Document Title

128K x 16 Hight Speed SRAM with 3.3V

Revision History

Revision No	History	Draft Date	Remark
0A	Initial Draft	September 12,2001	
0B	Revise typo on page 6	April 23,2004	

128K x 16 HIGH-SPEED CMOS STATIC RAM WITH 3.3V SUPPLY

FEATURES

- High-speed access time: 8, 10, 12, and 15 ns
- CMOS low power operation
- TTL and CMOS compatible interface levels
- Single 3.3V ± 10%power supply
- Fully static operation: no clock or refresh required
- Three state outputs
- Data control for upper and lower bytes
- Industrial temperature available

DESCRIPTION

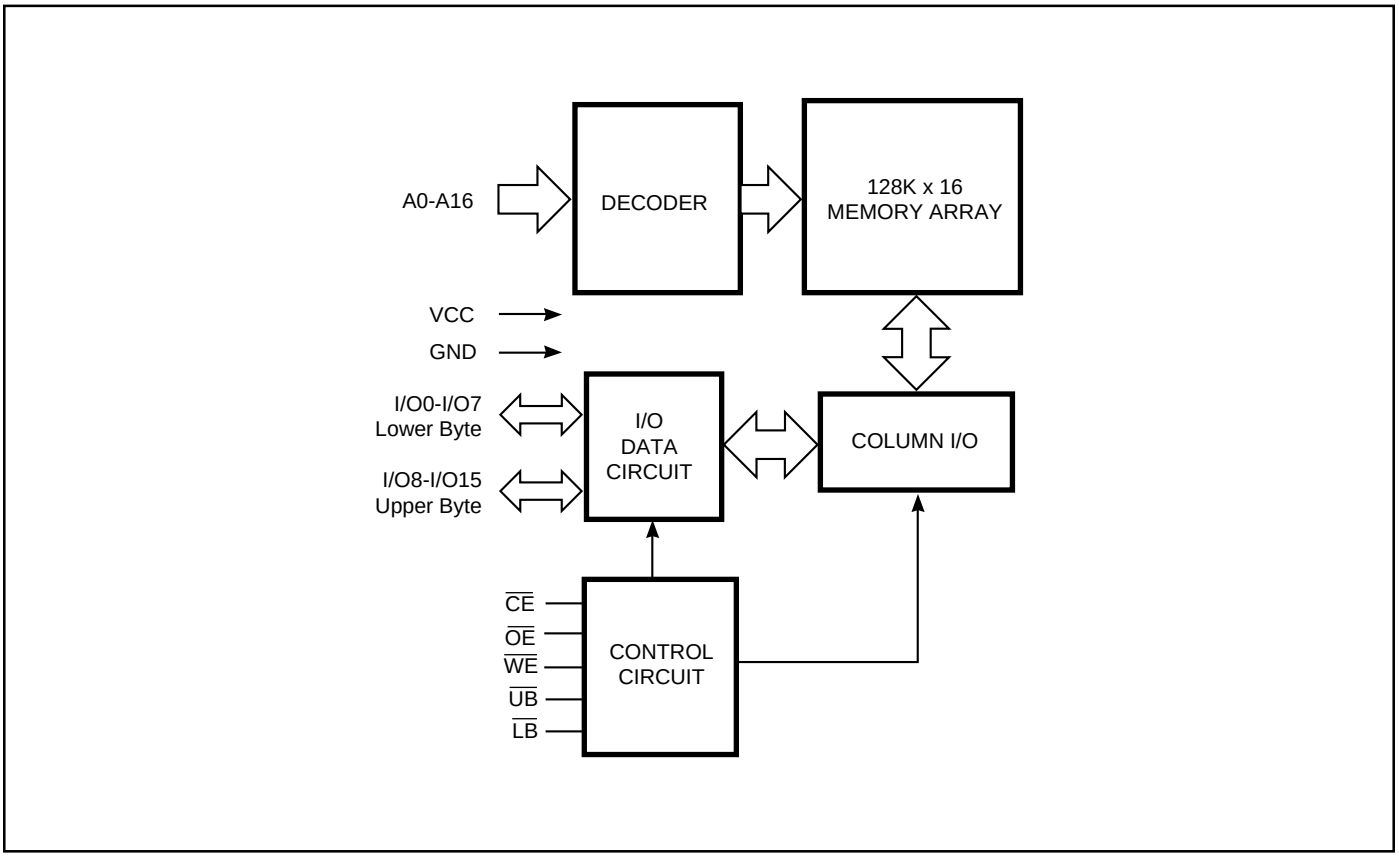
The *ICSI* IC61LV12816 is a high-speed, 2,097,152-bit static RAM organized as 131,072 words by 16 bits. It is fabricated using *ICSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 8 ns with low power consumption.

