/6/7]–C
HYS72D64320[G/H]BR–[5/6]–C
HYS72D128320[G/H]BR–[6/7]–C

184-Pin Registered Double Data Rate SDRAM Module
Reg DIMM
DDR SDRAM



Internet Data Sheet

Rev. 1.32

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HYS72D32300[G/H]BR–[5/6/7]–C, HYS72D64300[G/H]BR–[5/6/7]–C, HYS72D64320[G/H]BR–[5/6]–C, HYS72D128320[G/H]BR–[6/7]–C

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1 Overview

This chapter gives an overview of the 184-pin Registered Double Data Rate DDR2 SDRAM Modules with parity bit product family and describes its main characteristics.

1.1 Features

- 184-Pin Registered 8-Byte Dual-In-Line DDR SDRAM Module for "1U" PC, Workstation and Server main memory applications
- One rank 32M × 72 and 64M × 72 and two ranks 64M × 72 and 128M × 72 organization
- JEDEC standard Double Data Rate Synchronous DRAMs (DDR SDRAM) with a single + 2.5 V (± 0.2 V) power supply and + 2.6 V (± 0.1 V) power supply for DDR400
- Built with 256-Mbit DDR SDRAMs in P--TFBGA-60-1 packages
- Programmable CAS Latency, Burst Length, and Wrap Sequence (Sequential & Interleave)
- Auto Refresh (CBR) and Self Refresh
- All inputs and outputs SSTL_2 compatible
- Re-drive for all input signals using register and PLL devices.
- Serial Presence Detect with E^2PROM
- Low Profile Modules form factor: 133.35 mm × 28.58 mm × 4.00 mm / 2.64 mm and for 1GB 133.35 mm × 30.48 mm (1.2")× 4.00 mm
- JEDEC standard reference layout for one rank 256 MB, 512 MB and two ranks 512 MB, 1 GB: PC 2700 and PC 3200 Registered DIMM Raw Cards A,B,C,D
- Gold plated contacts

TABLE 1
Performance

Part Number Speed Code			-5	–6	-7	Unit
Speed Grade	Component		DDR400B	DDR333B	DDR266A	—
	Module		PC3200-3033	PC2700–2533	PC2100-2033	—
max. Clock Frequency	@CL3	f_{CK3}	200	166	—	MHz
	@CL2.5	$f_{CK2.5}$	166	166	143	MHz
	@CL2	f_{CK2}	133	133	133	MHz

1.2 Description

The HYS72D[128/64/32]3xx[G/H]BR–[5/6/7]–C and HYS72D64320GBR–5–C are low profile versions of the standard Registered DIMM modules suitable for 1U Server Applications. The Low Profile DIMM versions are available as 32M × 72 (256 MB), 64M × 72 (512 MB), 128M × 72 (1 GB)

The memory array is designed with Double Data Rate Synchronous DRAMs for ECC applications. All control and address signals are re-driven on the DIMM using register devices and a PLL for the clock distribution. This reduces capacitive loading to the system bus, but adds one cycle to the SDRAM timing. A variety of decoupling capacitors are mounted on the PC board. The DIMMs feature serial presence detect based on a serial E^2PROM device using the 2-pin I^2C protocol. The first 128 bytes are programmed with configuration data and the second 128 bytes are available to the customer.

TABLE 2
Ordering Information for Lead-Containing Products

Product Type	Compliance Code	Description	SDRAM Technology
PC3200 (CL = 3.0)			
HYS72D32300GBR–5–C	PC3200R–30330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)
HYS72D64300GBR–5–C	PC3200R–30330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)
HYS72D64320GBR–5–C	PC3200R–30330–B0	2 Ranks 512 MB Registered DIMM ECC	256 Mbit (×8)
PC2700 (CL = 2.5)			
HYS72D32300GBR–6–C	PC2700R–25330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)
HYS72D64300GBR–6–C	PC2700R–25330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)
HYS72D64320GBR–6–C	PC2700R–25330–B0	2 Ranks 512 MB Registered DIMM ECC	256 Mbit (×8)
HYS72D128320GBR–6–C	PC2700R–25330–D0	2 Ranks 1 GB Registered DIMM ECC	256 Mbit (×4)
PC2100 (CL = 2.0)			
HYS72D32300GBR–7–C	PC2100R–20330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)
HYS72D64300GBR–7–C	PC2100R–20330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)
HYS72D128320GBR–7–C	PC2100R–20330–D0	2 Ranks 1 GB Registered DIMM ECC	256 Mbit (×4)

green Product

TABLE 3
Ordering Information for Lead-Free (RoHS Compliant) Products

Product Type [1]	Compliance Code[2]	Description	SDRAM Technology	Note[3]
PC3200 (CL = 3.0)				
HYS72D32300HBR–5–C	PC3200R–30330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)	
HYS72D64300HBR–5–C	PC3200R–30330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)	
HYS72D64320HBR–5–C	PC3200R–30330–B0	2 Ranks 512 MB Registered DIMM ECC	256 Mbit (×8)	
PC2700 (CL = 2.5)				
HYS72D32300HBR–6–C	PC2700R–25330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)	
HYS72D64300HBR–6–C	PC2700R–25330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)	
HYS72D64320HBR–6–C	PC2700R–25330–B0	2 Ranks 512 MB Registered DIMM ECC	256 Mbit (×8)	
HYS72D128320HBR–6–C	PC2700R–25330–D0	2 Ranks 1 GB Registered DIMM ECC	256 Mbit (×4)	
PC2100 (CL = 2.0)				
HYS72D32300HBR–7–C	PC2100R–20330–A0	1 Rank 256 MB Registered DIMM ECC	256 Mbit (×8)	
HYS72D64300HBR–7–C	PC2100R–20330–C0	1 Rank 512 MB Registered DIMM ECC	256 Mbit (×4)	
HYS72D128320HBR–7–C	PC2100R–20330–D0	2 Ranks 1 GB Registered DIMM ECC	256 Mbit (×4)	

1) All product types end with a place code designating the silicon-die revision. Reference information available on request. Example: HYS72D128300GBR-5-B, indicating Rev.B die are used for SDRAM components.

2) The Compliance Code is printed on the module labels and describes the speed sort (for example “PC2100R”), the latencies (for example “20330” means CAS latency of 2.0 clocks, Row-Column-Delay (RCD) latency of 3 clocks and Row Precharge latency of 3 clocks), JEDEC SPD code definition version 0, and the Raw Card used for this module.

3) RoHS Compliant Product: Restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment as defined in the directive 2002/95/EC issued by the European Parliament and of the Council of 27 January 2003. These substances include mercury, lead, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated biphenyl ethers.

2 Pin Configuration

The pin configuration of the Registered DDR SDRAM DIMM is listed by function in **Table 4** (184 pins). The abbreviations used in columns Pin and Buffer Type are explained in **Table 5** and **Table 6** respectively. The pin numbering is depicted in **Figure 1**.

TABLE 4
Pin Configuration of RDIMM

Pin #	Name	Pin Type	Buffer Type	Function
Clock Signals				
137	CK0	I	SSTL	**Clock Signal**
138	$\overline{CK0}$	I	SSTL	**Complement Clock**
21	CKE0	I	SSTL	**Clock Enable Rank 0**
111	CKE1	I	SSTL	**Clock Enable Rank 1** *Note: 2-rank module*
	NC	NC	SSTL	*Note: **1**-rank module*
Control Signals				
157	$\overline{S0}$	I	SSTL	**Chip Select of Rank 0**
158	$\overline{S1}$	I	SSTL	**Chip Select of Rank 1** *Note: 2-ranks module*
	NC	NC	—	*Note: 1-rank module*
154	$\overline{RAS}$	I	SSTL	**Row Address Strobe**
65	$\overline{CAS}$	I	SSTL	**Column Address Strobe**
63	$\overline{WE}$	I	SSTL	**Write Enable**
10	$\overline{RESET}$	I	LV-CMOS	**Register Reset**
Address Signals				
59	BA0	I	SSTL	**Bank Address Bus 1:0**
52	BA1	I	SSTL	
48	A0	I	SSTL	**Address Bus 11:0**
43	A1	I	SSTL	
41	A2	I	SSTL	
130	A3	I	SSTL	
37	A4	I	SSTL	
32	A5	I	SSTL	
125	A6	I	SSTL	Address Bus 11:0
29	A7	I	SSTL	
122	A8	I	SSTL	
27	A9	I	SSTL	
141	A10	I	SSTL	
	AP	I	SSTL	
118	A11	I	SSTL	
115	A12	I	SSTL	**Address Signal 12** *Note: Module based on 256 Mbit or larger dies*
	NC	NC	—	*Note: 128 Mbit based module*
167	A13	I	SSTL	**Address Signal 13** *Note: 1 Gbit based module*
	NC	NC	—	*Note: Module based on 512 Mbit or smaller dies*
Data Signals				
2	DQ0	I/O	SSTL	**Data Bus 63:0**
4	DQ1	I/O	SSTL	
6	DQ2	I/O	SSTL	
8	DQ3	I/O	SSTL	
94	DQ4	I/O	SSTL	
95	DQ5	I/O	SSTL	
98	DQ6	I/O	SSTL	
99	DQ7	I/O	SSTL	
12	DQ8	I/O	SSTL	
13	DQ9	I/O	SSTL	
19	DQ10	I/O	SSTL	
20	DQ11	I/O	SSTL	

Pin #	Name	Pin Type	Buffer Type	Function
105	DQ12	I/O	SSTL	**Data Bus 63:0**
106	DQ13	I/O	SSTL	
109	DQ14	I/O	SSTL	
110	DQ15	I/O	SSTL	
23	DQ16	I/O	SSTL	
24	DQ17	I/O	SSTL	
28	DQ18	I/O	SSTL	
31	DQ19	I/O	SSTL	
114	DQ20	I/O	SSTL	
117	DQ21	I/O	SSTL	
121	DQ22	I/O	SSTL	
123	DQ23	I/O	SSTL	
33	DQ24	I/O	SSTL	
35	DQ25	I/O	SSTL	
39	DQ26	I/O	SSTL	
40	DQ27	I/O	SSTL	
126	DQ28	I/O	SSTL	
127	DQ29	I/O	SSTL	
131	DQ30	I/O	SSTL	
133	DQ31	I/O	SSTL	
53	DQ32	I/O	SSTL	
55	DQ33	I/O	SSTL	
57	DQ34	I/O	SSTL	
60	DQ35	I/O	SSTL	
146	DQ36	I/O	SSTL	
147	DQ37	I/O	SSTL	
150	DQ38	I/O	SSTL	
151	DQ39	I/O	SSTL	
61	DQ40	I/O	SSTL	
64	DQ41	I/O	SSTL	
68	DQ42	I/O	SSTL	
69	DQ43	I/O	SSTL	
153	DQ44	I/O	SSTL	
155	DQ45	I/O	SSTL	
161	DQ46	I/O	SSTL	
162	DQ47	I/O	SSTL	
72	DQ48	I/O	SSTL	
73	DQ49	I/O	SSTL	
79	DQ50	I/O	SSTL	
80	DQ51	I/O	SSTL	
165	DQ52	I/O	SSTL	**Data Bus 63:0**
166	DQ53	I/O	SSTL	
170	DQ54	I/O	SSTL	
171	DQ55	I/O	SSTL	
83	DQ56	I/O	SSTL	
84	DQ57	I/O	SSTL	
87	DQ58	I/O	SSTL	
88	DQ59	I/O	SSTL	
174	DQ60	I/O	SSTL	
175	DQ61	I/O	SSTL	
178	DQ62	I/O	SSTL	
179	DQ63	I/O	SSTL	
44	CB0	I/O	SSTL	**Check Bits 7:0**
45	CB1	I/O	SSTL	
49	CB2	I/O	SSTL	
51	CB3	I/O	SSTL	
134	CB4	I/O	SSTL	
135	CB5	I/O	SSTL	
142	CB6	I/O	SSTL	
144	CB7	I/O	SSTL	
5	DQS0	I/O	SSTL	**Data Strobes 8:0**
14	DQS1	I/O	SSTL	
25	DQS2	I/O	SSTL	
36	DQS3	I/O	SSTL	
56	DQS4	I/O	SSTL	
67	DQS5	I/O	SSTL	
78	DQS6	I/O	SSTL	**Data Strobes 8:0**
86	DQS7	I/O	SSTL	
47	DQS8	I/O	SSTL	
97	DM0	I	SSTL	**Data Mask 0** *Note: x8 based module*
	DQS9	I/O	SSTL	**Data Strobe 9** *Note: x4 based module*
107	DM1	I	SSTL	**Data Mask 1** *Note: x8 based module*
	DQS10	I/O	SSTL	**Data Strobe 10** *Note: x4 based module*

