

BGA  
Commercial Temp  
Industrial Temp

# 1M x 8 8Mb Asynchronous SRAM

10, 12, 15ns  
3.3V V<sub>DD</sub>

## Features

- Fast access time: 10, 12, 15ns.
- CMOS low power operation: 300/250/220/180mA at min. cycle time.
- Single 3.3V  $\pm$  0.3V power supply.
- All inputs and outputs are TTL compatible.
- Fully static operation.
- Industrial Temperature Option: -40° to 85°C.
- 14mm x 22mm, 119 Bump, 1.27mm Pitch Ball Grid Array package.

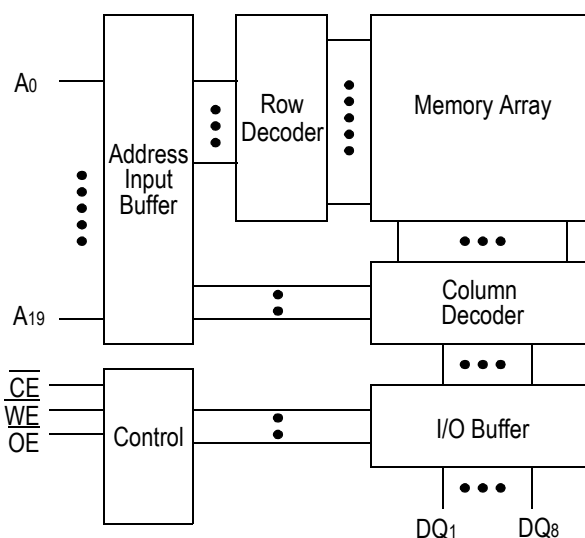
## Description

The GS78108 is a high speed CMOS static RAM organized as 1,048,576-words by 8-bits. Static design eliminates the need for external clocks or timing strobes. Operating on a single 3.3V power supply and all inputs and outputs are TTL compatible. The GS78108 is available in 14mm x 22mm BGA package.

## Pin Descriptions

Symbol	Description
A <sub>0</sub> to A <sub>19</sub>	Address input
DQ <sub>1</sub> to DQ <sub>8</sub>	Data input/output
$\overline{\text{CE}}$	Chip enable input
$\overline{\text{WE}}$	Write enable input
$\overline{\text{OE}}$	Output enable input
V <sub>DD</sub>	+3.3V power supply
V <sub>SS</sub>	Ground
NC	No connect

## Block Diagram



# 1M x 8 Async SRAM in Bump, 14x22mm BGA

## Top View

	1	2	3	4	5	6	7
A	NC	A <sub>15</sub>	A <sub>14</sub>	A <sub>16</sub>	A <sub>13</sub>	A <sub>12</sub>	NC
B	NC	A <sub>11</sub>	A <sub>10</sub>	$\overline{\text{CE}}$	A <sub>9</sub>	A <sub>8</sub>	NC
C	NC	NC	V <sub>DD</sub> , NC	A <sub>17</sub>	V <sub>SS</sub> , NC	NC	NC
D	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC
E	NC	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC	NC
F	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC
G	DQ <sub>1</sub>	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC	DQ <sub>5</sub>
H	DQ <sub>2</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	DQ <sub>6</sub>
J	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>
K	DQ <sub>3</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	DQ <sub>7</sub>
L	DQ <sub>4</sub>	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC	DQ <sub>8</sub>
M	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC
N	NC	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC	NC
P	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC
R	NC	NC	NC	NC	NC	NC	NC
T	NC	A <sub>7</sub>	A <sub>6</sub>	$\overline{\text{WE}}$	A <sub>5</sub>	A <sub>4</sub>	NC
U	A <sub>18</sub>	A <sub>3</sub>	A <sub>2</sub>	$\overline{\text{OE}}$	A <sub>1</sub>	A <sub>0</sub>	A <sub>19</sub>

Note: Bumps 3C and 5C are actually NC's but should be wired 3C = V<sub>DD</sub> and 5C = V<sub>SS</sub> to assure compatibility with future versions.

