

**TYPICAL DRAM CARD APPLICATIONS**

Typical DRAM memory card applications include portable computers, fax machines, electronic instruments, printers and PDAs.

**THE TOSHIBA DRAM PRODUCT LINE UP**

Toshiba has migrated to the 88-pin standard, which has replaced the older 38- and 60-pin DRAM cards. Toshiba offers a variety of 88-pin solutions including cards without buffered inputs for applications which do not require redrive circuitry within the card. Although the JEDEC standard calls for buffers to be included within the card, the unbuffered option allows for faster operation by eliminating the delay associated with the buffers.

All card densities are offered in both 5V as well as 3.3V operating voltages and x32 or x36 parity version bus widths as outlined in the part numbers below. The following card family utilizes 4 Mbit (1Mx4) and, where necessary for parity, 1 Mbit (1Mx1) low power DRAM components. Future card versions may use 16Mbit device technology for further power reduction and speed increases.

PART NUMBER	DENSITY/PARITY	VOLTAGE	SPEED
TH8D321000UA-70L	1Mx32	5V	70ns
TH8D322000UA-70L	2Mx32	5V	70ns
TH8D321042UA-80L	1Mx32	3.3V	80ns
TH8D322042UA-80L	2Mx32	3.3V	80ns
TH8D361000UA-70L	1Mx36	5V	70ns
TH8D362000UA-70L	2Mx36	5V	70ns
TH8D361042UA-80L	1Mx36	3.3V	80ns
TH8D362042UA-80L	2Mx36	3.3V	80ns

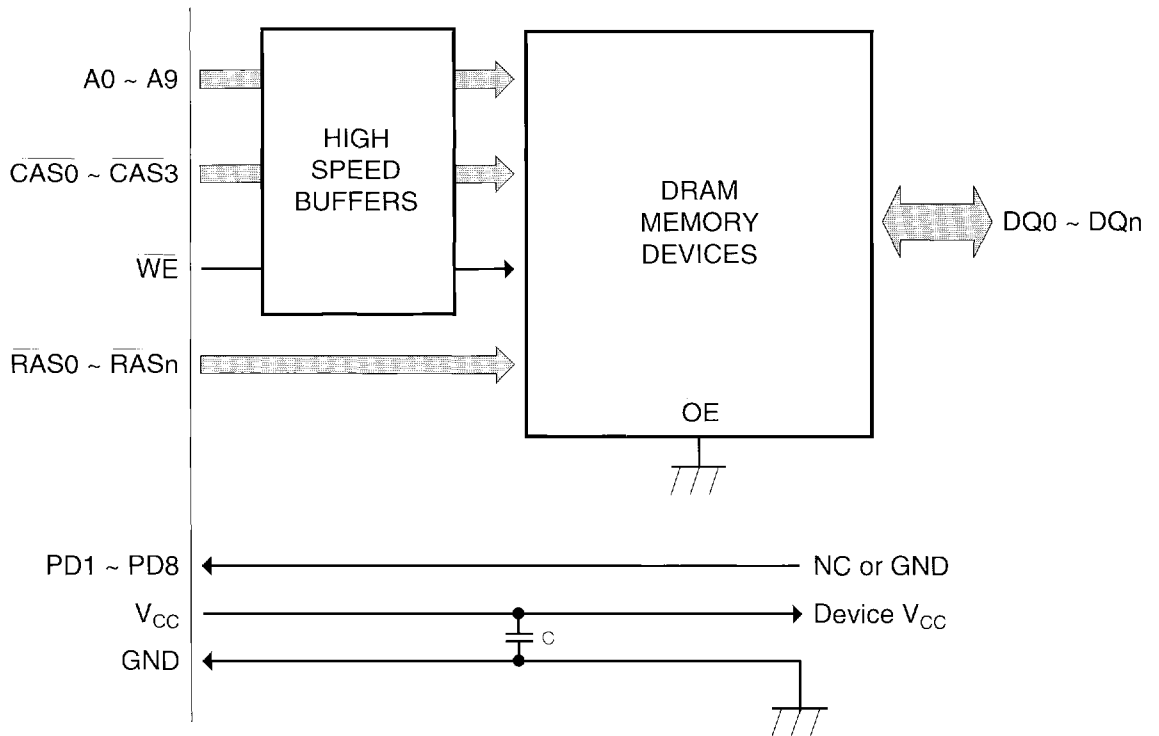
Toshiba is positioned to take advantage of the emerging half size card version of the standard 88-pin memory card. These cards offer additional space savings for applications such as PDA's and other handheld devices where minimum size is critical. Contact your Toshiba representative for more detailed information or to discuss your DRAM card requirements.