Pin #	Name	Pin Type	Buffer Type	Function
119	DM2	I	SSTL	**Data Mask 2** *Note: x8 based module*
	DQS11	I/O	SSTL	**Data Strobe 11** *Note: x4 based module*
129	DM3	I	SSTL	**Data Mask 3** *Note: x8 based module*
	DQS12	I/O	SSTL	**Data Strobe 12** *Note: x4 based module*
149	DM4	I	SSTL	**Data Mask 4** *Note: x8 based module*
	DQS13	I/O	SSTL	**Data Strobe 13** *Note: x4 based module*
159	DM5	I	SSTL	**Data Mask 5** *Note: x8 based module*
	DQS14	I/O	SSTL	**Data Strobe 14** *Note: x4 based module*
169	DM6	I	SSTL	**Data Mask 6** *Note: x8 based module*
	DQS15	I/O	SSTL	**Data Strobe 15** *Note: x4 based module*
177	DM7	I	SSTL	**Data Mask 7** *Note: x8 based module*
	DQS16	I/O	SSTL	**Data Strobe 16** *Note: x4 based module*
140	DM8	I	SSTL	**Data Mask 8** *Note: x8 based module*
	DQS17	I/O	SSTL	**Data Strobe 17** *Note: x4 based module*
E²PROM				
92	SCL	I	CMOS	**Serial Bus Clock**
91	SDA	I/O	OD	**Serial Bus Data**
181	SA0	I	CMOS	**Slave Address Select Bus 2:0**
182	SA1	I	CMOS	
183	SA2	I	CMOS	
Power Supplies				
1	V_{REF}	AI	—	**I/O Reference Voltage**
184	V_{DDSPD}	PWR	—	**E²PROM Power Supply**

Pin #	Name	Pin Type	Buffer Type	Function
15, 22, 30, 54, 62, 77, 96, 104, 112, 128, 136, 143, 156, 164, 172, 180	V_{DDQ}	PWR	—	**I/O Driver Power Supply**
7, 38, 46, 70, 85, 108, 120, 148, 168	V_{DD}	PWR	—	**Power Supply**
3, 11, 18, 26, 34, 42, 50, 58, 66, 74, 81, 89, 93, 100, 116, 124, 132, 139, 145, 152, 160, 176	V_{SS}	GND	—	**Ground Plane**

Pin #	Name	Pin Type	Buffer Type	Function
Other Pins				
82	V_{DDID}	O	OD	**V_{DD} Identification**
9, 16, 17, 71, 75, 76, 90, 101, 102, 103, 113, 163, 173	NC	NC	—	**Not connected**

TABLE 5
Abbreviations for Pin Type

Abbreviation	Description
I	Standard input-only pin. Digital levels.
O	Output. Digital levels.
I/O	I/O is a bidirectional input/output signal.
AI	Input. Analog levels.
PWR	Power
GND	Ground
NU	Not Usable (JEDEC Standard)
NC	Not Connected (JEDEC Standard)

TABLE 6
Abbreviations for Buffer Type

Abbreviation	Description
SSTL	Serial Stub Terminalted Logic (SSTL2)
LV-CMOS	Low Voltage CMOS
CMOS	CMOS Levels
OD	Open Drain. The corresponding pin has 2 operational states, active low and tristate, and allows multiple devices to share as a wire-OR.

FIGURE 1
Pin Configuration 184 Pins, Reg

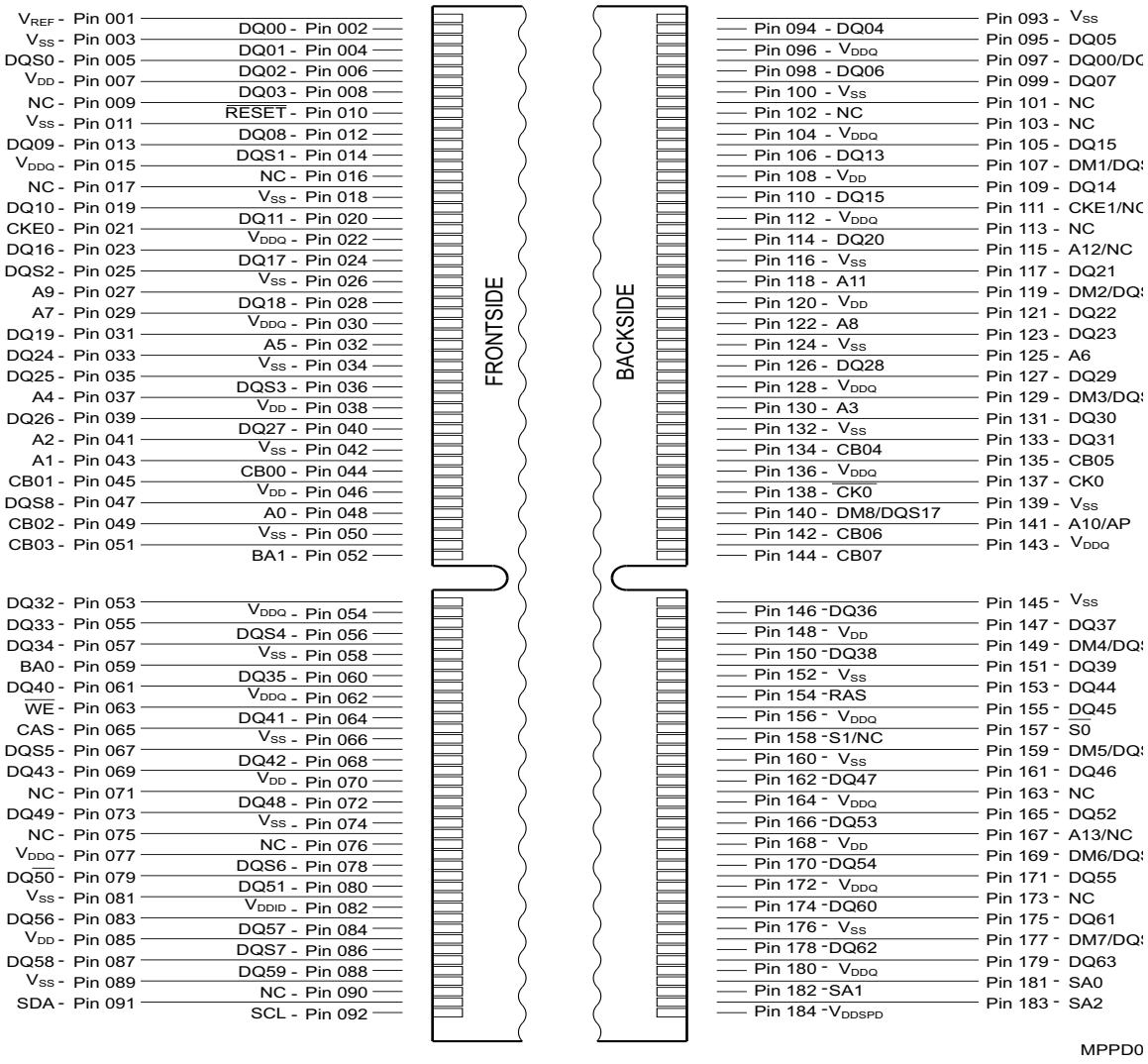


TABLE 7
Address Table

Density	Organization	Memory Ranks	SDRAMs	# of SDRAMs	# of row/rank/ columns bits	Refresh	Period	Interval
256 MB	32 M ×72	1	32 M ×8	9	13 / 2 / 10	8 K	64 ms	7.8 µs
512 MB	64 M ×72	1	64 M ×4	18	13 / 2 / 11	8 K	64 ms	7.8 µs
512 MB	64 M ×72	2	32 M ×8	18	13 / 2 / 10	8 K	64 ms	7.8 µs
1 GB	128 M ×72	2	64 M ×4	36	13 / 2 / 11	8 K	64 ms	7.8 µs

3 Electrical Characteristics

This chapter lists the electrical characteristics.

3.1 Operating Conditions

This chapter contains the operating conditions tables.

TABLE 8
Absolute Maximum Ratings

Parameter	Symbol	Values			Unit	Note/ Test Condition
		min.	typ.	max.		
Voltage on I/O pins relative to V_{SS}	V_{IN}, V_{OUT}	–0.5	—	V_{DDQ} +0.5	V	
Voltage on inputs relative to V_{SS}	V_{IN}	–1	—	+3.6	V	
Voltage on V_{DD} supply relative to V_{SS}	V_{DD}	–1	—	+3.6	V	
Voltage on V_{DDQ} supply relative to V_{SS}	V_{DDQ}	–1	—	+3.6	V	
Operating temperature (ambient)	T_A	0	—	+70	°C	
Storage temperature (plastic)	T_{STG}	–55	—	+150	°C	
Power dissipation (per SDRAM component)	P_D	—	1	—	W	
Short circuit output current	I_{OUT}	—	50	—	mA	

Attention: Permanent damage to the device may occur if "Absolute Maximum Ratings" are exceeded. This is a stress rating only, and functional operation should be restricted to recommended operation conditions. Exposure to absolute maximum rating conditions for extended periods of time may affect device reliability and exceeding only one of the values may cause irreversible damage to the integrated circuit.

TABLE 9
Electrical Characteristics and DC Operating Conditions

Parameter	Symbol	Values			Unit	Note[1)]/Test Condition
		Min.	Typ.	Max.		
Device Supply Voltage	V_{DD}	2.3	2.5	2.7	V	$f_{CK} \leq$ 166 MHz
Device Supply Voltage	V_{DD}	2.5	2.6	2.7	V	f_{CK} > 166 MHz [2)]
Output Supply Voltage	V_{DDQ}	2.3	2.5	2.7	V	$f_{CK} \leq$ 166 MHz [3)]
Output Supply Voltage	V_{DDQ}	2.5	2.6	2.7	V	f_{CK} > 166 MHz [2)3)]
E^2PROM supply voltage	V_{DDSPD}	2.3	2.5	3.6	V	
Supply Voltage, I/O Supply Voltage	V_{SS}, V_{SSQ}	0	—	0	V	
Input Reference Voltage	V_{REF}	0.49 × V_{DDQ}	0.5 × V_{DDQ}	0.51 × V_{DDQ}	V	[4)]
I/O Termination Voltage (System)	V_{TT}	V_{REF} – 0.04	—	V_{REF} + 0.04	V	[5)]

Parameter	Symbol	Values			Unit	Note[1)]/Test Condition
		Min.	Typ.	Max.		
Input High (Logic1) Voltage	$V_{IH(DC)}$	V_{REF} + 0.15	—	V_{DDQ} + 0.3	V	6)
Input Low (Logic0) Voltage	$V_{IL(DC)}$	–0.3	—	V_{REF} – 0.15	V	6)
Input Voltage Level, CK and $\overline{CK}$ Inputs	$V_{IN(DC)}$	–0.3	—	V_{DDQ} + 0.3	V	6)
Input Differential Voltage, CK and $\overline{CK}$ Inputs	$V_{ID(DC)}$	0.36	—	V_{DDQ} + 0.6	V	6)7)
VI-Matching Pull-up Current to Pull-down Current	VI_{Ratio}	0.71	—	1.4	—	8)
Input Leakage Current	I_I	–2	—	2	µA	Any input 0 V ≤ V_{IN} ≤ V_{DD}; All other pins not under test = 0 V 6)9)
Output Leakage Current	I_{OZ}	–5	—	5	µA	DQs are disabled; 0 V ≤ V_{OUT} ≤ V_{DDQ}
Output High Current, Normal Strength Driver	I_{OH}	—	—	–16.2	mA	V_{OUT} = 1.95 V
Output Low Current, Normal Strength Driver	I_{OL}	16.2	—	—	mA	V_{OUT} = 0.35 V

1) 0 °C ≤ T_A ≤ 70 °C
2) DDR400 conditions apply for all clock frequencies above 166 MHz
3) Under all conditions, V_{DDQ} must be less than or equal to V_{DD}.
4) Peak to peak AC noise on V_{REF} may not exceed ± 2% $V_{REF\ (DC)}$. V_{REF} is also expected to track noise variations in V_{DDQ}.
5) V_{TT} is not applied directly to the device. V_{TT} is a system supply for signal termination resistors, is expected to be set equal to V_{REF}, and must track variations in the DC level of V_{REF}.
6) Inputs are not recognized as valid until V_{REF} stabilizes.
7) V_{ID} is the magnitude of the difference between the input level on CK and the input level on CK.
8) The ratio of the pull-up current to the pull-down current is specified for the same temperature and voltage, over the entire temperature and voltage range, for device drain to source voltage from 0.25 to 1.0 V. For a given output, it represents the maximum difference between pull-up and pull-down drivers due to process variation.
9) Values are shown per DDR SDRAM component

3.2 Current Conditions

This chapter describes the Conditions.