### Truth Table

$\overline{\text{CE}}$	$\overline{\text{OE}}$	$\overline{\text{WE}}$	DQ <sub>1</sub> to DQ <sub>8</sub>	V <sub>DD</sub> Current
H	X	X	Not Selected	ISB1, ISB2
L	L	H	Read	
L	X	L	Write	I <sub>DD</sub>
L	H	H	High Z	

Note: X: "H" or "L"

### Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply Voltage	V <sub>DD</sub>	-0.5 to +4.6	V
Input Voltage	V <sub>IN</sub>	-0.5 to V <sub>DD</sub> +0.5 (≤ 4.6V max.)	V
Output Voltage	V <sub>OUT</sub>	-0.5 to V <sub>DD</sub> +0.5 (≤ 4.6V max.)	V
Allowable power dissipation	PD	1.5	W
Storage temperature	T <sub>STG</sub>	-55 to 150	°C

Note:

Permanent device damage may occur if Absolute Maximum Ratings are exceeded. Functional operation shall be restricted to Recommended Operating Conditions. Exposure to higher than recommended voltages for extended periods of time could affect device reliability.

### Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage for -10/12/15	V <sub>DD</sub>	3.0	3.3	3.6	V
Input High Voltage	V <sub>IH</sub>	2.0	-	V <sub>DD</sub> +0.3	V
Input Low Voltage	V <sub>IL</sub>	-0.3	-	0.8	V
Ambient Temperature, Commercial Range	T <sub>Ac</sub>	0	-	70	°C
Ambient Temperature, Industrial Range	T <sub>Ai</sub>	-40	-	85	°C

Note:

1. Input overshoot voltage should be less than V<sub>DD</sub>+2V and not exceed 20ns.
2. Input undershoot voltage should be greater than -2V and not exceed 20ns.

## Capacitance

Parameter	Symbol	Test Condition	Max	Unit
Input Capacitance	$C_{IN}$	$V_{IN}=0V$	10	pF
Output Capacitance	$C_{OUT}$	$V_{OUT}=0V$	7	pF

Notes:

1. Tested at  $T_A=25^{\circ}C$ ,  $f=1MHz$
2. These parameters are sampled and are not 100% tested

## DC I/O Pin Characteristics

Parameter	Symbol	Test Conditions	Min	Max
Input Leakage Current	$I_{IL}$	$V_{IN} = 0 \text{ to } V_{DD}$	-2uA	2uA
Output Leakage Current	$I_{OL}$	Output High Z, $V_{OUT} = 0 \text{ to } V_{DD}$	-1uA	1uA
Output High Voltage	$V_{OH}$	$I_{OH} = -4mA$	2.4	
Output Low Voltage	$V_{OL}$	$I_{OL} = +4mA$		0.4V

## Power Supply Currents

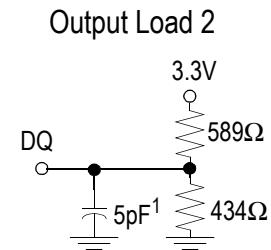
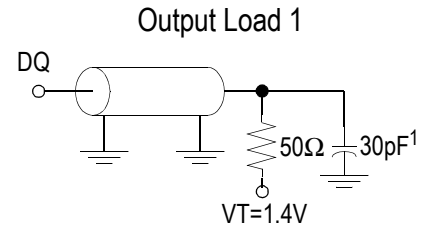
Parameter	Symbol	Test Conditions	0 to 70°C			-40 to 85°C		
			10ns	12ns	15ns	10ns	12ns	15ns
Operating Supply Current	$I_{DD}$	$\bar{E} \leq V_{IL}$ All other inputs $\geq V_{IH}$ or $\leq V_{IL}$ Min. cycle time $I_{OUT} = 0 \text{ mA}$	225mA	220mA	180mA	270mA	240mA	200mA
Standby Current	$I_{SB1}$	$\bar{E} \geq V_{IH}$ All other inputs $\geq V_{IH}$ or $\leq V_{IL}$ Min. cycle time	130mA	120mA	110mA	150mA	140mA	130mA
Standby Current	$I_{SB2}$	$E \geq V_{DD} - 0.2V$ All other inputs $\geq V_{DD} - 0.2V$ or $\leq 0.2V$	60mA			80mA		

## AC Test Conditions

Parameter	Conditions
Input high level	$V_{IH}=2.4V$
Input low level	$V_{IL}=0.4V$
Input rise time	$t_r=1V/ns$
Input fall time	$t_f=1V/ns$
Input reference level	1.4V
Output reference level	1.4V
Output load	Fig. 1 & 2

Note:

1. Include scope and jig capacitance.
2. Test conditions as specified with output loading as shown in Fig. 1 unless otherwise noted
3. Output load 2 for  $t_{LZ}$ ,  $t_{HZ}$ ,  $t_{OLZ}$  and  $t_{OHZ}$ .

