

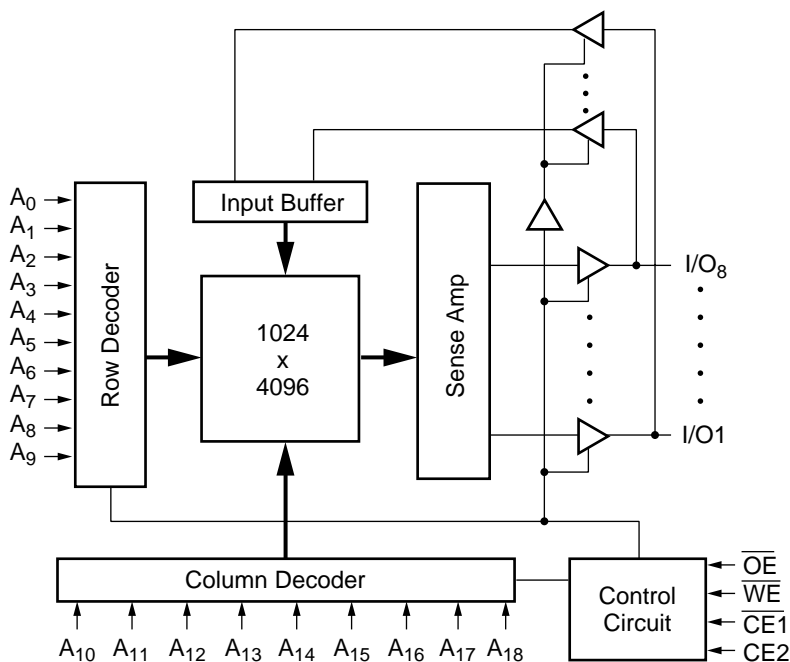
**Features**

- High-speed: 70, 85 ns
- Ultra low standby current of 4µA (max.)
- Fully static operation
- All inputs and outputs directly compatible
- Three state outputs
- Ultra low data retention current ( $V_{CC} = 1.2V$ )
- Operating voltage: 2.3V–3.0V
- Packages
  - 32-Pin TSOP (Standard)
  - 36-Ball CSP BGA (8mm x 10mm)

**Description**

The V62C2804096 is a very low power CMOS static RAM organized as 524,288 words by 8 bits. Easy memory expansion is provided by an active LOW CE1, and active HIGH CE2, an active LOW OE, and three static I/O's. This device has an automatic power-down mode feature when deselected.

**Functional Block Diagram**



**Device Usage Chart**

Operating Temperature Range	Package Outline		Access Time (ns)		Power		Temperature Mark
	T	B	70	85	L	LL	
0°C to 70°C	•	•	•	•	•	•	Blank
-40°C to +85°C	•	•	•	•		•	I

**Pin Descriptions**

**A<sub>0</sub>–A<sub>18</sub> Address Inputs**

These 19 address inputs select one of the 512K x 8 bit segments in the RAM.

**$\overline{CE}_1$ , CE<sub>2</sub>\* Chip Enable Inputs**

$\overline{CE}_1$  is active LOW and CE<sub>2</sub> is active HIGH. Both chip enables must be active to read from or write to the device. If either chip enable is not active, the device is deselected and is in a standby power mode. The I/O pins will be in the high-impedance state when deselected.

**$\overline{OE}$  Output Enable Input**

The Output Enable input is active LOW. With chip enabled, when  $\overline{OE}$  is LOW and  $\overline{WE}$  HIGH, data of the selected memory location will be available on the I/O pins. When  $\overline{OE}$  is HIGH, the I/O pins will be in the high impedance state.

**$\overline{WE}$  Write Enable Input**

The write enable input is active LOW and controls read and write operations. With the chip enabled, when  $\overline{WE}$  is HIGH and  $\overline{OE}$  is LOW, output data will be present at the I/O pins; when  $\overline{WE}$  is LOW and  $\overline{OE}$  is HIGH, the data present on the I/O pins will be written into the selected memory locations.

**I/O<sub>1</sub>–I/O<sub>8</sub> Data Input and Data Output Ports**

These 8 bidirectional ports are used to read data from and write data into the RAM.