TABLE 10
I_{DD} Conditions

Parameter	Symbol
Operating Current 0 one bank; active/ precharge; DQ, DM, and DQS inputs changing once per clock cycle; address and control inputs changing once every two clock cycles.	I_{DD0}
Operating Current 1 one bank; active/read/precharge; Burst Length = 4; see component data sheet.	I_{DD1}
Precharge Power-Down Standby Current all banks idle; power-down mode; CKE ≤ $V_{IL,MAX}$	I_{DD2P}
Precharge Floating Standby Current $\overline{CS}$ ≥ $V_{IH,,MIN}$, all banks idle; CKE ≥ $V_{IH,MIN}$; address and other control inputs changing once per clock cycle; V_{IN} = V_{REF} for DQ, DQS and DM.	I_{DD2F}
Precharge Quiet Standby Current $\overline{CS}$ ≥ V_{IHMIN}, all banks idle; CKE ≥ $V_{IH,MIN}$; V_{IN} = V_{REF} for DQ, DQS and DM; address and other control inputs stable at ≥ $V_{IH,MIN}$ or ≤ $V_{IL,MAX}$.	I_{DD2Q}
Active Power-Down Standby Current one bank active; power-down mode; CKE ≤ V_{ILMAX}; V_{IN} = V_{REF} for DQ, DQS and DM.	I_{DD3P}
Active Standby Current one bank active; $\overline{CS}$ ≥ $V_{IH,MIN}$; CKE ≥ $V_{IH,MIN}$; t_{RC} = $t_{RAS,MAX}$; DQ, DM and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle.	I_{DD3N}
Operating Current Read one bank active; Burst Length = 2; reads; continuous burst; address and control inputs changing once per clock cycle; 50 % of data outputs changing on every clock edge; CL = 2 for DDR266(A), CL = 3 for DDR333 and DDR400B; I_{OUT} = 0 mA	I_{DD4R}
Operating Current Write one bank active; Burst Length = 2; writes; continuous burst; address and control inputs changing once per clock cycle; 50 % of data outputs changing on every clock edge; CL = 2 for DDR266(A), CL = 3 for DDR333 and DDR400B	I_{DD4W}
Auto-Refresh Current t_{RC} = t_{RFCMIN}, burst refresh	I_{DD5}
Self-Refresh Current CKE ≤ 0.2 V; external clock on	I_{DD6}
Operating Current 7 four bank interleaving with Burst Length = 4; see component data sheet.	I_{DD7}

3.3 Current Specifications

This chapter describes the Specifications.

TABLE 11
I_{DD} Specification for HYS72D[128/64/32]3xxx[G/H]BR–5–C

Product Type	HYS72D32300GBR–5–C HYS72D32300HBR–5–C		HYS72D64300GBR–5–C HYS72D64300HBR–5–C		HYS72D64320GBR–5–C HYS72D64320HBR–5–C		Unit	Note/ Test Conditions[1) 2)]
Organization	256 MB		512 MB		512 MB			
	×72		×72		×72			
	1 Rank		1 Rank		2 Ranks			
	–5		–5		–5			
Symbol	Typ.	Max.	Typ.	Max.	Typ.	Max.		
I_{DD0}	1140	1370	2070	2480	1780	2080	mA	3)
I_{DD1}	1360	1600	2380	2800	2000	2310	mA	3)4)
I_{DD2P}	390	440	730	790	730	790	mA	5)
I_{DD2F}	880	990	1450	1620	1450	1620	mA	5)
I_{DD2Q}	540	650	1020	1200	1020	1200	mA	5)
I_{DD3P}	470	560	890	720	890	1020	mA	5)
I_{DD3N}	950	1080	1590	1780	1590	1780	mA	5)
I_{DD4R}	1400	1600	2470	2800	2040	2310	mA	3)4)
I_{DD4W}	1450	1650	2560	2890	2090	2350	mA	3)
I_{DD5}	1630	2120	3190	4130	2270	2830	mA	3)
I_{DD6}	330	370	640	700	640	700	mA	5)
I_{DD7}	2530	2950	4720	5500	3170	3660	mA	3)4)

1) Test condition for maximum values: V_{DD} = 2.7 V, T_A = 10 °C
2) Module I_{DD} is calculated on the basis of component I_{DD} and includes Register and PLL
3) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: $n * I_{DD} \times$ [component] for single bank modules (n: number of components per module bank) $n * I_{DD} \times$ [component] + $n * I_{DD3N}$ [component] for two bank modules (n: number of components per module bank)
4) DQ I/O (I_{DDQ}) currents are not included into calculations: module *I*DD values will be measured differently depending on load conditions
5) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: $n * I_{DD} \times$ [component] for single bank modules (n: number of components per module bank)$2 * n * I_{DD} \times$ [component] for single two bank modules (n: number of components per module bank)

TABLE 12

I_{DD} Specification for HYS72D[256/128/64/32]3xxx[G/H]BR–6–C

Product Type	HYS72D32300GBR–6–C HYS72D32300HBR–6–C		HYS72D64300GBR–6–C HYS72D64300HBR–6–C		HYS72D64320GBR–6–C HYS72D64320HBR–6–C		HYS72D128320GBR–6–C HYS72D128320HBR–6–C		Unit	Note/ Test Conditions[1) 2)]
Organization	256 MB		512 MB		512 MB		1 GB			
	×72		×72		×72		×72			
	1 Rank		1 Rank		2 Ranks		2 Ranks			
	–6		–6		–6		–6			
Symbol	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.		
I_{DD0}	1000	1190	1790	2110	1540	1780	2870	3290	mA	3)
I_{DD1}	1210	1410	2090	2420	1750	2000	3160	3600	mA	3)4)
I_{DD2P}	370	410	650	710	650	710	1220	1300	mA	5)
I_{DD2F}	780	880	1250	1400	1250	1400	2200	2440	mA	5)
I_{DD2Q}	480	580	890	1050	890	1050	1690	1980	mA	5)
I_{DD3P}	430	500	780	640	780	890	1480	1660	mA	5)
I_{DD3N}	840	950	1380	1540	1380	1540	2450	2730	mA	5)
I_{DD4R}	1210	1410	2090	2420	1750	2000	3160	3600	mA	3)4)
I_{DD4W}	1250	1450	2180	2510	1790	2040	3250	3690	mA	3)
I_{DD5}	1420	1820	2750	3510	1960	2410	3830	4690	mA	3)
I_{DD6}	320	370	580	640	580	640	1110	1190	mA	5)
I_{DD7}	2200	2580	4070	4760	2740	3170	5140	5940	mA	3)4)

1) Test condition for maximum values: V_{DD} = 2.7 V, T_A = 10 °C
2) Module I_{DD} is calculated on the basis of component I_{DD} and includes Register and PLL
3) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: n * I_{DD} × [component] for single bank modules (n: number of components per module bank)n * I_{DD} × [component] + n * I_{DD3N} [component] for two bank modules (n: number of components per module bank)
4) DQ I/O (I_{DDQ}) currents are not included into calculations: module *I*DD values will be measured differently depending on load conditions
5) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: n * I_{DD} × [component] for single bank modules (n: number of components per module bank)2 * n * I_{DD} × [component] for single two bank modules (n: number of components per module bank)

TABLE 13
I_{DD} Specification for HYS72D[128/64/32]3xxx[G/H]BR–7–C

Product Type	HYS72D32300GBR-7-C HYS72D32300HBR-7-C		HYS72D64300GBR-7-C HYS72D64300HBR-7-C		HYS72D128320GBR-7-C HYS72D128320HBR-7-C		Unit	Note/ Test Conditions[1) 2)]
Organization	256 MB		512 MB		1 GB			
	×72		×72		×72			
	1 Rank		1 Rank		2 Ranks			
	–7		–7		–7			
Symbol	Typ.	Max.	Typ.	Max.	Typ.	Max.		
I_{DD0}	860	1040	1510	1830	2410	2870	mA	3)
I_{DD1}	1100	1250	1890	2120	2790	3170	mA	3)4)
I_{DD2P}	330	370	560	610	1010	1080	mA	5)
I_{DD2F}	670	760	1050	1180	1810	2010	mA	5)
I_{DD2Q}	440	520	770	910	1440	1690	mA	5)
I_{DD3P}	380	450	660	570	1230	1400	mA	5)
I_{DD3N}	740	870	1200	1390	2100	2440	mA	5)
I_{DD4R}	1060	1200	1800	2030	2700	3080	mA	3)4)
I_{DD4W}	1100	1250	1890	2120	2790	3170	mA	3)
I_{DD5}	1210	1600	2310	3060	3210	4110	mA	3)
I_{DD6}	300	350	520	580	940	1030	mA	5)
I_{DD7}	1780	2100	3240	3830	4140	4880	mA	3)4)

1) Test condition for maximum values: V_{DD} = 2.7 V, T_A = 10 °C
2) Module I_{DD} is calculated on the basis of component I_{DD} and includes Register and PLL
3) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: n * I_{DD} × [component] for single bank modules (n: number of components per module bank)n * I_{DD} × [component] + n * I_{DD3N} [component] for two bank modules (n: number of components per module bank)
4) DQ I/O (I_{DDQ}) currents are not included into calculations: module *I*DD values will be measured differently depending on load conditions
5) The module I_{DD} values are calculated from the component I_{DD} datasheet values are: n * I_{DD} × [component] for single bank modules (n: number of components per module bank)2 * n * I_{DD} × [component] for single two bank modules (n: number of components per module bank)

3.4 AC Characteristics

This chapter describes the AC characteristics.