When $\overline{CE}$ is HIGH (deselected), the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels.

Easy memory expansion is provided by using Chip Enable and Output Enable inputs, $\overline{CE}$ and $\overline{OE}$. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory. A data byte allows Upper Byte ($\overline{UB}$) and Lower Byte ($\overline{LB}$) access.

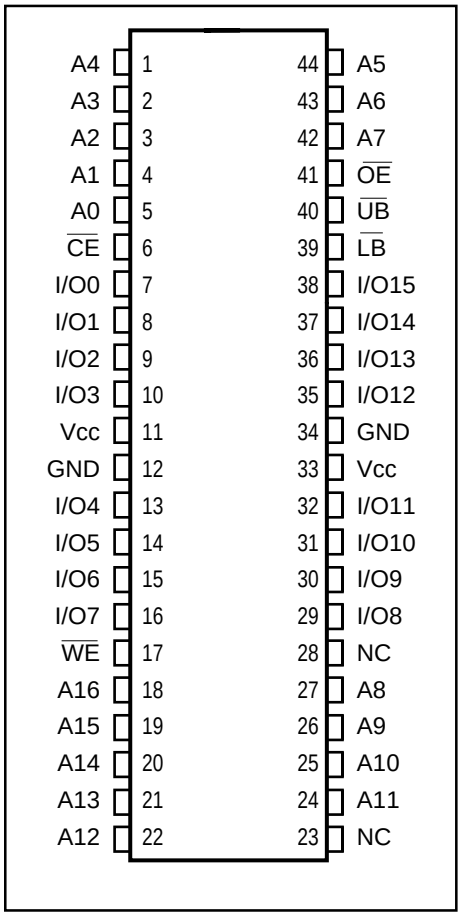
The IC61LV12816 is packaged in the JEDEC standard 44-pin 400mil SOJ, 44-pin 400mil TSOP-2, and 48-pin 6*8mm TF-BGA.