**FEATURES AND OPTIONS**

Standard cards listed above come with the following features:

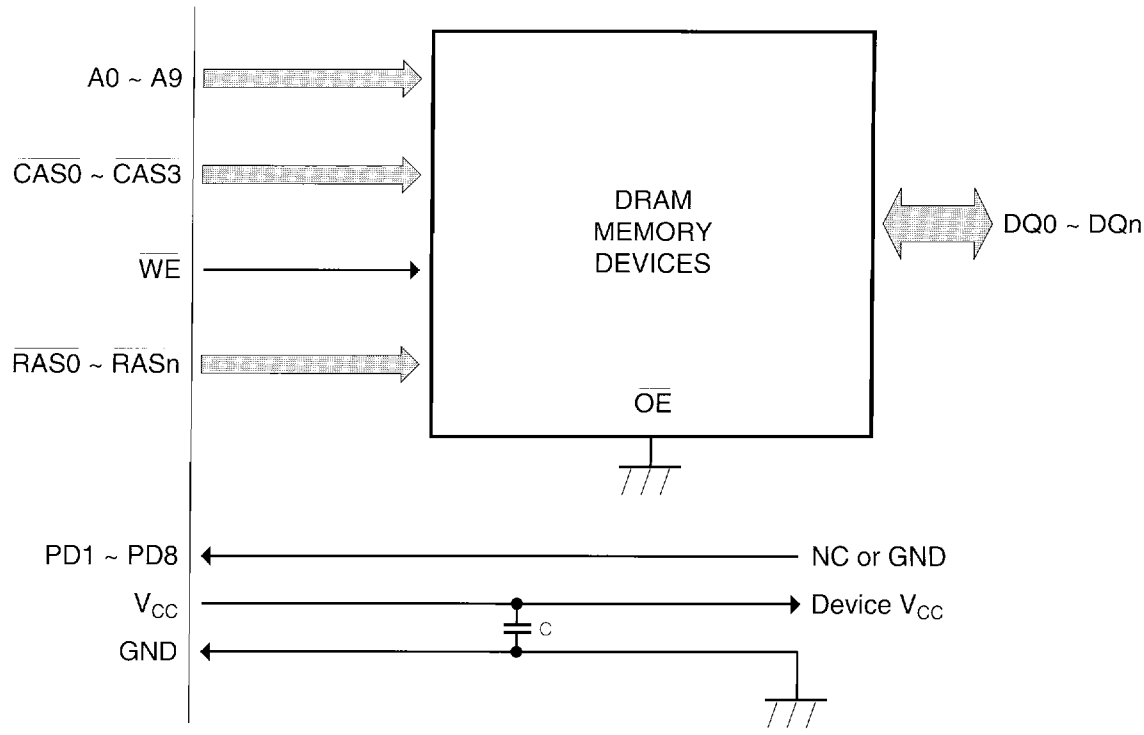
- ▶ JEDEC/JEIDA standard pinout and function
- ▶ Low power dissipation
- ▶ 128ms refresh rate
- ▶ Operating temperature range from 0°C to 55°C
- ▶ Storage temperature range from -20°C to 65°C
- ▶ Buffered or unbuffered control line options
- ▶ Ease of installation and removal
- ▶ Rugged enclosure for optimum component protection
- ▶ 5V or 3.3V options

**BUFFERED DRAM CARD**



This card configuration is 100% compliant with the JEDEC 88-pin standard by the use of buffers on the address, CAS, and WE input lines. This will add a delay of about 5ns to these signals and thus will affect the overall timing requirements of the card as outlined in the AC Electrical Characteristics chart on page 7. For this reason, some customers may prefer to use unbuffered cards as outlined in the diagram on page 3.