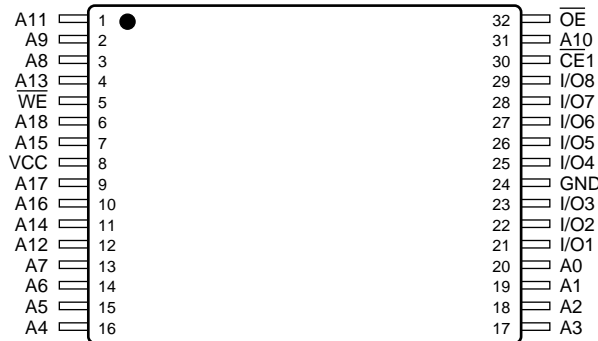
**V<sub>CC</sub> Power Supply**

**GND Ground**

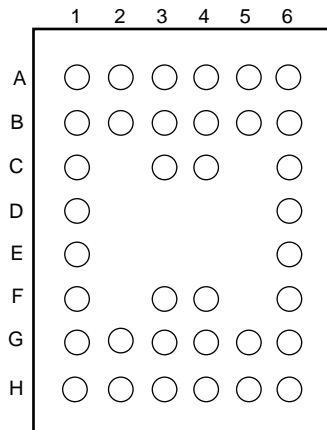
\*CE<sub>2</sub> is available on BGA package only.

**Pin Configurations (Top View)**

**32-Pin TSOP (Standard)**



**36 BGA**



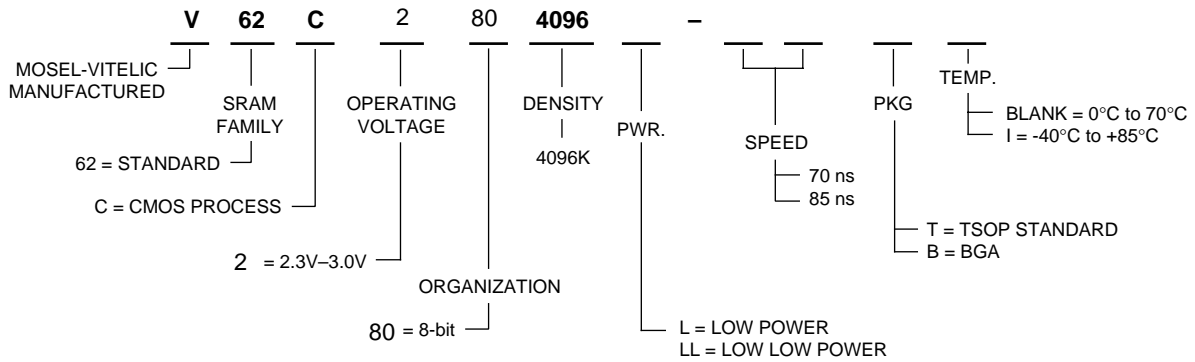
TOP VIEW

	1	2	3	4	5	6
A	A0	A1	CE2	A3	A6	A8
B	I/O5	A2	$\overline{WE}$	A4	A7	I/O1
C	I/O6	NB	NC	A5	NB	I/O2
D	VSS	NB	NB	NB	NB	VCC
E	VCC	NB	NB	NB	NB	VSS
F	I/O7	NB	A18	A17	NB	I/O3
G	I/O8	$\overline{OE}$	CE1	A16	A15	I/O4
H	A9	A10	A11	A12	A13	A14

Note: NC means no connect.  
NB means no ball.

TOP VIEW

**Part Number Information**



**Absolute Maximum Ratings (1)**

Symbol	Parameter	Commercial	Industrial	Units
V <sub>CC</sub>	Supply Voltage	-0.5 to +V <sub>CC</sub> + 0.5	-0.5 to +V <sub>CC</sub> + 0.5	V
V <sub>N</sub>	Input Voltage	-0.5 to +V <sub>CC</sub> + 0.5	-0.5 to +V <sub>CC</sub> + 0.5	V
V <sub>DQ</sub>	Input/Output Voltage Applied	V <sub>CC</sub> + 0.3	V <sub>CC</sub> + 0.3	V
T <sub>BIAS</sub>	Temperature Under Bias	-10 to +125	-65 to +135	°C
T <sub>STG</sub>	Storage Temperature	-55 to +125	-65 to +150	°C

**NOTE:**

- Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**Capacitance\***

T<sub>A</sub> = 25°C, f = 1.0MHz

Symbol	Parameter	Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	6	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>I/O</sub> = 0V	8	pF

**NOTE:**

- This parameter is guaranteed and not tested.