FUNCTIONAL BLOCK DIAGRAM

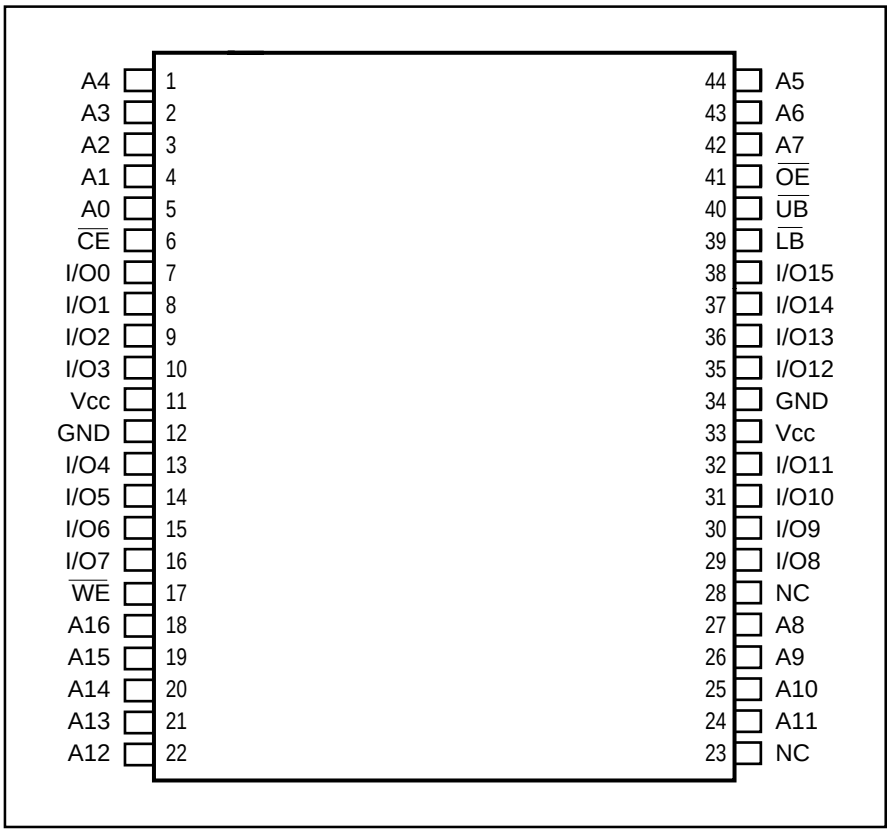


PIN CONFIGURATIONS

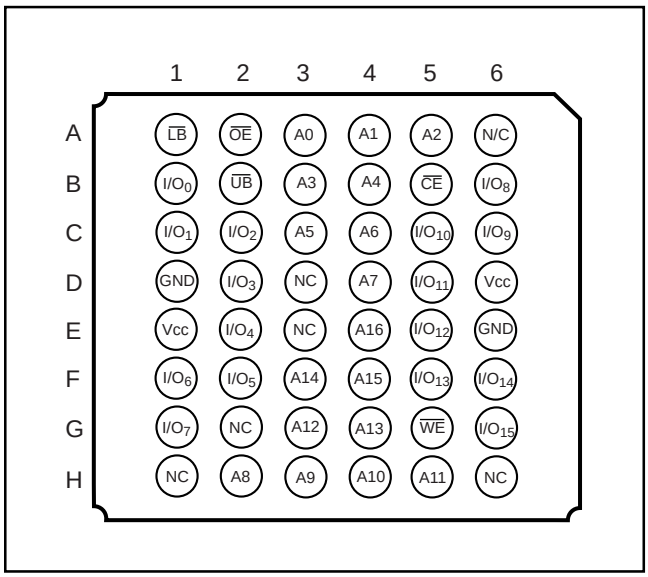
44-Pin SOJ



44-Pin TSOP-2



48-Pin TF-BGA



PIN DESCRIPTIONS

A0-A16	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
$\overline{LB}$	Lower-byte Control (I/O0-I/O7)
$\overline{UB}$	Upper-byte Control (I/O8-I/O15)
NC	No Connection
Vcc	Power
GND	Ground

OPERATING RANGE

Range	Ambient Temperature	Vcc
Commercial	0°C to +70°C	3.3V ± 10%
Industrial	–40°C to +85°C	3.3V ± 10%

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Parameter		Value	Unit
V_{CC}	Power Supply Voltage Relative to GND		–0.5 to 4.0	V
V_{TERM}	Terminal Voltage with Respect to GND		–0.5 to Vcc+0.5	V
T_{STG}	Storage Temperature		–65 to +150	°C
T_{BIAS}	Temperature Under Bias:	Com.	–65 to +85	°C
		Ind.	–45 to +90	°C
P_T	Power Dissipation		2.0	W
I_{OUT}	DC Output Current (LOW)		+20	mA

Note:
1. Stress 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.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA		2.4	—	V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA		—	0.4	V
V_{IH}	Input HIGH Voltage			2	V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage(1)			–0.3	0.8	V
I_{LI}	Input Leakage	GND ≤ V_{IN} ≤ V_{CC}	Com.	–1	1	µA
			Ind.	–5	5	µA
I_{LO}	Output Leakage	GND ≤ V_{OUT} ≤ V_{CC}, Outputs Disabled	Com.	–1	1	µA
			Ind.	–5	5	µA

Notes:
1. V_{IL} (min.) = –2.0V for pulse width less than 10 ns.
2. The Vcc operating range for 8 ns is 3.3V +10%, -5%.

TRUTH TABLE

Mode	$\overline{WE}$	$\overline{CE}$	$\overline{OE}$	$\overline{LB}$	$\overline{UB}$	I/O PIN I/O0-I/O7	I/O PIN I/O8-I/O15	Vcc Current
Not Selected	X	H	X	X	X	High-Z	High-Z	I_{SB1}, I_{SB2}
Output Disabled	H	L	H	X	X	High-Z	High-Z	I_{CC}
	X	L	X	H	H	High-Z	High-Z	
Read	H	L	L	L	H	D_{OUT}	High-Z	I_{CC}
	H	L	L	H	L	High-Z	D_{OUT}	
	H	L	L	L	L	D_{OUT}	D_{OUT}	
Write	L	L	X	L	H	D_{IN}	High-Z	I_{CC}
	L	L	X	H	L	High-Z	D_{IN}	
	L	L	X	L	L	D_{IN}	D_{IN}	

POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	Test Conditions		-8 ns Min.	-8 ns Max.	-10 ns Min.	-10 ns Max.	-12 ns Min.	-12 ns Max.	-15 ns Min.	-15 ns Max.	Unit
I_{CC}	Vcc Dynamic Operating Supply Current	V_{CC} = Max., $\overline{CE}$ = V_{IL} I_{OUT} = 0 mA, f = f_{MAX}	Com. Ind.	— —	220 230	— —	200 210	— —	180 190	— —	165 175	mA
I_{SB1}	TTL Standby Current (TTL Inputs)	V_{CC} = Max., V_{IN} = V_{IH} or V_{IL} $\overline{CE} \geq V_{IH}$, f = 0	Com. Ind.	— —	30 40	— —	30 40	— —	30 40	— —	30 40	mA
I_{SB2}	CMOS Standby Current (CMOS Inputs)	V_{CC} = Max., $\overline{CE} \geq V_{CC}$ – 0.2V, $V_{IN} \geq V_{CC}$ – 0.2V, or $V_{IN} \leq$ 0.2V, f = 0	Com. Ind.	— —	10 15	— —	10 15	— —	10 15	— —	10 15	mA

Note:
1. At f = f_{MAX}, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.

CAPACITANCE[1]

Symbol	Parameter	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	pF
C_{OUT}	Input/Output Capacitance	V_{OUT} = 0V	8	pF

Note:
1. Tested initially and after any design or process changes that may affect these parameters.

READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

		-8		-10		-12		-15		
Symbol	Parameter	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Unit
t_{RC}	Read Cycle Time	8	—	10	—	12	—	15	—	ns
t_{AA}	Address Access Time	—	8	—	10	—	12	—	15	ns
t_{OHA}	Output Hold Time	3	—	3	—	3	—	3	—	ns
t_{ACE}	$\overline{CE}$ Access Time	—	8	—	10	—	12	—	15	ns
t_{DOE}	$\overline{OE}$ Access Time	—	3	—	4	—	5	—	6	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	—	3	—	4	—	5	0	6	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	0	—	0	—	0	—	0	—	ns
t_{HZCE}[2]	$\overline{CE}$ to High-Z Output	0	3	0	4	0	5	0	8	ns
t_{LZCE}[2]	$\overline{CE}$ to Low-Z Output	3	—	3	—	3	—	3	—	ns
t_{BA}	$\overline{LB}$, $\overline{UB}$ Access Time	—	3	—	4	—	5	—	6	ns
t_{HZB}[2]	$\overline{LB}$, $\overline{UB}$ to High-Z Output	0	3	0	4	0	5	0	6	ns
t_{LZB}[2]	$\overline{LB}$, $\overline{UB}$ to Low-Z Output	0	—	0	—	0	—	0	—	ns

Notes:
1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.

AC TEST CONDITIONS

Parameter	Unit
Input Pulse Level	0V to 3.0V
Input Rise and Fall Times	3 ns
Input and Output Timing and Reference Level	1.5V
Output Load	See Figures 1 and 2

Notes:
1. The Vcc operating range for 8 ns is 3.3V +10%, -5%.

AC TEST LOADS

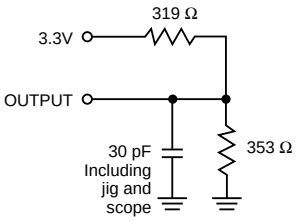


Figure 1.

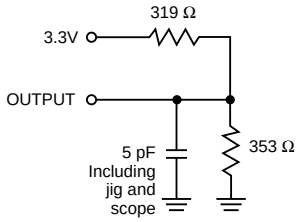
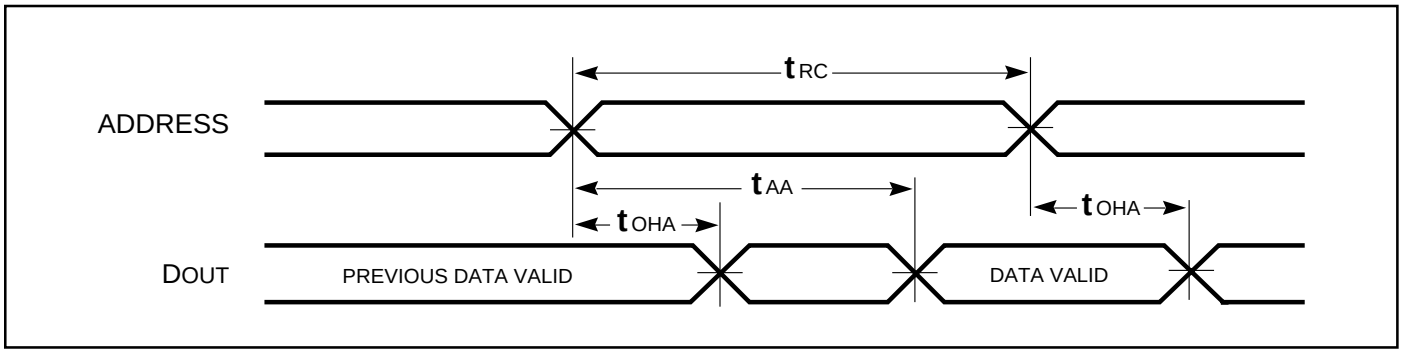