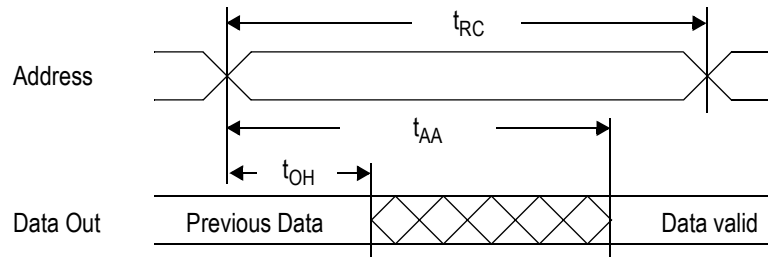


## AC Characteristics

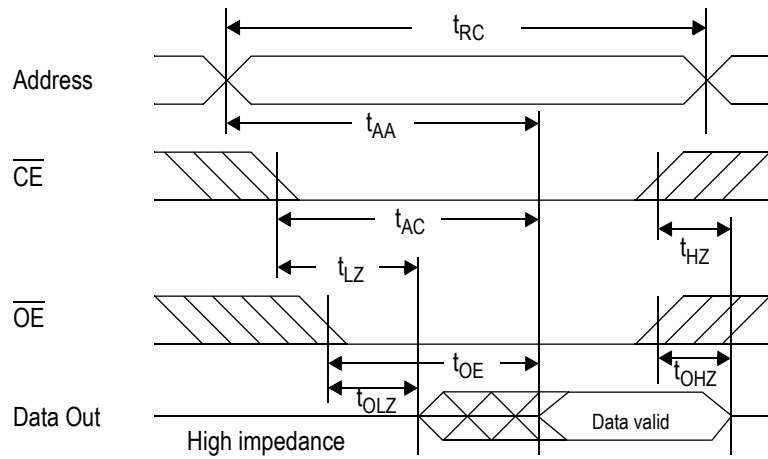
### Read Cycle

Parameter	Symbol	-10		-12		-15		Unit
		Min	Max	Min	Max	Min	Max	
Read cycle time	$t_{RC}$	10	---	12	---	15	---	ns
Address access time	$t_{AA}$	---	10	---	12	---	15	ns
Chip enable access time ( $\overline{CE}$ )	$t_{AC}$	---	10	---	12	---	15	ns
Output enable to output valid ( $\overline{OE}$ )	$t_{OE}$	---	4	---	5	---	6	ns
Output hold from address change	$t_{OH}$	3	---	3	---	3	---	ns
Chip enable to output in low Z ( $\overline{CE}$ )	$t_{LZ}^*$	3	---	3	---	3	---	ns
Output enable to output in low Z ( $\overline{OE}$ )	$t_{OLZ}^*$	0	---	0	---	0	---	ns
Chip disable to output in High Z ( $\overline{CE}$ )	$t_{HZ}^*$	---	5	---	6	---	7	ns
Output disable to output in High Z ( $\overline{OE}$ )	$t_{OHZ}^*$	---	4	---	5	---	6	ns