**Truth Table**

Mode	$\overline{CE}_1$	CE <sub>2</sub>	$\overline{OE}$	$\overline{WE}$	I/O Operation
Standby	H	X	X	X	High Z
Standby	X	L	X	X	High Z
Output Disable	L	H	H	H	High Z
Read	L	H	L	H	D <sub>OUT</sub>
Write	L	H	X	L	D <sub>IN</sub>

**NOTE:**

X = Don't Care, L = LOW, H = HIGH

**DC Electrical Characteristics** (over all temperature ranges,  $V_{CC} = 2.3V-3.0V$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{IL}$	Input LOW Voltage <sup>(1,2)</sup>		-0.5	—	0.4	V
$V_{IH}$	Input HIGH Voltage <sup>(1)</sup>		2.0	—	$V_{CC}+0.3$	V
$I_{IL}$	Input Leakage Current	$V_{CC} = \text{Max}, V_{IN} = 0V \text{ to } V_{CC}$	—	—	1	$\mu A$
$I_{OL}$	Output Leakage Current	$V_{CC} = \text{Max}, \overline{CE}_1 = V_{IH}, V_{OUT} = 0V \text{ to } V_{CC}$	—	—	1	$\mu A$
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{Min}, I_{OL} = 2mA$	—	—	0.4	V
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{Min}, I_{OH} = -0.5mA$	$V_{CC}-0.4$	—	—	V

Symbol	Parameter		Comm. <sup>(3)</sup>	Ind. <sup>(3)</sup>	Units
$I_{CC1}$	Average Operating Current, $\overline{CE}_1 = V_{IL}, CE_2 = V_{CC} - 0.2$ , Output Open, $V_{CC} = \text{Max}$ .	$f = f_{max}$	35	40	mA
		$f = 1 \text{ MHz}$	4	5	
$I_{SB}$	TTL Standby Current $\overline{CE}_1 \checkmark V_{IH}, CE_2 \checkmark V_{IL}, V_{CC} = \text{Max.}, f = 0$	L	0.5	1	mA
		LL	0.3	1	
$I_{SB1}$	CMOS Standby Current, $\overline{CE}_1 \checkmark V_{CC} - 0.2V, CE_2 \checkmark 0.2V,$ $V_{IN} \checkmark V_{CC} - 0.2V \text{ or } V_{IN} \checkmark 0.2V, V_{CC} = \text{Max.}, f = 0$	L	10	15	$\mu A$
		LL	5	7	

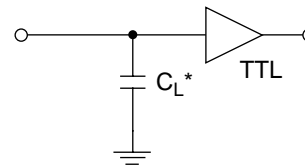
**NOTES:**

1. These are absolute values with respect to device ground and all overshoots due to system or tester noise are included.
2.  $V_{IL}$  (Min.) = -3.0V for pulse width <  $t_{RC}/2$ .
3. Maximum value.

**AC Test Conditions**

Input Pulse Levels	0 to 2.0V
Input Rise and Fall Times	5 ns
Timing Reference Levels	1.1V
Output Load	see below

**AC Test Loads and Waveforms**



$C_L = 30pF + 1TTL \text{ Load}$

\* Includes scope and jig capacitance

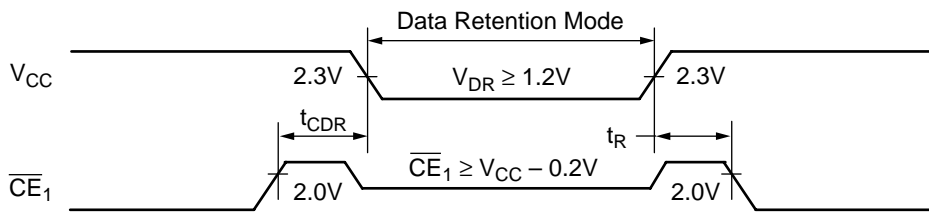
**Data Retention Characteristics**

Symbol	Parameter	Power	Min.	Typ. <sup>(2)</sup>	Max.	Units	
$V_{DR}$	$V_{CC}$ for Data Retention $\overline{CE}_1 \geq V_{CC} - 0.2V$ , $CE_2 < 0.2V$ , $V_{IN} \geq V_{CC} - 0.2V$ , or $V_{IN} \leq 0.2V$		1.2	—	3.0	V	
$I_{CCDR}$	Data Retention Current $\overline{CE}_1 \geq V_{DR} - 0.2V$ , $CE_2 < 0.2V$ , $V_{IN} \geq V_{CC} - 0.2V$ , or $V_{IN} \leq 0.2V$ , $V_{DR} = 1.2V$	Com'l	L	—	1	3	$\mu A$
			LL	—	0.5	2	
		Ind.	L	—	—	5	
			LL	—	—	4	
$t_{CDR}$	Chip Deselect to Data Retention Time		0	—	—	ns	
$t_R$	Operation Recovery Time (see Retention Waveform)		$t_{RC}^{(1)}$	—	—	ns	