**UNBUFFERED DRAM CARD**



Although the JEDEC standard states that buffers are required on the address, CAS and WE input lines, there is a current trend to omit the buffers to gain additional performance from the card. If the system has been designed with the necessary drive capability, buffers may not be needed. This optional card can be ordered from Toshiba by specifying a "U" at the end of the speed designator in the part number. Example: -70LU



Pin	Signal	Function
1	GND	Ground
2	DQ0	Data 0
3	DQ1	Data 1
4	DQ2	Data 2
5	DQ3	Data 3
6	DQ4	Data 4
7	DQ5	Data 5
8	DQ6	Data 6
9	V <sub>CC</sub>	Power supply (5V)
10	DQ7	Data 7
11	V <sub>CC</sub>	Power supply (3.3V)
12	DQ8	Data 8
13	A0	Address 0
14	A2	Address 2
15	V <sub>CC</sub>	Power supply (5V)
16	A4	Address 4
17	V <sub>CC</sub>	Power supply (3.3V)
18	A6	Address 6
19	A8	Address 8
20	A10	Address 10
21	A12	Address 12
22	$\overline{\text{RAS0}}$	Row Address Strobe 0
23	$\overline{\text{CAS0}}$	Column Address Strobe 0
24	$\overline{\text{CAS1}}$	Column Address Strobe 1
25	V <sub>CC</sub>	Power supply (3.3V)
26	$\overline{\text{RAS2}}$	Row Address Strobe 2
27	V <sub>CC</sub>	Power supply (5V)
28	PD2	Presence Detect 2
29	PD4	Presence Detect 4
30	PD6	Presence Detect 6
31	NC	No Connect
32	NC	No Connect
33	DQ17	Data 17
34	DQ9	Data 9
35	V <sub>CC</sub>	Power supply (3.3V)
36	DQ10	Data 10
37	V <sub>CC</sub>	Power supply (5V)
38	DQ11	Data 11
39	DQ12	Data 12
40	DQ13	Data 13
41	DQ14	Data 14
42	DQ15	Data 15
43	DQ16	Data 16
44	GND	Ground

Pin	Signal	Function
45	GND	Ground
46	DQ18	Data 18
47	DQ19	Data 19
48	DQ 20	Data 20
49	DQ 21	Data 21
50	DQ 22	Data 22
51	DQ 23	Data 23
52	DQ 24	Data 24
53	DQ 25	Data 25
54	DQ 26	Data 26
55	NC	No Connect
56	GND	Ground
57	A1	Address 1
58	A3	Address 3
59	A5	Address 5
60	A7	Address 7
61	A9	Address 9
62	A11	Address 11
63	GND	Ground
64	A13	Address 13
65	$\overline{\text{RAS1}}$	Row Address Strobe 1
66	$\overline{\text{CAS2}}$	Column Address Strobe 2
67	GND	Ground
68	$\overline{\text{CAS3}}$	Column Address Strobe 3
69	$\overline{\text{RAS3}}$	Row Address Strobe 3
70	$\overline{\text{WE}}$	Write Enable
71	PD1	Presence Detect 1
72	PD3	Presence Detect 3
73	GND	Ground
74	PD5	Presence Detect 5
75	PD7	Presence Detect 7
76	PD8	Presence Detect 8
77	NC	No Connect
78	NC	No Connect
79	DQ35	Data 35
80	DQ27	Data 27
81	DQ28	Data 28
82	DQ29	Data 29
83	DQ30	Data 30
84	DQ31	Data 31
85	DQ32	Data 32
86	DQ33	Data 33
87	DQ34	Data 34
88	GND	Ground

Note: x32 cards do not use pins 12, 33, 54 and 79. Card will support either 5V or 3.3V but not both voltages.