TABLE 14
AC Timing - Absolute Specifications for PC3200 and PC2700

Parameter	Symbol	–5		–6		Unit	Note/ Test Condition [1]
		DDR400B		DDR333			
		Min.	Max.	Min.	Max.		
DQ output access time from CK/$\overline{CK}$	t_{AC}	–0.5	+0.5	–0.7	+0.7	ns	2)3)4)5)
CK high-level width	t_{CH}	0.45	0.55	0.45	0.55	t_{CK}	2)3)4)5)
Clock cycle time	t_{CK}	5	8	6	12	ns	CL = 3.0 2)3)4)5)
		6	12	6	12	ns	CL = 2.5 2)3)4)5)
		7.5	12	7.5	12	ns	CL = 2.0 2)3)4)5)
CK low-level width	t_{CL}	0.45	0.55	0.45	0.55	t_{CK}	2)3)4)5)
Auto precharge write recovery + precharge time	t_{DAL}	(tWR/tCK)+(tRP/tCK)				t_{CK}	2)3)4)5)6)
DQ and DM input hold time	t_{DH}	0.4	—	0.45	—	ns	2)3)4)5)
DQ and DM input pulse width (each input)	t_{DIPW}	1.75	—	1.75	—	ns	2)3)4)5)6)
DQS output access time from CK/$\overline{CK}$	t_{DQSCK}	–0.6	+0.6	–0.6	+0.6	ns	2)3)4)5)
DQS input low (high) pulse width (write cycle)	$t_{DQSL,H}$	0.35	—	0.35	—	t_{CK}	2)3)4)5)
DQS-DQ skew (DQS and associated DQ signals)	t_{DQSQ}	—	+0.40	—	+0.40	ns	TFBGA 2)3)4)5)
Write command to 1st DQS latching transition	t_{DQSS}	0.72	1.25	0.75	1.25	t_{CK}	2)3)4)5)
DQ and DM input setup time	t_{DS}	0.4	—	0.45	—	ns	2)3)4)5)
DQS falling edge hold time from CK (write cycle)	t_{DSH}	0.2	—	0.2	—	t_{CK}	2)3)4)5)
DQS falling edge to CK setup time (write cycle)	t_{DSS}	0.2	—	0.2	—	t_{CK}	2)3)4)5)
Clock Half Period	t_{HP}	min. (t_{CL}, t_{CH})	—	min. (t_{CL}, t_{CH})	—	ns	2)3)4)5)
Data-out high-impedance time from CK/$\overline{CK}$	t_{HZ}	—	+0.7	–0.7	+0.7	ns	2)3)4)5)6)
Address and control input hold time	t_{IH}	0.6	—	0.75	—	ns	fast slew rate 3)4)5)6)7)
		0.7	—	0.8	—	ns	slow slew rate 3)4)5)6)7)
Control and Addr. input pulse width (each input)	t_{IPW}	2.2	—	2.2	—	ns	2)3)4)5)8)

Parameter	Symbol	–5		–6		Unit	Note/ Test Condition [1]
		DDR400B		DDR333			
		Min.	Max.	Min.	Max.		
Address and control input setup time	t_{IS}	0.6	—	0.75	—	ns	fast slew rate 3)4)5)6)7)
		0.7	—	0.8	—	ns	slow slew rate 3)4)5)6)7)
Data-out low-impedance time from CK/$\overline{CK}$	t_{LZ}	–0.7	+0.7	–0.7	+0.7	ns	2)3)4)5)6)
Mode register set command cycle time	t_{MRD}	2	—	2	—	t_{CK}	2)3)4)5)
DQ/DQS output hold time	t_{QH}	t_{HP} –t_{QHS}	—	t_{HP} –t_{QHS}	—	ns	2)3)4)5)
Data hold skew factor	t_{QHS}	—	+0.50	—	+0.50	ns	TFBGA 2)3)4)5)
Active to Autoprecharge delay	t_{RAP}	t_{RCD}	—	t_{RCD}	—	ns	2)3)4)5)
Active to Precharge command	t_{RAS}	40	70E+3	42	70E+3	ns	2)3)4)5)
Active to Active/Auto-refresh command period	t_{RC}	55	—	60	—	ns	2)3)4)5)
Active to Read or Write delay	t_{RCD}	15	—	18	—	ns	2)3)4)5)
Average Periodic Refresh Interval	t_{REFI}	—	7.8	—	7.8	µs	2)3)4)5)9)
Auto-refresh to Active/Auto-refresh command period	t_{RFC}	65	—	72	—	ns	2)3)4)5)
Precharge command period	t_{RP}	15	—	18	—	ns	2)3)4)5)
Read preamble	t_{RPRE}	0.9	1.1	0.9	1.1	t_{CK}	2)3)4)5)
Read postamble	t_{RPST}	0.40	0.60	0.40	0.60	t_{CK}	2)3)4)5)
Active bank A to Active bank B command	t_{RRD}	10	—	12	—	ns	2)3)4)5)
Write preamble	t_{WPRE}	0.25	—	0.25	—	t_{CK}	2)3)4)5)
Write preamble setup time	t_{WPRES}	0	—	0	—	ns	2)3)4)5)8)
Write postamble	t_{WPST}	0.40	0.60	0.40	0.60	t_{CK}	2)3)4)5)8)
Write recovery time	t_{WR}	15	—	15	—	ns	2)3)4)5)
Internal write to read command delay	t_{WTR}	2	—	1	—	t_{CK}	2)3)4)5)
Exit self-refresh to non-read command	t_{XSNR}	75	—	75	—	ns	2)3)4)5)
Exit self-refresh to read command	t_{XSRD}	200	—	200	—	t_{CK}	2)3)4)5)

1) 0 °C ≤ T_A ≤ 70 °C; V_{DDQ} = 2.5 V ± 0.2 V, V_{DD} = +2.5 V ± 0.2 V (DDR333); V_{DDQ} = 2.6 V ± 0.1 V, V_{DD} = +2.6 V ± 0.1 V (DDR400)
2) Input slew rate ≥ 1 V/ns for DDR400, DDR333
3) The CK/$\overline{CK}$ input reference level (for timing reference to CK/$\overline{CK}$) is the point at which CK and $\overline{CK}$ cross: the input reference level for signals other than CK/$\overline{CK}$, is V_{REF}. CK/$\overline{CK}$ slew rate are ≥ 1.0 V/ns.
4) Inputs are not recognized as valid until V_{REF} stabilizes.
5) The Output timing reference level, as measured at the timing reference point indicated in AC Characteristics (note 3) is V_{TT}.
6) For each of the terms, if not already an integer, round to the next highest integer. t_{CK} is equal to the actual system clock cycle time.
7) Fast slew rate ≥ 1.0 V/ns , slow slew rate ≥ 0.5 V/ns and < 1 V/ns for command/address and CK & $\overline{CK}$ slew rate > 1.0 V/ns, measured between $V_{IH(ac)}$ and $V_{IL(ac)}$.
8) These parameters guarantee device timing, but they are not necessarily tested on each device.
9) A maximum of eight Autorefresh commands can be posted to any given DDR SDRAM device.

TABLE 15
AC Timing - Absolute Specifications for PC2700

Parameter	Symbol	–7		Unit	Note/Test Condition [1]
		DDR266A			
		Min.	Max.		
DQ output access time from CK/$\overline{CK}$	t_{AC}	–0.75	+0.75	ns	2)3)4)5)
CK high-level width	t_{CH}	0.45	0.55	t_{CK}	2)3)4)5)
Clock cycle time	t_{CK}	7.5	12	ns	CL = 2.5 2)3)4)5)
		7.5	12	ns	CL = 2.0 2)3)4)5)
CK low-level width	t_{CL}	0.45	0.55	t_{CK}	2)3)4)5)
Auto precharge write recovery + precharge time	t_{DAL}	$(t_{WR}/t_{CK})+(t_{RP}/t_{CK})$	—	t_{CK}	2)3)4)5)6)
DQ and DM input hold time	t_{DH}	0.5	—	ns	2)3)4)5)
DQ and DM input pulse width (each input)	t_{DIPW}	1.75	—	ns	2)3)4)5)
DQS output access time from CK/$\overline{CK}$	t_{DQSCK}	–0.75	+0.75	ns	2)3)4)5)
DQS input low (high) pulse width (write cycle)	$t_{DQSL,H}$	0.35	—	t_{CK}	2)3)4)5)
DQS-DQ skew (DQS and associated DQ signals)	t_{DQSQ}	—	+0.5	ns	FBGA 2)3)4)5)
Write command to 1st DQS latching transition	t_{DQSS}	0.75	1.25	t_{CK}	2)3)4)5)
DQ and DM input setup time	t_{DS}	0.5	—	ns	2)3)4)5)
DQS falling edge hold time from CK (write cycle)	t_{DSH}	0.2	—	t_{CK}	2)3)4)5)
DQS falling edge to CK setup time (write cycle)	t_{DSS}	0.2	—	t_{CK}	2)3)4)5)
Clock Half Period	t_{HP}	min. (t_{CL}, t_{CH})	—	ns	2)3)4)5)
Data-out high-impedance time from CK/$\overline{CK}$	t_{HZ}	–0.75	+0.75	ns	2)3)4)5)6)
Address and control input hold time	t_{IH}	0.9	—	ns	fast slew rate 3)4)5)6)7)
		1.0	—	ns	slow slew rate 3)4)5)6)8)
Control and Addr. input pulse width (each input)	t_{IPW}	2.2	—	ns	2)3)4)5)8)
Address and control input setup time	t_{IS}	0.9	—	ns	fast slew rate 3)4)5)6)8)
		1.0	—	ns	slow slew rate 3)4)5)6)8)
Data-out low-impedance time from CK/$\overline{CK}$	t_{LZ}	–0.75	+0.75	ns	2)3)4)5)6)
Mode register set command cycle time	t_{MRD}	2	—	t_{CK}	2)3)4)5)
DQ/DQS output hold time	t_{QH}	$t_{HP} - t_{QHS}$		ns	2)3)4)5)
Data hold skew factor	t_{QHS}	—	0.75	ns	FBGA 2)3)4)5)
Active to Read w/AP delay	t_{RAP}	t_{RCD} or t_{RASmin}	—	ns	2)3)4)5)
Active to Precharge command	t_{RAS}	45	120E+3	ns	2)3)4)5)
Active to Active/Auto-refresh command period	t_{RC}	65	—	ns	2)3)4)5)
Active to Read or Write delay	t_{RCD}	20	—	ns	2)3)4)5)
Average Periodic Refresh Interval	t_{REFI}	7.8	—	µs	2)3)4)5)8)
Auto-refresh to Active/Auto-refresh command period	t_{RFC}	75	—	ns	2)3)4)5)

Parameter	Symbol	–7		Unit	Note/Test Condition [1]
		DDR266A			
		Min.	Max.		
Precharge command period	t_{RP}	20	—	ns	2)3)4)5)
Read preamble	t_{RPRE}	0.9	1.1	t_{CK}	2)3)4)5)
Read postamble	t_{RPST}	0.4	0.6	t_{CK}	2)3)4)5)
Active bank A to Active bank B command	t_{RRD}	15	—	ns	2)3)4)5)
Write preamble	t_{WPRE}	0.25	—	t_{CK}	2)3)4)5)
Write preamble setup time	t_{WPRES}	0	—	ns	2)3)4)5)9)
Write postamble	t_{WPST}	0.4	—	t_{CK}	2)3)4)5)10)
Write recovery time	t_{WR}	15	—	ns	2)3)4)5)
Internal write to read command delay	t_{WTR}	1	—	t_{CK}	2)3)4)5)
Exit self-refresh to non-read command	t_{XSNR}	75	—	ns	2)3)4)5)11)
Exit self-refresh to read command	t_{XSRD}	200	—	t_{CK}	2)3)4)5)

1) V_{DDQ} = 2.5 V ± 0.2 V, V_{DD} = +2.5 V ± 0.2 V ; 0 °C ≤ T_A ≤ 70 °C
2) Input slew rate ≥ 1 V/ns
3) The CK/$\overline{CK}$ input reference level (for timing reference to CK/$\overline{CK}$) is the point at which CK and $\overline{CK}$ cross: the input reference level for signals other than CK/$\overline{CK}$, is V_{REF}. CK/$\overline{CK}$ slew rate are ≥ 1.0 V/ns.
4) Inputs are not recognized as valid until stabilizes.
5) The Output timing reference level, as measured at the timing reference point indicated in AC Characteristics (note 3) is V_{TT}.
6) t_{HZ} and t_{LZ} transitions occur in the same access time windows as valid data transitions. These parameters are not referred to a specific voltage level, but specify when the device is no longer driving (HZ), or begins driving (LZ).
7) Fast slew rate ≥ 1.0 V/ns , slow slew rate ≥ 0.5 V/ns and < 1 V/ns for command/address and CK & $\overline{CK}$ slew rate > 1.0 V/ns, measured between $V_{IH(ac)}$ and $V_{IL(ac)}$.
8) A maximum of eight Autorefresh commands can be posted to any given DDR SDRAM device.
9) The specific requirement is that DQS be valid (HIGH, LOW, or some point on a valid transition) on or before this CK edge. A valid transition is defined as monotonic and meeting the input slew rate specifications of the device. When no writes were previously in progress on the bus, DQS will be transitioning from Hi-Z to logic LOW. If a previous write was in progress, DQS could be HIGH, LOW, or transitioning from HIGH to LOW at this time, depending on t_{DQSS}.
10) The maximum limit for this parameter is not a device limit. The device operates with a greater value for this parameter, but system performance (bus turnaround) degrades accordingly.
11) In all circumstances, t_{XSNR} can be satisfied using $t_{XSNR} = t_{RFC,min} + 1 \times t_{CK}$

4 SPD Codes

This chapter lists all hexadecimal byte values stored in the EEPROM of the products described in this data sheet. SPD stands for serial presence detect. All values with XX in the table are module specific bytes which are defined during production.