Read Cycle 1:  $\overline{CE} = \overline{OE} = V_{IL}$



Read Cycle 2:  $\overline{WE} = V_{IH}$

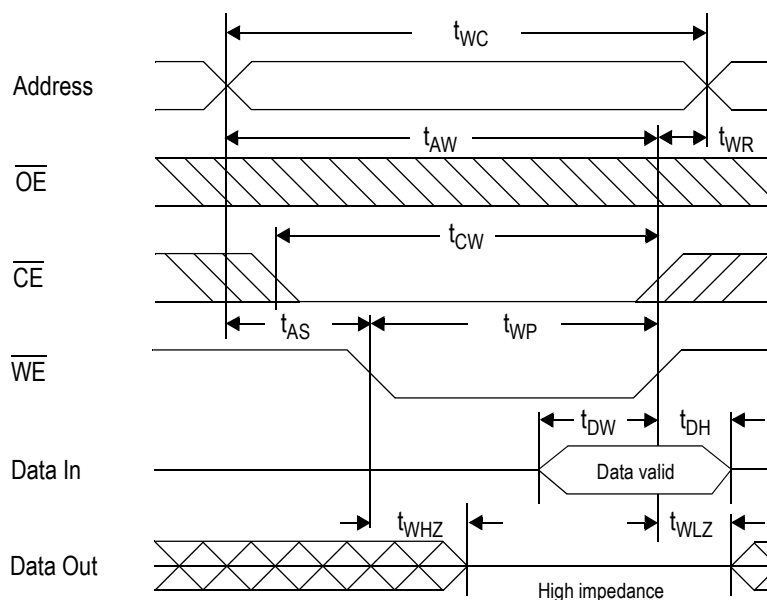


## Write Cycle

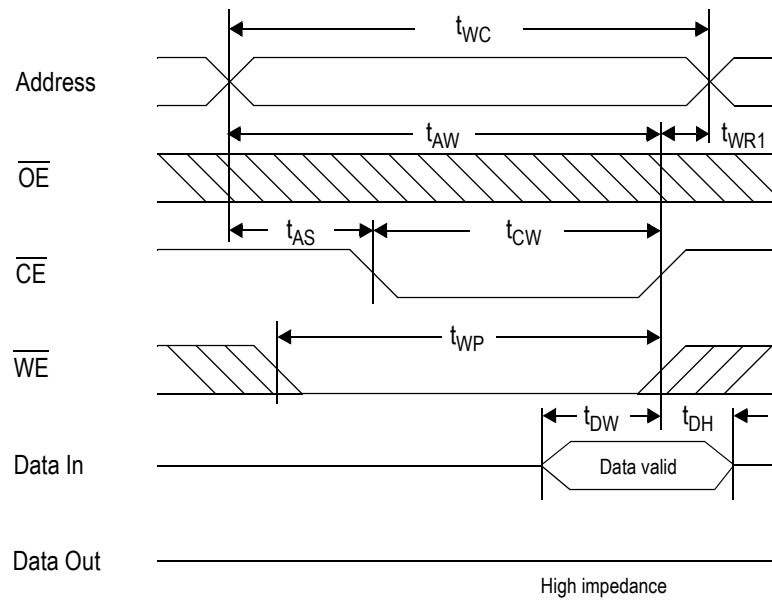
Parameter	Symbol	-10		-12		-15		Unit
		Min	Max	Min	Max	Min	Max	
Write cycle time	t <sub>WC</sub>	10	---	12	---	15	---	ns
Address valid to end of write	t <sub>AW</sub>	7	---	8	---	10	---	ns
Chip enable to end of write	t <sub>CW</sub>	7	---	8	---	10	---	ns
Data set up time	t <sub>DW</sub>	5	---	6	---	7	---	ns
Data hold time	t <sub>DH</sub>	0	---	0	---	0	---	ns
Write pulse width	t <sub>WP</sub>	7	---	8	---	10	---	ns
Address set up time	t <sub>AS</sub>	0	---	0	---	0	---	ns
Write recovery time ( $\overline{WE}$ )	t <sub>WR</sub>	0	---	0	---	0	---	ns
Write recovery time ( $\overline{CE}$ )	t <sub>WR1</sub>	0	---	0	---	0	---	ns
Output Low Z from end of write	t <sub>WLZ</sub> *	3	---	3	---	3	---	ns
Write to output in High Z	t <sub>WHZ</sub> *	---	4	---	5	---	6	ns