PD #	4 MB		8 MB		Description of PD Pins
	70ns	80ns	70ns	80ns	
PD1	GND	GND	GND	GND	Card Organization
PD2	NC	NC	NC	NC	Card Organization
PD3	GND	GND	GND	GND	Card Organization
PD4	GND	GND	GND	GND	Card Organization
PD5	NC	NC	GND	GND	Number of Banks
PD6	GND	NC	GND	NC	Access Time
PD7	NC	GND	NC	GND	Access Time
PD8	NC	NC	NC	NC	Refresh Type

Memory cards, like modules, contain presence detect pins that can be read by the system to determine the card's organization, number of banks, access time and refresh operation. The 88-pin standard contains 8 presence detects located at pins 71, 28, 72, 29, 74, 30, 75 and 76 respectively. Note that the presence detect table is the same for x32 and x36 cards as well as for 5V and 3.3V cards. The presence detect pins do not distinguish between different bus widths or operation voltage.



**x32 UNBUFFERED/BUFFERED CARDS**

Symbol	Parameter	4 MB		8 MB		Units
		5V	3.3V	5V	3.3V	
I <sub>CC1</sub>	Operating Current	800/800	480/482	832/832	488/491	mA
I <sub>CC2</sub>	Standby Current	16/16	8/8.4	32/32	16/16.4	mA
I <sub>CC3</sub>	$\overline{\text{RAS}}$ Only Refresh Current	800/800	480/482	832/832	488/491	mA
I <sub>CC4</sub>	Fast Page Mode Current	560/560	320/322	592/592	328/331	mA
I <sub>CC5</sub>	Standby Current	1.6/1.6	2.0/2.2	3.2/3.2	4.0/4.4	mA
I <sub>CC6</sub>	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh Current	800/800	480/482	832/832	488/491	mA
I <sub>CC7</sub>	Battery Back-up Current	2.4/2.4	2.4/2.6	4.8/4.8	4.8/5.2	mA

**x36 UNBUFFERED/BUFFERED CARDS**

Symbol	Parameter	4 MB		8 MB		Units
		5V	3.3V	5V	3.3V	
I <sub>CC1</sub>	Operating Current	1120/1120	661/663	1144/1144	672/675	mA
I <sub>CC2</sub>	Standby Current	24/24	12/12.4	48/48	25/25	mA
I <sub>CC3</sub>	RAS Only Refresh Current	1120/1120	661/663	1144/1144	672/675	mA
I <sub>CC4</sub>	Fast Page Mode Current	800/800	441/443	824/824	452/455	mA
I <sub>CC5</sub>	Standby Current	2/2.4	2.6/3.0	4.4/4.8	5.2/5.6	mA
I <sub>CC6</sub>	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh Current	1120/1120	663/663	1144/1144	675/675	mA
I <sub>CC7</sub>	Battery Back-up Current	3.6/3.6	3.4/3.6	7.2/7.2	6.4/6.8	mA

**AC ELECTRICAL CHARACTERISTICS**

Symbol	Parameter	4MB and 8MB, 5V, 70ns				4MB and 8MB, 3.3V, 80ns				Units
		Unbuffered		Buffered		Unbuffered		Buffered		
		Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>RC</sub>	Random read or write cycle time	130	-	140	-	150	-	160	-	ns
t <sub>PC</sub>	Fast page mode cycle time	45	-	52	-	50	-	57	-	ns
t <sub>RAC</sub>	Access time from $\overline{RAS}$	-	70	-	70	-	80	-	80	ns
t <sub>CAC</sub>	Access time from $\overline{CAS}$	-	20	-	25	-	20	-	27	ns
t <sub>AA</sub>	Access time from column addresss	-	35	-	42	-	40	-	47	ns