List of SPD Code Tables

- **Table 16 “HYS72D[32/64]3x0GBR-5-C” on Page 21**
- **Table 17 “HYS72D[32/64/128]3x0GBR-6-C” on Page 25**
- **Table 18 “HYS72D[32/64/128]3x0GBR-7-C” on Page 29**
- **Table 19 “HYS72D[32/64]3x0HBR-5-C” on Page 33**
- **Table 20 “HYS72D[32/64/128]3x0HBR-6-C” on Page 37**
- **Table 21 “HYS72D[32/64/128]3x0HBR-7-C” on Page 41**

TABLE 16
HYS72D[32/64]3x0GBR-5-C

Product Type		HYS72D32300GBR–5–C	HYS72D64300GBR–5–C	HYS72D64320GBR–5–C
Organization		256MB	512MB	512MB
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)
Label Code		PC3200R–30331	PC3200R–30331	PC3200R–30331
JEDEC SPD Revision		Rev. 1.0	Rev. 1.0	Rev. 1.0
Byte#	Description	HEX	HEX	HEX
0	Programmed SPD Bytes in E2PROM	80	80	80
1	Total number of Bytes in E2PROM	08	08	08
2	Memory Type (DDR = 07h)	07	07	07
3	Number of Row Addresses	0D	0D	0D
4	Number of Column Addresses	0A	0B	0A
5	Number of DIMM Ranks	01	01	02
6	Data Width (LSB)	48	48	48
7	Data Width (MSB)	00	00	00
8	Interface Voltage Levels	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	50	50	50
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	50	50	50

Product Type		**HYS72D32300GBR–5–C**	**HYS72D64300GBR–5–C**	**HYS72D64320GBR–5–C**
Organization		**256MB**	**512MB**	**512MB**
		×72	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**
Label Code		**PC3200R–30331**	**PC3200R–30331**	**PC3200R–30331**
JEDEC SPD Revision		**Rev. 1.0**	**Rev. 1.0**	**Rev. 1.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**
11	Error Correction Support	02	02	02
12	Refresh Rate	82	82	82
13	Primary SDRAM Width	08	04	08
14	Error Checking SDRAM Width	08	04	08
15	t_{CCD} [cycles]	01	01	01
16	Burst Length Supported	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04
18	CAS Latency	1C	1C	1C
19	CS Latency	01	01	01
20	Write Latency	02	02	02
21	DIMM Attributes	26	26	26
22	Component Attributes	C1	C1	C1
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	60	60	60
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	50	50	50
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	75	75	75
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	50	50	50
27	t_{RPmin} [ns]	3C	3C	3C
28	t_{RRDmin} [ns]	28	28	28
29	t_{RCDmin} [ns]	3C	3C	3C
30	t_{RASmin} [ns]	28	28	28
31	Module Density per Rank	40	80	40
32	$t_{AS,}$ t_{CS} [ns]	60	60	60
33	$t_{AH,}$ t_{CH} [ns]	60	60	60
34	t_{DS} [ns]	40	40	40
35	t_{DH} [ns]	40	40	40
36 - 40	Not used	00	00	00
41	t_{RCmin} [ns]	37	37	37

Product Type		**HYS72D32300GBR–5–C**	**HYS72D64300GBR–5–C**	**HYS72D64320GBR–5–C**
Organization		**256MB**	**512MB**	**512MB**
		×72	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**
Label Code		**PC3200R–30331**	**PC3200R–30331**	**PC3200R–30331**
JEDEC SPD Revision		**Rev. 1.0**	**Rev. 1.0**	**Rev. 1.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**
42	t_{RFCmin} [ns]	41	41	41
43	t_{CKmax} [ns]	28	28	28
44	$t_{DQSQmax}$ [ns]	28	28	28
45	t_{QHSmax} [ns]	50	50	50
46	not used	00	00	00
47	DIMM PCB Height	01	01	01
48 - 61	Not used	00	00	00
62	SPD Revision	10	10	10
63	Checksum of Byte 0-62	26	5F	27
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F
65	Manufacturer’s JEDEC ID Code (2)	7F	7F	7F
66	Manufacturer’s JEDEC ID Code (3)	7F	7F	7F
67	Manufacturer’s JEDEC ID Code (4)	7F	7F	7F
68	Manufacturer’s JEDEC ID Code (5)	7F	7F	7F
69	Manufacturer’s JEDEC ID Code (6)	51	51	51
70	Manufacturer’s JEDEC ID Code (7)	00	00	00
71	Manufacturer’s JEDEC ID Code (8)	00	00	00
72	Module Manufacturer Location	xx	xx	xx
73	Part Number, Char 1	37	37	37
74	Part Number, Char 2	32	32	32
75	Part Number, Char 3	44	44	44
76	Part Number, Char 4	33	36	36
77	Part Number, Char 5	32	34	34
78	Part Number, Char 6	33	33	33
79	Part Number, Char 7	30	30	32
80	Part Number, Char 8	30	30	30
81	Part Number, Char 9	47	47	47

Product Type		HYS72D32300GBR–5–C	HYS72D64300GBR–5–C	HYS72D64320GBR–5–C
Organization		256MB	512MB	512MB
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)
Label Code		PC3200R–30331	PC3200R–30331	PC3200R–30331
JEDEC SPD Revision		Rev. 1.0	Rev. 1.0	Rev. 1.0
Byte#	Description	HEX	HEX	HEX
82	Part Number, Char 10	42	42	42
83	Part Number, Char 11	52	52	52
84	Part Number, Char 12	35	35	35
85	Part Number, Char 13	43	43	43
86	Part Number, Char 14	20	20	20
87	Part Number, Char 15	20	20	20
88	Part Number, Char 16	20	20	20
89	Part Number, Char 17	20	20	20
90	Part Number, Char 18	20	20	20
91	Module Revision Code	1x	1x	1x
92	Test Program Revision Code	xx	xx	xx
93	Module Manufacturing Date Year	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx
95 - 98	Module Serial Number	xx	xx	xx
99 - 127	Not used	00	00	00

TABLE 17
HYS72D[32/64/128]3x0GBR-6-C

Product Type		HYS72D32300GBR–6–C	HYS72D64300GBR–6–C	HYS72D64320GBR–6–C	HYS72D128320GBR–6–C
Organization		256MB	512MB	512MB	1 GByte
		×72	×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)	2 Ranks (×4)
Label Code		PC2700R–25330	PC2700R–25330	PC2700R–25330	PC2700R–25330
JEDEC SPD Revision		Rev. 0.0	Rev. 0.0	Rev. 0.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX	HEX
0	Programmed SPD Bytes in E2PROM	80	80	80	80
1	Total number of Bytes in E2PROM	08	08	08	08
2	Memory Type (DDR = 07h)	07	07	07	07
3	Number of Row Addresses	0D	0D	0D	0D
4	Number of Column Addresses	0A	0B	0A	0B
5	Number of DIMM Ranks	01	01	02	02
6	Data Width (LSB)	48	48	48	48
7	Data Width (MSB)	00	00	00	00
8	Interface Voltage Levels	04	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	60	60	60	60
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	70	70	70	70
11	Error Correction Support	02	02	02	02
12	Refresh Rate	82	82	82	82
13	Primary SDRAM Width	08	04	08	04
14	Error Checking SDRAM Width	08	04	08	04
15	t_{CCD} [cycles]	01	01	01	01
16	Burst Length Supported	0E	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04	04
18	CAS Latency	0C	0C	0C	0C
19	CS Latency	01	01	01	01
20	Write Latency	02	02	02	02
21	DIMM Attributes	26	26	26	26
22	Component Attributes	C1	C1	C1	C1

Product Type		HYS72D32300GBR–6–C	HYS72D64300GBR–6–C	HYS72D64320GBR–6–C	HYS72D128320GBR–6–C
Organization		256MB	512MB	512MB	1 GByte
		×72	×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)	2 Ranks (×4)
Label Code		PC2700R–25330	PC2700R–25330	PC2700R–25330	PC2700R–25330
JEDEC SPD Revision		Rev. 0.0	Rev. 0.0	Rev. 0.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX	HEX
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	75	75	75	75
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	70	70	70	70
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	00	00	00	00
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	00	00	00	00
27	t_{RPmin} [ns]	48	48	48	48
28	t_{RRDmin} [ns]	30	30	30	30
29	t_{RCDmin} [ns]	48	48	48	48
30	t_{RASmin} [ns]	2A	2A	2A	2A
31	Module Density per Rank	40	80	40	80
32	$t_{AS,}$ t_{CS} [ns]	75	75	75	75
33	$t_{AH,}$ t_{CH} [ns]	75	75	75	75
34	t_{DS} [ns]	45	45	45	45
35	t_{DH} [ns]	45	45	45	45
36 - 40	Not used	00	00	00	00
41	t_{RCmin} [ns]	3C	3C	3C	3C
42	t_{RFCmin} [ns]	48	48	48	48
43	t_{CKmax} [ns]	30	30	30	30
44	$t_{DQSQmax}$ [ns]	28	28	28	28
45	t_{QHSmax} [ns]	50	50	50	50
46	not used	00	00	00	00
47	DIMM PCB Height	00	00	00	00
48 - 61	Not used	00	00	00	00
62	SPD Revision	00	00	00	00
63	Checksum of Byte 0-62	0F	48	10	49
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F	7F

Product Type		**HYS72D32300GBR–6–C**	**HYS72D64300GBR–6–C**	**HYS72D64320GBR–6–C**	**HYS72D128320GBR–6–C**
Organization		**256MB**	**512MB**	**512MB**	**1 GByte**
		×72	**×72**	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**	**2 Ranks (×4)**
Label Code		**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**
JEDEC SPD Revision		**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**	**HEX**
65	Manufacturer's JEDEC ID Code (2)	7F	7F	7F	7F
66	Manufacturer's JEDEC ID Code (3)	7F	7F	7F	7F
67	Manufacturer's JEDEC ID Code (4)	7F	7F	7F	7F
68	Manufacturer's JEDEC ID Code (5)	7F	7F	7F	7F
69	Manufacturer's JEDEC ID Code (6)	51	51	51	51
70	Manufacturer's JEDEC ID Code (7)	00	00	00	00
71	Manufacturer's JEDEC ID Code (8)	00	00	00	00
72	Module Manufacturer Location	xx	xx	xx	xx
73	Part Number, Char 1	37	37	37	37
74	Part Number, Char 2	32	32	32	32
75	Part Number, Char 3	44	44	44	44
76	Part Number, Char 4	33	36	36	31
77	Part Number, Char 5	32	34	34	32
78	Part Number, Char 6	33	33	33	38
79	Part Number, Char 7	30	30	32	33
80	Part Number, Char 8	30	30	30	32
81	Part Number, Char 9	47	47	47	30
82	Part Number, Char 10	42	42	42	47
83	Part Number, Char 11	52	52	52	42
84	Part Number, Char 12	36	36	36	52
85	Part Number, Char 13	43	43	43	36
86	Part Number, Char 14	20	20	20	43
87	Part Number, Char 15	20	20	20	20
88	Part Number, Char 16	20	20	20	20
89	Part Number, Char 17	20	20	20	20

Product Type		HYS72D32300GBR–6–C	HYS72D64300GBR–6–C	HYS72D64320GBR–6–C	HYS72D128320GBR–6–C
Organization		256MB	512MB	512MB	1 GByte
		×72	×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)	2 Ranks (×4)
Label Code		PC2700R–25330	PC2700R–25330	PC2700R–25330	PC2700R–25330
JEDEC SPD Revision		Rev. 0.0	Rev. 0.0	Rev. 0.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX	HEX
90	Part Number, Char 18	20	20	20	20
91	Module Revision Code	1x	1x	1x	1x
92	Test Program Revision Code	xx	xx	xx	xx
93	Module Manufacturing Date Year	xx	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx	xx
95 - 98	Module Serial Number	xx	xx	xx	xx
99 - 127	Not used	00	00	00	00