**NOTES:**

- $t_{RC}$  = Read Cycle Time
- $T_A = +25^\circ C$ .

**Low  $V_{CC}$  Data Retention Waveform (1) ( $\overline{CE}_1$  Controlled)**



**Key to Switching Waveforms**

WAVEFORM	INPUTS	OUTPUTS
	MUST BE STEADY	WILL BE STEADY
	MAY CHANGE FROM H TO L	WILL BE CHANGING FROM H TO L
	MAY CHANGE FROM L TO H	WILL BE CHANGING FROM L TO H
	DON'T CARE: ANY CHANGE PERMITTED	CHANGING: STATE UNKNOWN
	DOES NOT APPLY	CENTER LINE IS HIGH IMPEDANCE "OFF" STATE

**AC Electrical Characteristics**

(over all temperature ranges)

**Read Cycle**

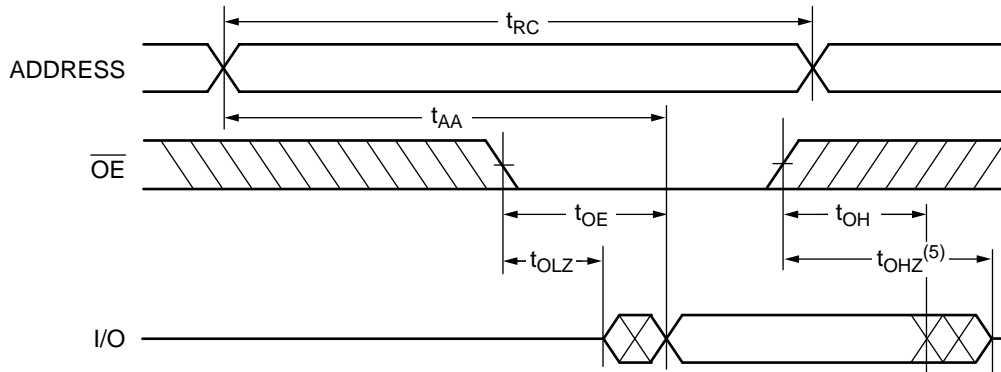
Parameter Name	Parameter	70		85		Unit
		Min.	Max.	Min.	Max.	
$t_{RC}$	Read Cycle Time	70	—	85	—	ns
$t_{AA}$	Address Access Time	—	70	—	85	ns
$t_{ACS1}$	Chip Enable Access Time	—	70	—	85	ns
$t_{ACS2}$	Chip Enable Access Time	—	70	—	85	ns
$t_{OE}$	Output Enable to Output Valid	—	40	—	85	ns
$t_{CLZ1}$	Chip Enable to Output in Low Z	10	—	10	—	ns
$t_{CLZ2}$	Chip Enable to Output in Low Z	10	—	10	—	ns
$t_{OLZ}$	Output Enable to Output in Low Z	5	—	10	—	ns
$t_{CHZ}$	Chip Disable to Output in High Z	—	30	—	30	ns
$t_{OHZ}$	Output Disable to Output in High Z	—	25	—	30	ns
$t_{OH}$	Output Hold from Address Change	10	—	10	—	ns