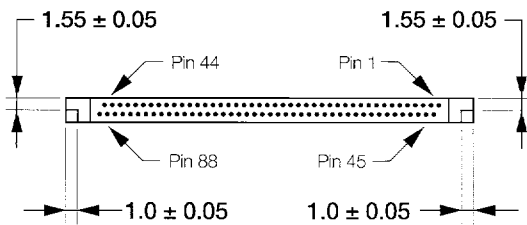
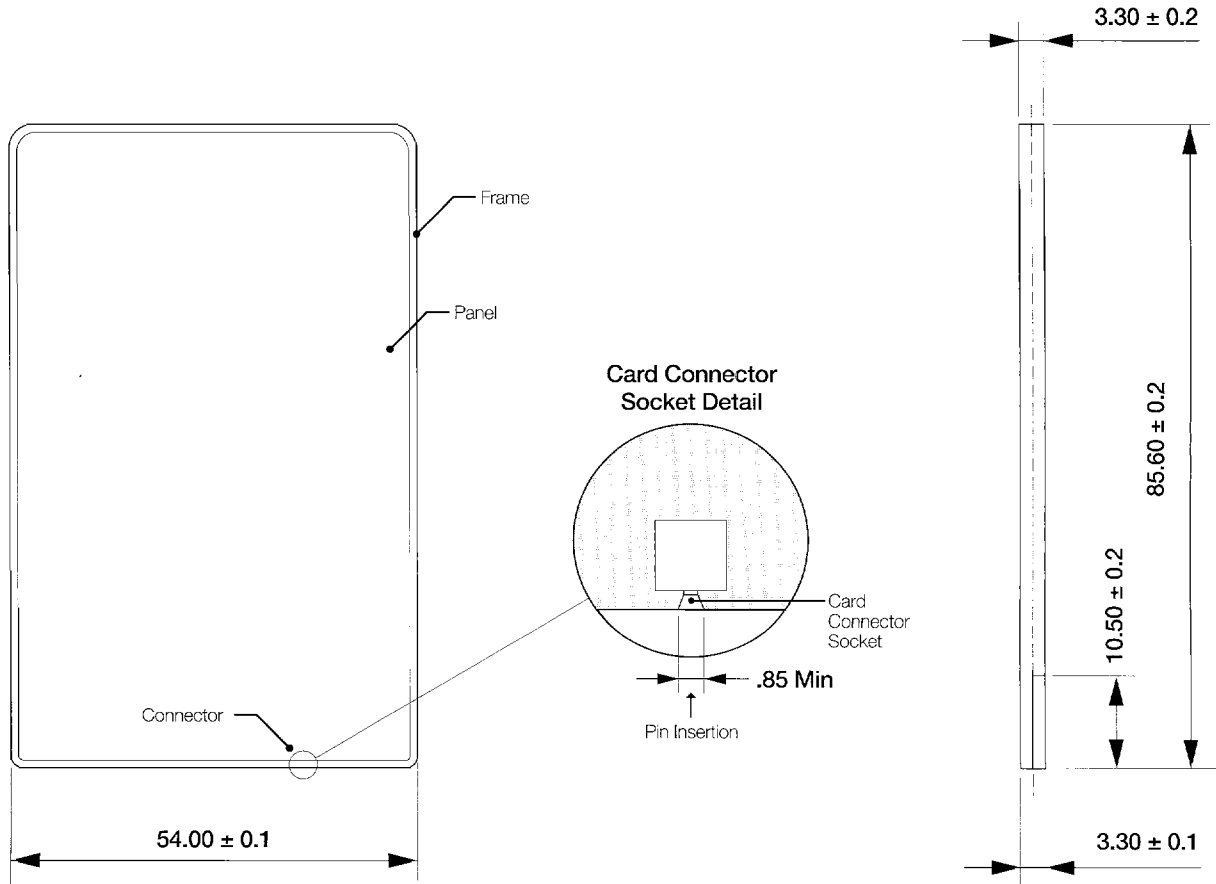
Characteristics apply for both x32 and x36 Memory Cards

**CAPACITANCE**

Symbol	Parameter	Buffered	Unbuffered		Units
		All Cards*	4 MB*	8 MB*	
C <sub>I1</sub>	Input Capacitance (A0 ~ A9)	15	115	145	pF
C <sub>I2</sub>	Input Capacitance ( $\overline{WE}$ )	15	115	145	pF
C <sub>I3</sub>	Input Capacitance (RAS Lines)	55	65	65	pF
C <sub>I4</sub>	Input Capacitance ( $\overline{CAS}$ Lines)	15	55	55	pF
C <sub>DQ</sub>	Input/Output Capacitance (DQ Lines)	40	40	40	pF

\* All entries represent maximum allowed values.

All Dimensions in mm



Pin Orientation

Pin Layout: 2 Rows - 88 Pins