TABLE 18
HYS72D[32/64/128]3x0GBR-7-C

Product Type		HYS72D32300GBR–7–C	HYS72D64300GBR–7–C	HYS72D128320GBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
0	Programmed SPD Bytes in E2PROM	80	80	80
1	Total number of Bytes in E2PROM	08	08	08
2	Memory Type (DDR = 07h)	07	07	07
3	Number of Row Addresses	0D	0D	0D
4	Number of Column Addresses	0A	0B	0B
5	Number of DIMM Ranks	01	01	02
6	Data Width (LSB)	48	48	48
7	Data Width (MSB)	00	00	00
8	Interface Voltage Levels	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	70	70	70
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	75	75	75
11	Error Correction Support	02	02	02
12	Refresh Rate	82	82	82
13	Primary SDRAM Width	08	04	04
14	Error Checking SDRAM Width	08	04	04
15	t_{CCD} [cycles]	01	01	01
16	Burst Length Supported	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04
18	CAS Latency	0C	0C	0C
19	CS Latency	01	01	01
20	Write Latency	02	02	02
21	DIMM Attributes	26	26	26
22	Component Attributes	C1	C1	C1
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	75	75	75

Product Type		HYS72D32300GBR–7–C	HYS72D64300GBR–7–C	HYS72D128320GBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	75	75	75
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	00	00	00
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	00	00	00
27	t_{RPmin} [ns]	50	50	50
28	t_{RRDmin} [ns]	3C	3C	3C
29	t_{RCDmin} [ns]	50	50	50
30	t_{RASmin} [ns]	2D	2D	2D
31	Module Density per Rank	40	80	80
32	$t_{AS,}$ t_{CS} [ns]	90	90	90
33	$t_{AH,}$ t_{CH} [ns]	90	90	90
34	t_{DS} [ns]	50	50	50
35	t_{DH} [ns]	50	50	50
36 - 40	Not used	00	00	00
41	t_{RCmin} [ns]	41	41	41
42	t_{RFCmin} [ns]	4B	4B	4B
43	t_{CKmax} [ns]	30	30	30
44	$t_{DQSQmax}$ [ns]	32	32	32
45	t_{QHSmax} [ns]	75	75	75
46	not used	00	00	00
47	DIMM PCB Height	00	00	00
48 - 61	Not used	00	00	00
62	SPD Revision	00	10	00
63	Checksum of Byte 0-62	CB	14	05
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F
65	Manufacturer’s JEDEC ID Code (2)	7F	7F	7F
66	Manufacturer’s JEDEC ID Code (3)	7F	7F	7F

Product Type		HYS72D32300GBR–7–C	HYS72D64300GBR–7–C	HYS72D128320GBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
67	Manufacturer's JEDEC ID Code (4)	7F	7F	7F
68	Manufacturer's JEDEC ID Code (5)	7F	7F	7F
69	Manufacturer's JEDEC ID Code (6)	51	51	51
70	Manufacturer's JEDEC ID Code (7)	00	00	00
71	Manufacturer's JEDEC ID Code (8)	00	00	00
72	Module Manufacturer Location	xx	xx	xx
73	Part Number, Char 1	37	37	37
74	Part Number, Char 2	32	32	32
75	Part Number, Char 3	44	44	44
76	Part Number, Char 4	33	36	31
77	Part Number, Char 5	32	34	32
78	Part Number, Char 6	33	33	38
79	Part Number, Char 7	30	30	33
80	Part Number, Char 8	30	30	32
81	Part Number, Char 9	47	47	30
82	Part Number, Char 10	42	42	47
83	Part Number, Char 11	52	52	42
84	Part Number, Char 12	37	37	52
85	Part Number, Char 13	43	43	37
86	Part Number, Char 14	20	20	43
87	Part Number, Char 15	20	20	20
88	Part Number, Char 16	20	20	20
89	Part Number, Char 17	20	20	20
90	Part Number, Char 18	20	20	20
91	Module Revision Code	1x	0x	1x
92	Test Program Revision Code	xx	xx	xx

Product Type		**HYS72D32300GBR–7–C**	**HYS72D64300GBR–7–C**	**HYS72D128320GBR–7–C**
Organization		**256MB**	**512MB**	**1 GByte**
		×72	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×4)**
Label Code		**PC2100R–20330**	**PC2100R–20331**	**PC2100R–20330**
JEDEC SPD Revision		**Rev. 0.0**	**Rev. 1.0**	**Rev. 0.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**
93	Module Manufacturing Date Year	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx
95 - 98	Module Serial Number	xx	xx	xx
99 - 127	Not used	00	00	00

TABLE 19
HYS72D[32/64]3x0HBR-5-C

Product Type		HYS72D32300HBR–5–C	HYS72D64300HBR–5–C	HYS72D64320HBR–5–C
Organization		256MB	512MB	512MB
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)
Label Code		PC3200R–30331	PC3200R–30331	PC3200R–30331
JEDEC SPD Revision		Rev. 1.0	Rev. 1.0	Rev. 1.0
Byte#	Description	HEX	HEX	HEX
0	Programmed SPD Bytes in E2PROM	80	80	80
1	Total number of Bytes in E2PROM	08	08	08
2	Memory Type (DDR = 07h)	07	07	07
3	Number of Row Addresses	0D	0D	0D
4	Number of Column Addresses	0A	0B	0A
5	Number of DIMM Ranks	01	01	02
6	Data Width (LSB)	48	48	48
7	Data Width (MSB)	00	00	00
8	Interface Voltage Levels	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	50	50	50
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	50	50	50
11	Error Correction Support	02	02	02
12	Refresh Rate	82	82	82
13	Primary SDRAM Width	08	04	08
14	Error Checking SDRAM Width	08	04	08
15	t_{CCD} [cycles]	01	01	01
16	Burst Length Supported	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04
18	CAS Latency	1C	1C	1C
19	CS Latency	01	01	01
20	Write Latency	02	02	02
21	DIMM Attributes	26	26	26
22	Component Attributes	C1	C1	C1
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	60	60	60

Product Type		**HYS72D32300HBR–5–C**	**HYS72D64300HBR–5–C**	**HYS72D64320HBR–5–C**
Organization		**256MB**	**512MB**	**512MB**
		×72	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**
Label Code		**PC3200R–30331**	**PC3200R–30331**	**PC3200R–30331**
JEDEC SPD Revision		**Rev. 1.0**	**Rev. 1.0**	**Rev. 1.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	50	50	50
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	75	75	75
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	50	50	50
27	t_{RPmin} [ns]	3C	3C	3C
28	t_{RRDmin} [ns]	28	28	28
29	t_{RCDmin} [ns]	3C	3C	3C
30	t_{RASmin} [ns]	28	28	28
31	Module Density per Rank	40	80	40
32	$t_{AS,}$ t_{CS} [ns]	60	60	60
33	$t_{AH,}$ t_{CH} [ns]	60	60	60
34	t_{DS} [ns]	40	40	40
35	t_{DH} [ns]	40	40	40
36 - 40	Not used	00	00	00
41	t_{RCmin} [ns]	37	37	37
42	t_{RFCmin} [ns]	41	41	41
43	t_{CKmax} [ns]	28	28	28
44	$t_{DQSQmax}$ [ns]	28	28	28
45	t_{QHSmax} [ns]	50	50	50
46	not used	00	00	00
47	DIMM PCB Height	01	01	01
48 - 61	Not used	00	00	00
62	SPD Revision	10	10	10
63	Checksum of Byte 0-62	26	5F	27
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F
65	Manufacturer’s JEDEC ID Code (2)	7F	7F	7F
66	Manufacturer’s JEDEC ID Code (3)	7F	7F	7F
67	Manufacturer’s JEDEC ID Code (4)	7F	7F	7F

Product Type		HYS72D32300HBR–5–C	HYS72D64300HBR–5–C	HYS72D64320HBR–5–C
Organization		256MB	512MB	512MB
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)
Label Code		PC3200R–30331	PC3200R–30331	PC3200R–30331
JEDEC SPD Revision		Rev. 1.0	Rev. 1.0	Rev. 1.0
Byte#	Description	HEX	HEX	HEX
68	Manufacturer's JEDEC ID Code (5)	7F	7F	7F
69	Manufacturer's JEDEC ID Code (6)	51	51	51
70	Manufacturer's JEDEC ID Code (7)	00	00	00
71	Manufacturer's JEDEC ID Code (8)	00	00	00
72	Module Manufacturer Location	xx	xx	xx
73	Part Number, Char 1	37	37	37
74	Part Number, Char 2	32	32	32
75	Part Number, Char 3	44	44	44
76	Part Number, Char 4	33	36	36
77	Part Number, Char 5	32	34	34
78	Part Number, Char 6	33	33	33
79	Part Number, Char 7	30	30	32
80	Part Number, Char 8	30	30	30
81	Part Number, Char 9	48	48	48
82	Part Number, Char 10	42	42	42
83	Part Number, Char 11	52	52	52
84	Part Number, Char 12	35	35	35
85	Part Number, Char 13	43	43	43
86	Part Number, Char 14	20	20	20
87	Part Number, Char 15	20	20	20
88	Part Number, Char 16	20	20	20
89	Part Number, Char 17	20	20	20
90	Part Number, Char 18	20	20	20
91	Module Revision Code	1x	1x	1x
92	Test Program Revision Code	xx	xx	xx
93	Module Manufacturing Date Year	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx

Product Type		**HYS72D32300HBR–5–C**	**HYS72D64300HBR–5–C**	**HYS72D64320HBR–5–C**
Organization		**256MB**	**512MB**	**512MB**
		×72	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**
Label Code		**PC3200R–30331**	**PC3200R–30331**	**PC3200R–30331**
JEDEC SPD Revision		**Rev. 1.0**	**Rev. 1.0**	**Rev. 1.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**
95 - 98	Module Serial Number	xx	xx	xx
99 - 127	Not used	00	00	00

TABLE 20
HYS72D[32/64/128]3x0HBR-6-C

Product Type		**HYS72D32300HBR–6–C**	**HYS72D64300HBR–6–C**	**HYS72D64320HBR–6–C**	**HYS72D128320HBR–6–C**
Organization		**256MB**	**512MB**	**512MB**	**1 GByte**
		×72	**×72**	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**	**2 Ranks (×4)**
Label Code		**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**
JEDEC SPD Revision		**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**	**HEX**
0	Programmed SPD Bytes in E2PROM	80	80	80	80
1	Total number of Bytes in E2PROM	08	08	08	08
2	Memory Type (DDR = 07h)	07	07	07	07
3	Number of Row Addresses	0D	0D	0D	0D
4	Number of Column Addresses	0A	0B	0A	0B
5	Number of DIMM Ranks	01	01	02	02
6	Data Width (LSB)	48	48	48	48
7	Data Width (MSB)	00	00	00	00
8	Interface Voltage Levels	04	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	60	60	60	60
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	70	70	70	70
11	Error Correction Support	02	02	02	02
12	Refresh Rate	82	82	82	82
13	Primary SDRAM Width	08	04	08	04
14	Error Checking SDRAM Width	08	04	08	04
15	t_{CCD} [cycles]	01	01	01	01
16	Burst Length Supported	0E	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04	04
18	CAS Latency	0C	0C	0C	0C
19	CS Latency	01	01	01	01
20	Write Latency	02	02	02	02
21	DIMM Attributes	26	26	26	26
22	Component Attributes	C1	C1	C1	C1

Product Type		HYS72D32300HBR–6–C	HYS72D64300HBR–6–C	HYS72D64320HBR–6–C	HYS72D128320HBR–6–C
Organization		256MB	512MB	512MB	1 GByte
		×72	×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)	2 Ranks (×4)
Label Code		PC2700R–25330	PC2700R–25330	PC2700R–25330	PC2700R–25330
JEDEC SPD Revision		Rev. 0.0	Rev. 0.0	Rev. 0.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX	HEX
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	75	75	75	75
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	70	70	70	70
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	00	00	00	00
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	00	00	00	00
27	t_{RPmin} [ns]	48	48	48	48
28	t_{RRDmin} [ns]	30	30	30	30
29	t_{RCDmin} [ns]	48	48	48	48
30	t_{RASmin} [ns]	2A	2A	2A	2A
31	Module Density per Rank	40	80	40	80
32	$t_{AS,}$ t_{CS} [ns]	75	75	75	75
33	$t_{AH,}$ t_{CH} [ns]	75	75	75	75
34	t_{DS} [ns]	45	45	45	45
35	t_{DH} [ns]	45	45	45	45
36 - 40	Not used	00	00	00	00
41	t_{RCmin} [ns]	3C	3C	3C	3C
42	t_{RFCmin} [ns]	48	48	48	48
43	t_{CKmax} [ns]	30	30	30	30
44	$t_{DQSQmax}$ [ns]	28	28	28	28
45	t_{QHSmax} [ns]	50	50	50	50
46	not used	00	00	00	00
47	DIMM PCB Height	00	00	00	00
48 - 61	Not used	00	00	00	00
62	SPD Revision	00	00	00	00
63	Checksum of Byte 0-62	0F	48	10	49
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F	7F
65	Manufacturer’s JEDEC ID Code (2)	7F	7F	7F	7F