**Write Cycle**

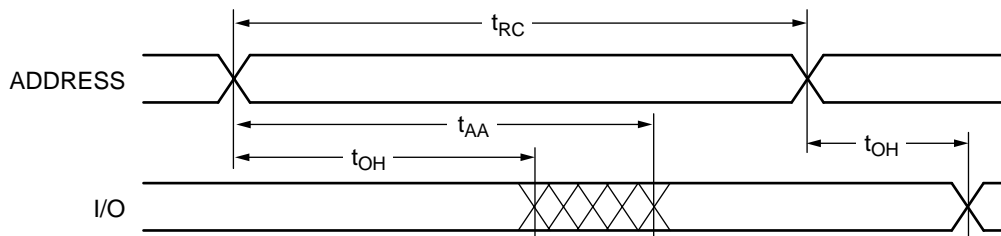
Parameter Name	Parameter	70		85		Unit
		Min.	Max.	Min.	Max.	
$t_{WC}$	Write Cycle Time	70	—	85	—	ns
$t_{CW}$	Chip Enable to End of Write	60	—	70	—	ns
$t_{AS}$	Address Setup Time	0	—	0	—	ns
$t_{AW}$	Address Valid to End of Write	60	—	70	—	ns
$t_{WP}$	Write Pulse Width	50	—	60	—	ns
$t_{WR}$	Write Recovery Time	0	—	0	—	ns
$t_{WHZ}$	Write to Output High-Z	—	20	—	25	ns
$t_{DW}$	Data Setup to End of Write	35	—	40	—	ns
$t_{DH}$	Data Hold from End of Write	0	—	0	—	ns