\* These parameters are sampled and are not 100% tested

## Write Cycle 1: $\overline{WE}$ Controlled

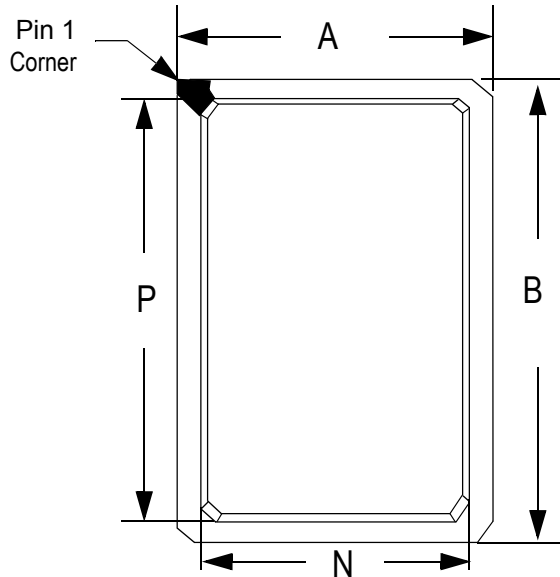


## Write Cycle 2: $\overline{\text{CE}}$ Controlled

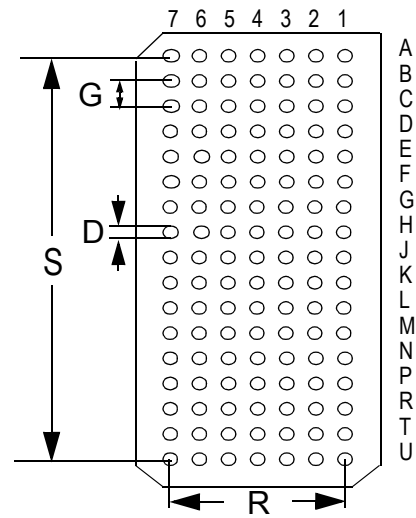




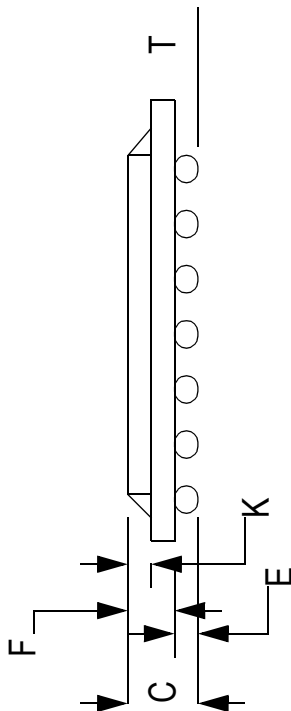
## Package Dimensions - 119 Pin PBGA



Top View



Bottom View



Side View

## Package Dimensions - 119 Pin PBGA

Symbol	Description	Min.	Nom.	Max
A	Width	13.8	14.0	14.2
B	Length	21.8	22.0	22.2
C	Package Height (including ball)	-		2.40
D	Ball Size	0.60	0.75	0.90
E	Ball Height	0.50	0.60	0.70
F	Package Height (excluding balls)		1.46	1.70
G	Width between Balls		1.27	
K	Package Height above board	0.80	0.90	1.00
N	Cut-out Package Width		12.00	
P	Foot Length		19.50	
R	Width of package between balls		7.62	
S	Length of package between balls		20.32	
T	Variance of Ball Height		0.15	

Unit: mm

BPR 1999.05.18

## Ordering Information

Part Number *	Package	Access Time	Temp. Range	Status
GS78108B-10	BGA	10 ns	Commercial	
GS78108B-12	BGA	12 ns	Commercial	
GS78108B-15	BGA	15 ns	Commercial	
GS78108B-10I	BGA	10 ns	Industrial	
GS78108B-12I	BGA	12 ns	Industrial	
GS78108B-15I	BGA	15 ns	Industrial	

\* Customers requiring delivery in Tape and Reel should add the character "T" to the end of the part number. For example: GS78108B-12T

## Revision History

Rev. Code: Old; New	Types of Changes Format or Content	Page #/Revisions/Reason
GS78108Rev0.01a 5/1999; 1.00 X/1999	Format/Typos	• p.2/Changed $\bar{E}$ to $\bar{CE}$ /consistency.
	Content	• p.2/Changed Pin T1 from $\bar{BA}$ to $\bar{BD}$ /Correction
GS78108Rev 1.0010/1999A;Rev 1.01 2/2000FormatB		• Added GSI Logo