Product Type		HYS72D32300HBR–6–C	HYS72D64300HBR–6–C	HYS72D64320HBR–6–C	HYS72D128320HBR–6–C
Organization		256MB	512MB	512MB	1 GByte
		×72	×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×8)	2 Ranks (×4)
Label Code		PC2700R–25330	PC2700R–25330	PC2700R–25330	PC2700R–25330
JEDEC SPD Revision		Rev. 0.0	Rev. 0.0	Rev. 0.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX	HEX
66	Manufacturer's JEDEC ID Code (3)	7F	7F	7F	7F
67	Manufacturer's JEDEC ID Code (4)	7F	7F	7F	7F
68	Manufacturer's JEDEC ID Code (5)	7F	7F	7F	7F
69	Manufacturer's JEDEC ID Code (6)	51	51	51	51
70	Manufacturer's JEDEC ID Code (7)	00	00	00	00
71	Manufacturer's JEDEC ID Code (8)	00	00	00	00
72	Module Manufacturer Location	xx	xx	xx	xx
73	Part Number, Char 1	37	37	37	37
74	Part Number, Char 2	32	32	32	32
75	Part Number, Char 3	44	44	44	44
76	Part Number, Char 4	33	36	36	31
77	Part Number, Char 5	32	34	34	32
78	Part Number, Char 6	33	33	33	38
79	Part Number, Char 7	30	30	32	33
80	Part Number, Char 8	30	30	30	32
81	Part Number, Char 9	48	48	48	30
82	Part Number, Char 10	42	42	42	48
83	Part Number, Char 11	52	52	52	42
84	Part Number, Char 12	36	36	36	52
85	Part Number, Char 13	43	43	43	36
86	Part Number, Char 14	20	20	20	43
87	Part Number, Char 15	20	20	20	20
88	Part Number, Char 16	20	20	20	20
89	Part Number, Char 17	20	20	20	20
90	Part Number, Char 18	20	20	20	20
91	Module Revision Code	1x	1x	1x	1x

Product Type		**HYS72D32300HBR–6–C**	**HYS72D64300HBR–6–C**	**HYS72D64320HBR–6–C**	**HYS72D128320HBR–6–C**
Organization		**256MB**	**512MB**	**512MB**	**1 GByte**
		×72	**×72**	**×72**	**×72**
		1 Rank (×8)	**1 Rank (×4)**	**2 Ranks (×8)**	**2 Ranks (×4)**
Label Code		**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**	**PC2700R–25330**
JEDEC SPD Revision		**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**	**Rev. 0.0**
Byte#	**Description**	**HEX**	**HEX**	**HEX**	**HEX**
92	Test Program Revision Code	xx	xx	xx	xx
93	Module Manufacturing Date Year	xx	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx	xx
95 - 98	Module Serial Number	xx	xx	xx	xx
99 - 127	Not used	00	00	00	00

TABLE 21
HYS72D[32/64/128]3x0HBR-7-C

Product Type		HYS72D32300HBR–7–C	HYS72D64300HBR–7–C	HYS72D128320HBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
0	Programmed SPD Bytes in E2PROM	80	80	80
1	Total number of Bytes in E2PROM	08	08	08
2	Memory Type (DDR = 07h)	07	07	07
3	Number of Row Addresses	0D	0D	0D
4	Number of Column Addresses	0A	0B	0B
5	Number of DIMM Ranks	01	01	02
6	Data Width (LSB)	48	48	48
7	Data Width (MSB)	00	00	00
8	Interface Voltage Levels	04	04	04
9	t_{CK} @ CL_{max} (Byte 18) [ns]	70	70	70
10	t_{AC} SDRAM @ CL_{max} (Byte 18) [ns]	75	75	75
11	Error Correction Support	02	02	02
12	Refresh Rate	82	82	82
13	Primary SDRAM Width	08	04	04
14	Error Checking SDRAM Width	08	04	04
15	t_{CCD} [cycles]	01	01	01
16	Burst Length Supported	0E	0E	0E
17	Number of Banks on SDRAM Device	04	04	04
18	CAS Latency	0C	0C	0C
19	CS Latency	01	01	01
20	Write Latency	02	02	02
21	DIMM Attributes	26	26	26
22	Component Attributes	C1	C1	C1
23	t_{CK} @ CL_{max} -0.5 (Byte 18) [ns]	75	75	75

Product Type		HYS72D32300HBR–7–C	HYS72D64300HBR–7–C	HYS72D128320HBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
24	t_{AC} SDRAM @ CL_{max} -0.5 [ns]	75	75	75
25	t_{CK} @ CL_{max} -1 (Byte 18) [ns]	00	00	00
26	t_{AC} SDRAM @ CL_{max} -1 [ns]	00	00	00
27	t_{RPmin} [ns]	50	50	50
28	t_{RRDmin} [ns]	3C	3C	3C
29	t_{RCDmin} [ns]	50	50	50
30	t_{RASmin} [ns]	2D	2D	2D
31	Module Density per Rank	40	80	80
32	$t_{AS,}$ t_{CS} [ns]	90	90	90
33	$t_{AH,}$ t_{CH} [ns]	90	90	90
34	t_{DS} [ns]	50	50	50
35	t_{DH} [ns]	50	50	50
36 - 40	Not used	00	00	00
41	t_{RCmin} [ns]	41	41	41
42	t_{RFCmin} [ns]	4B	4B	4B
43	t_{CKmax} [ns]	30	30	30
44	$t_{DQSQmax}$ [ns]	32	32	32
45	t_{QHSmax} [ns]	75	75	75
46	not used	00	00	00
47	DIMM PCB Height	00	00	00
48 - 61	Not used	00	00	00
62	SPD Revision	00	10	00
63	Checksum of Byte 0-62	CB	14	05
64	Manufacturer’s JEDEC ID Code (1)	7F	7F	7F
65	Manufacturer’s JEDEC ID Code (2)	7F	7F	7F
66	Manufacturer’s JEDEC ID Code (3)	7F	7F	7F

Product Type		HYS72D32300HBR–7–C	HYS72D64300HBR–7–C	HYS72D128320HBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
67	Manufacturer's JEDEC ID Code (4)	7F	7F	7F
68	Manufacturer's JEDEC ID Code (5)	7F	7F	7F
69	Manufacturer's JEDEC ID Code (6)	51	51	51
70	Manufacturer's JEDEC ID Code (7)	00	00	00
71	Manufacturer's JEDEC ID Code (8)	00	00	00
72	Module Manufacturer Location	xx	xx	xx
73	Part Number, Char 1	37	37	37
74	Part Number, Char 2	32	32	32
75	Part Number, Char 3	44	44	44
76	Part Number, Char 4	33	36	31
77	Part Number, Char 5	32	34	32
78	Part Number, Char 6	33	33	38
79	Part Number, Char 7	30	30	33
80	Part Number, Char 8	30	30	32
81	Part Number, Char 9	48	48	30
82	Part Number, Char 10	42	42	48
83	Part Number, Char 11	52	52	42
84	Part Number, Char 12	37	37	52
85	Part Number, Char 13	43	43	37
86	Part Number, Char 14	20	20	43
87	Part Number, Char 15	20	20	20
88	Part Number, Char 16	20	20	20
89	Part Number, Char 17	20	20	20
90	Part Number, Char 18	20	20	20
91	Module Revision Code	1x	0x	1x
92	Test Program Revision Code	xx	xx	xx

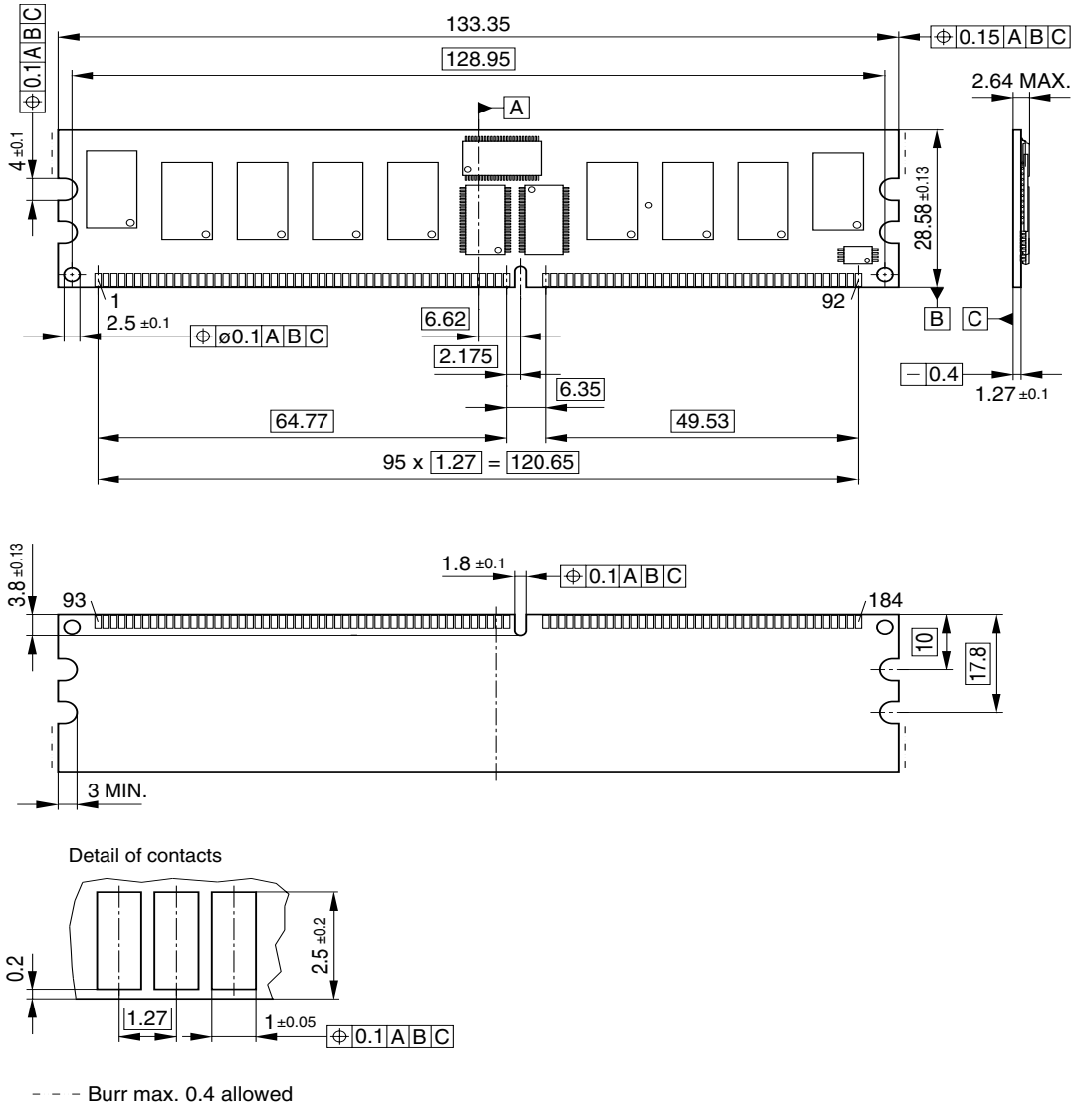
Product Type		HYS72D32300HBR–7–C	HYS72D64300HBR–7–C	HYS72D128320HBR–7–C
Organization		256MB	512MB	1 GByte
		×72	×72	×72
		1 Rank (×8)	1 Rank (×4)	2 Ranks (×4)
Label Code		PC2100R–20330	PC2100R–20331	PC2100R–20330
JEDEC SPD Revision		Rev. 0.0	Rev. 1.0	Rev. 0.0
Byte#	Description	HEX	HEX	HEX
93	Module Manufacturing Date Year	xx	xx	xx
94	Module Manufacturing Date Week	xx	xx	xx
95 - 98	Module Serial Number	xx	xx	xx
99 - 127	Not used	00	00	00

5 Package Outlines

This chapter contains the package outlines of the products.