**Switching Waveforms (Read Cycle)**

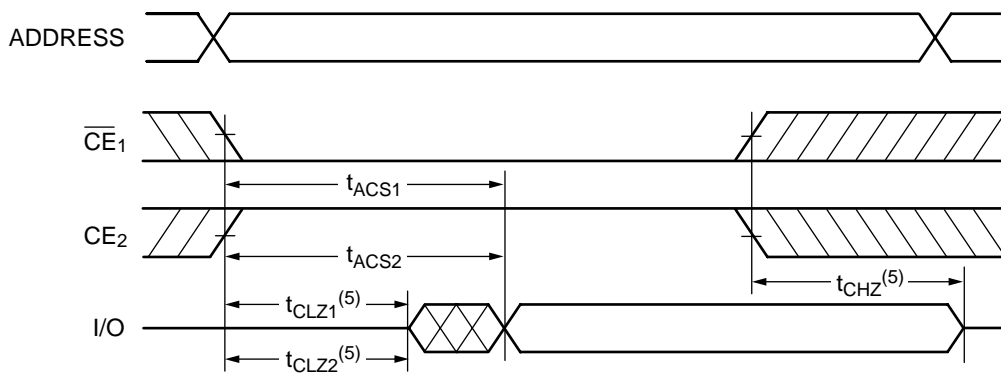
**Read Cycle 1<sup>(1, 2, 6)</sup>**



**Read Cycle 2<sup>(1, 2, 4, 6)</sup>**



**Read Cycle 3<sup>(1, 3, 4, 6)</sup>**

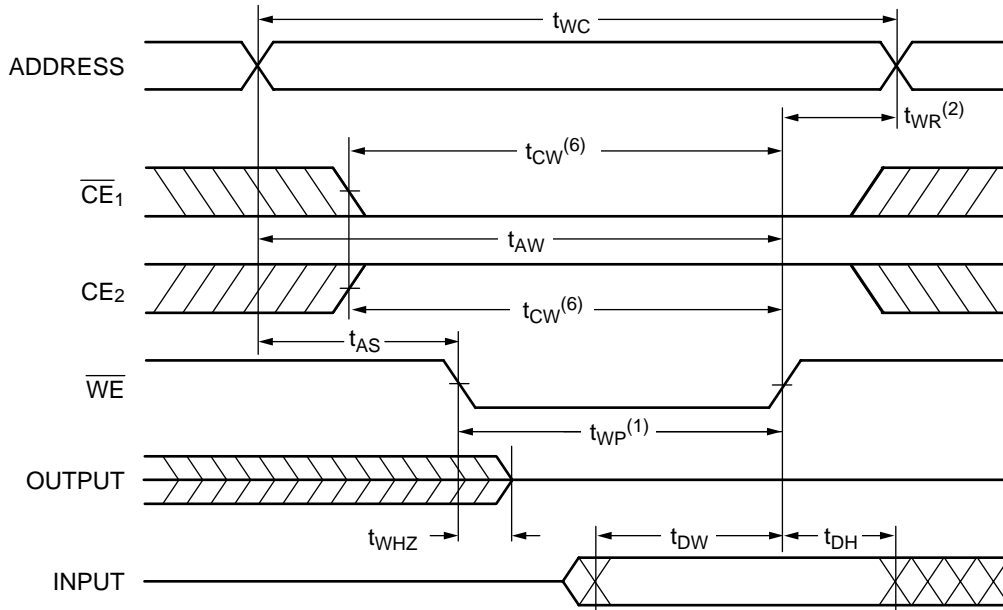


**NOTES:**

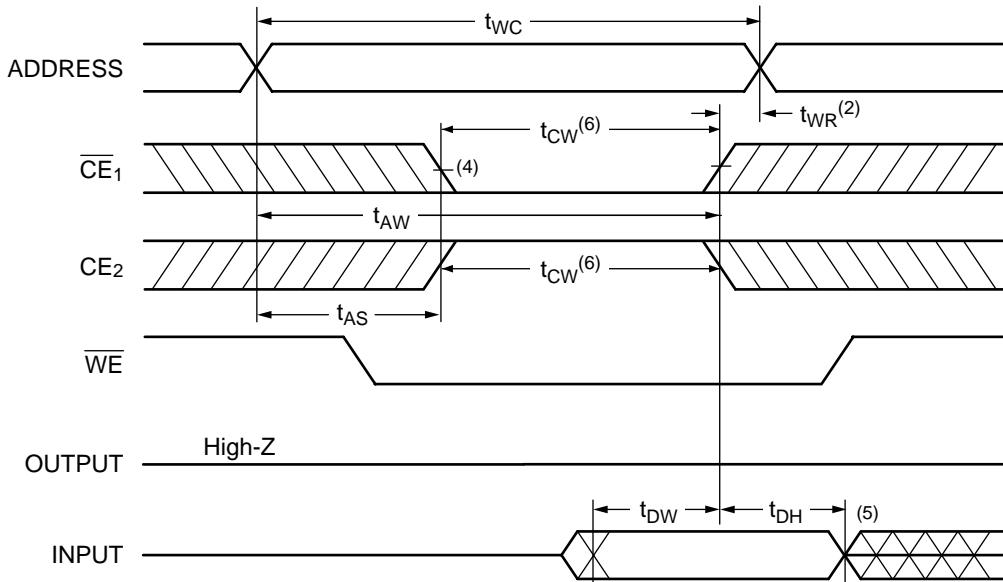
1.  $\overline{WE} = V_{IH}$ .
2.  $\overline{CE}_1 = V_{IL}$  and  $CE_2 = V_{IH}$ .
3. Address valid prior to or coincident with  $\overline{CE}_1$  transition LOW and/or  $CE_2$  transition HIGH.
4.  $\overline{OE} = V_{IL}$ .
5. Transition is measured  $\pm 500mV$  from steady state with  $C_L = 5pF$ . This parameter is guaranteed and not 100% tested.
6.  $CE_2$  is offered on BGA package only.

Switching Waveforms (Write Cycle)

Write Cycle 1 ( $\overline{WE}$  Controlled)<sup>(4, 7)</sup>



Write Cycle 2 (CE Controlled)<sup>(4, 7)</sup>



NOTES:

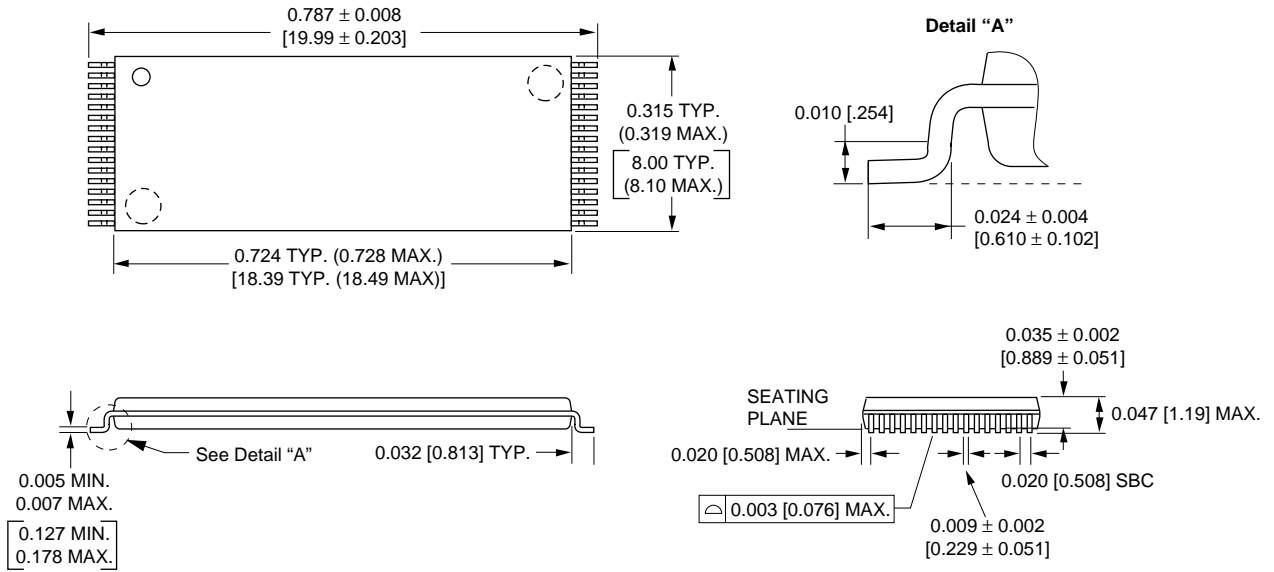
1. The internal write time of the memory is defined by the overlap of  $\overline{CE}_1$  and  $CE_2$  active and  $\overline{WE}$  low. All signals must be active to initiate and any one signal can terminate a write by going inactive. The data input setup and hold timing should be referenced to the second transition edge of the signal that terminates the write.
2.  $t_{WR}$  is measured from the earlier of  $\overline{CE}_1$  or  $\overline{WE}$  going high, or  $CE_2$  going LOW at the end of the write cycle.
3. During this period, I/O pins are in the output state so that the input signals of opposite phase to the outputs must not be applied.
4.  $\overline{OE} = V_{IL}$  or  $V_{IH}$ . However it is recommended to keep  $\overline{OE}$  at  $V_{IH}$  during write cycle to avoid bus contention.
5. If  $\overline{CE}_1$  is LOW and  $CE_2$  is HIGH during this period, I/O pins are in the output state. Then the data input signals of opposite phase to the outputs must not be applied to them.
6.  $t_{CW}$  is measured from  $\overline{CE}_1$  going low or  $CE_2$  going HIGH to the end of write.
7.  $CE_2$  is offered on BGA package only.



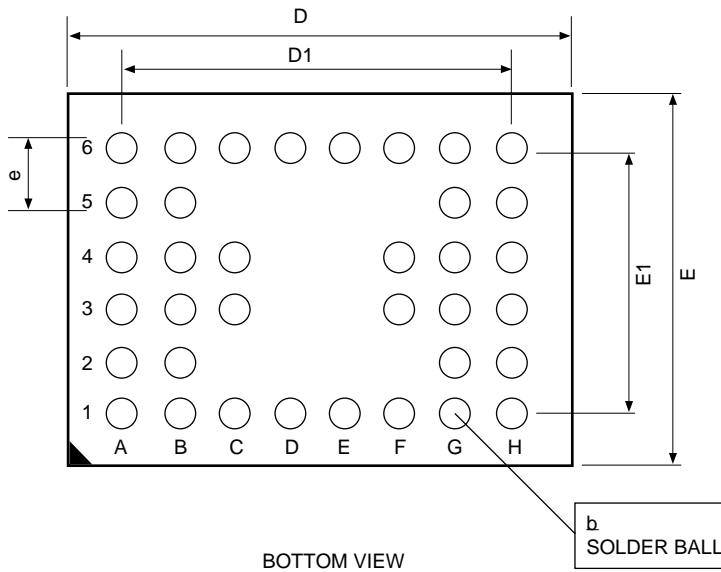
**Package Diagrams**

**32-Pin TSOP (Standard)**

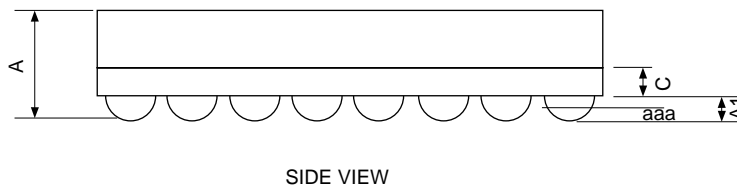
Units in inches [mm]



**36 Ball—8x10 BGA**



SYMBOL	UNIT.MM
A	1.05+0.15
A1	0.25±0.05
b	0.35±0.05
c	0.30(TYP)
D	10.00±0.10
E	8.00±0.10
E1	3.75
e	0.75TYP
aaa	0.10



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