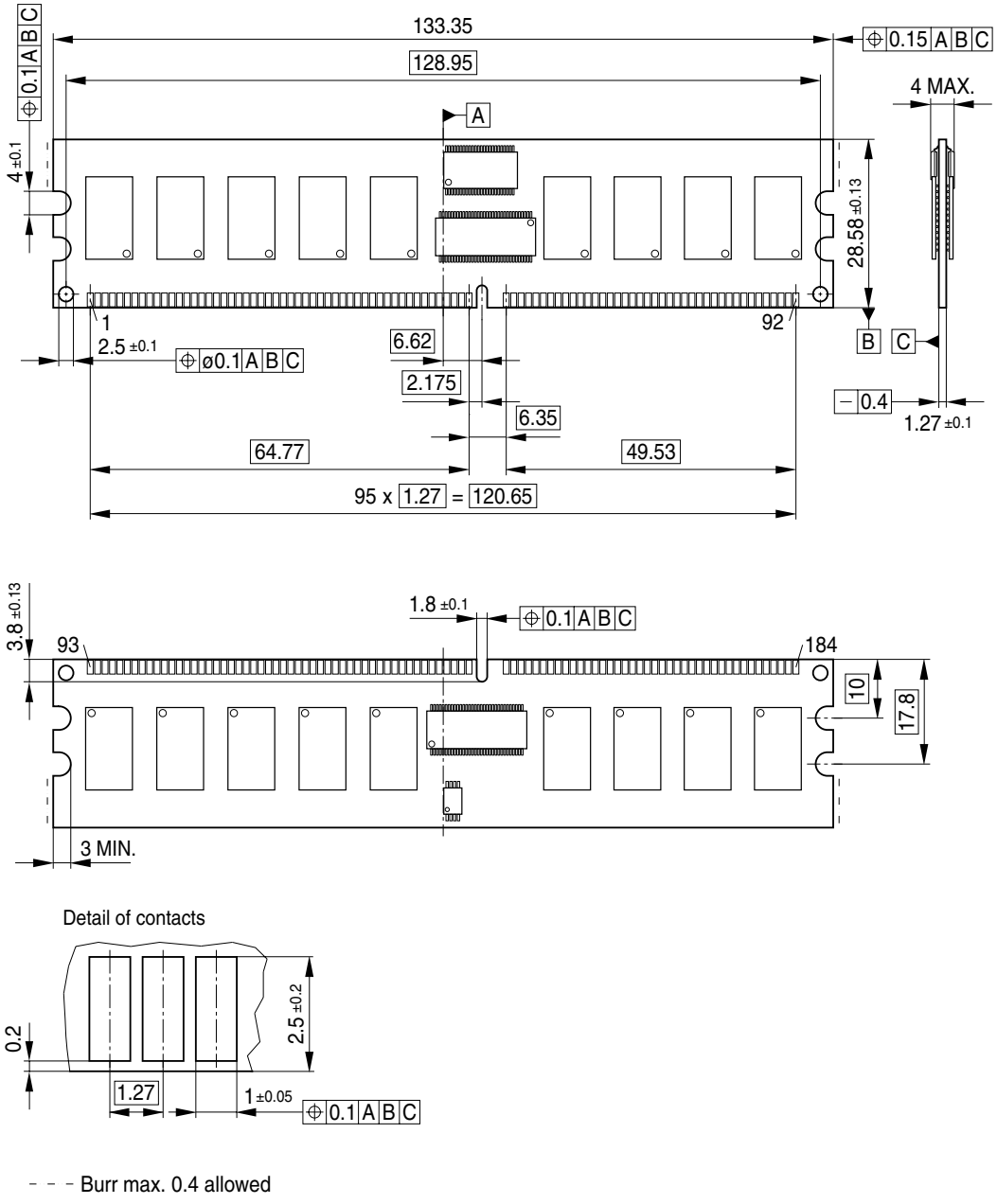
5.1 Raw Card A

FIGURE 2
Package Outlines – Raw Card A HYS72D32300[G/H]BR–[5/6/7]–C (1 Rank × 8)



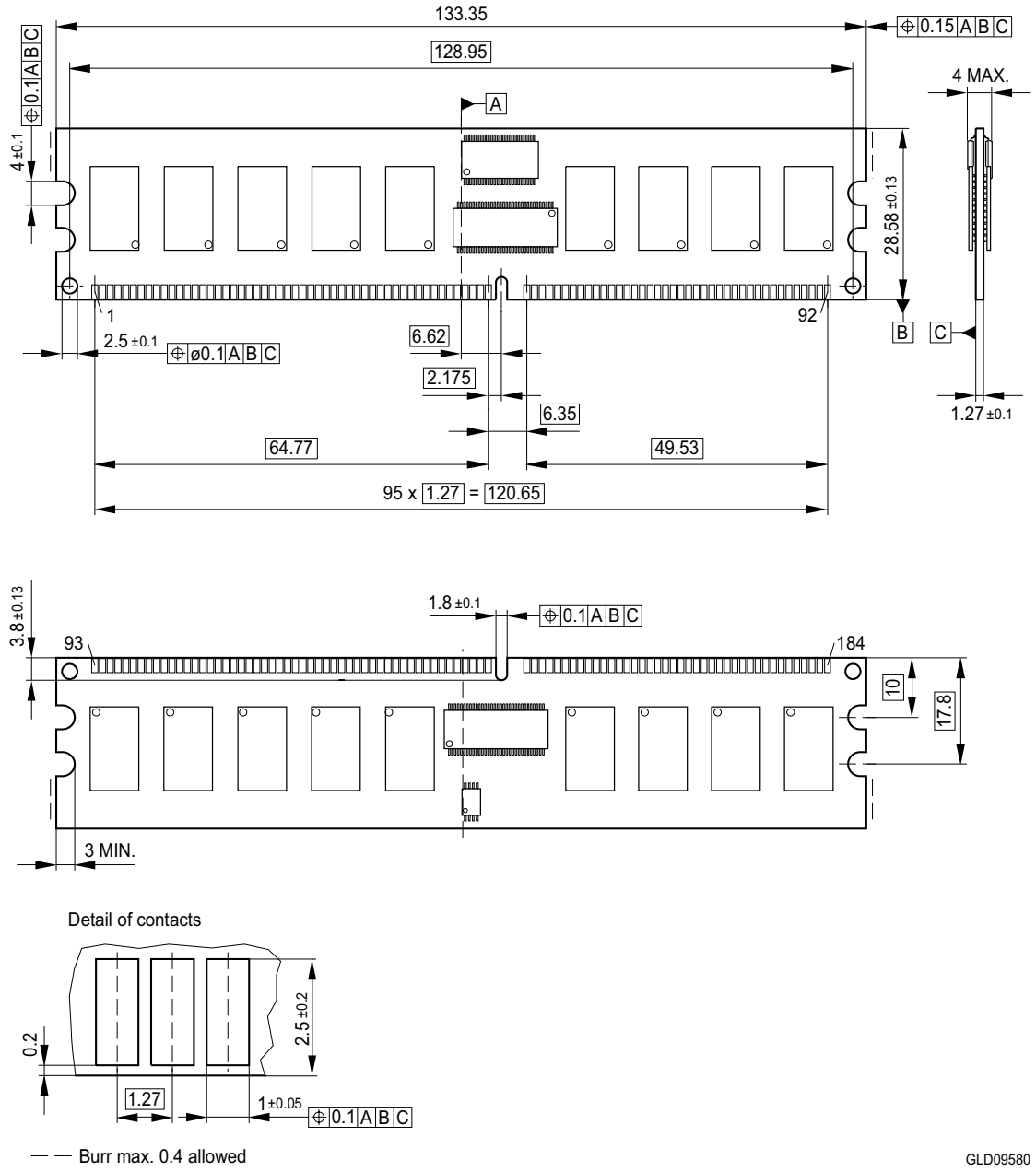
5.2 Raw Card B

FIGURE 3
Package Outlines – Raw Card B HYS72D64320GBR–[5/6]–C (2 Ranks ×8)



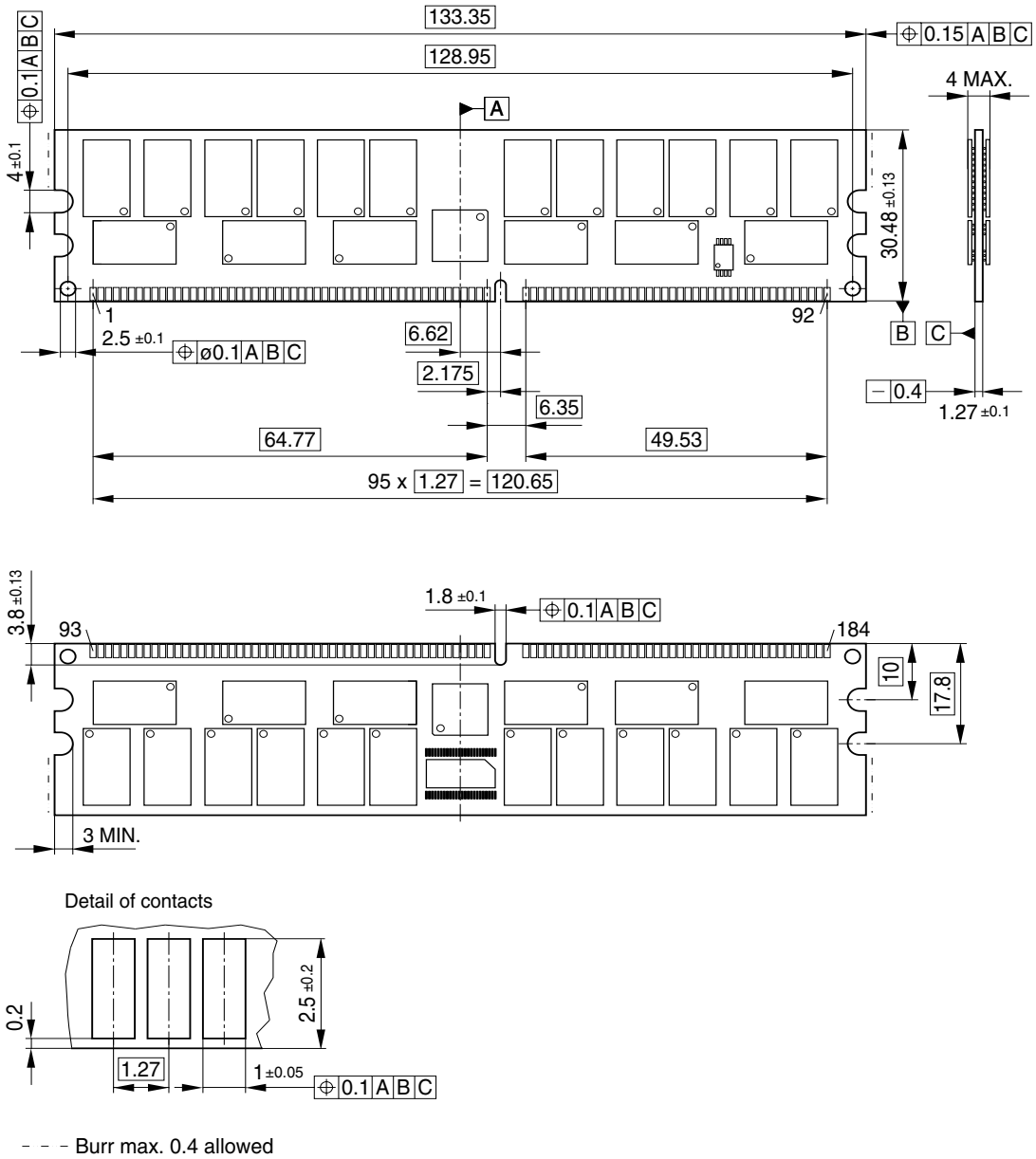
5.3 Raw Card C

FIGURE 4
Package Outlines – Raw Card C HYS72D64300[G/H]BR–[5/6/7]–C (1 Rank × 4)



5.4 Raw Card D

FIGURE 5
Package Outlines – Raw Card D HYS72D128320[G/H]BR–[6/7]–C (2 Ranks ×4)



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