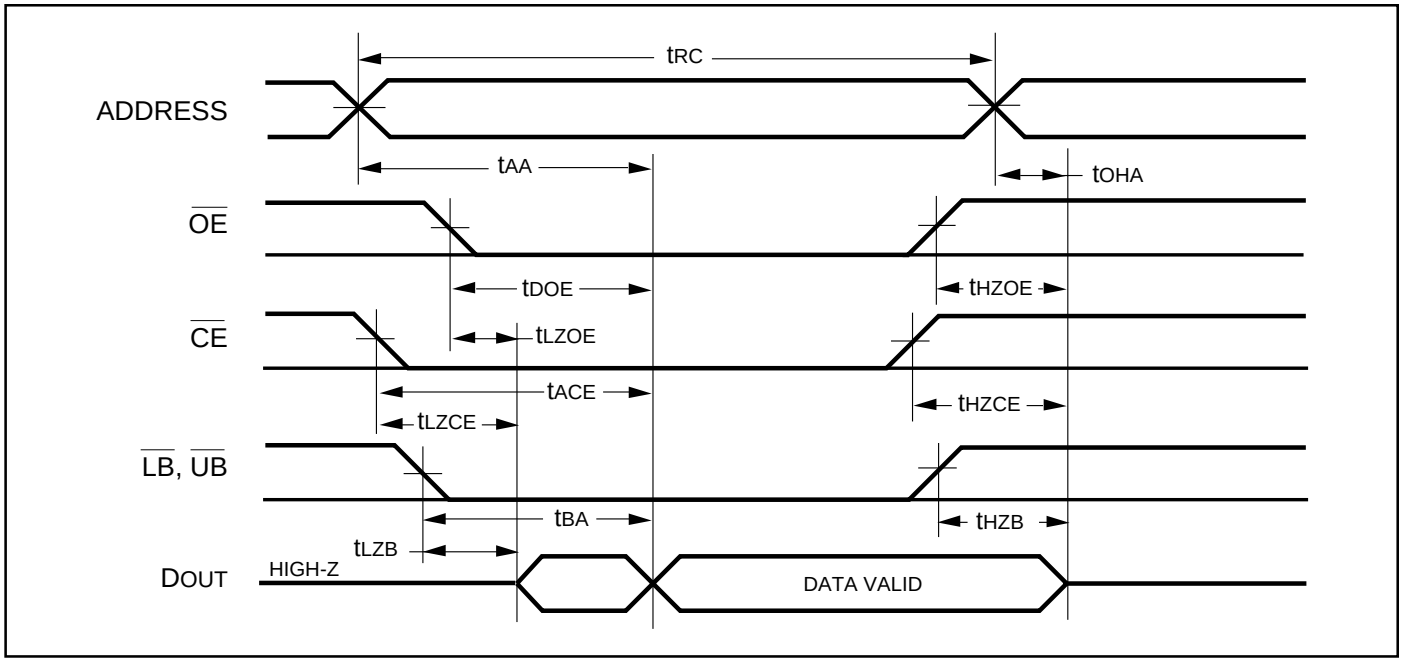
Figure 2.

AC WAVEFORMS

READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CE}$ = $\overline{OE}$ = V_{IL}, $\overline{UB}$ or $\overline{LB}$ = V_{IL})



READ CYCLE NO. 2[1,3]



Notes:
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{UB}$, or $\overline{LB}$ = V_{IL}.
3. Address is valid prior to or coincident with $\overline{CE}$ LOW transition.

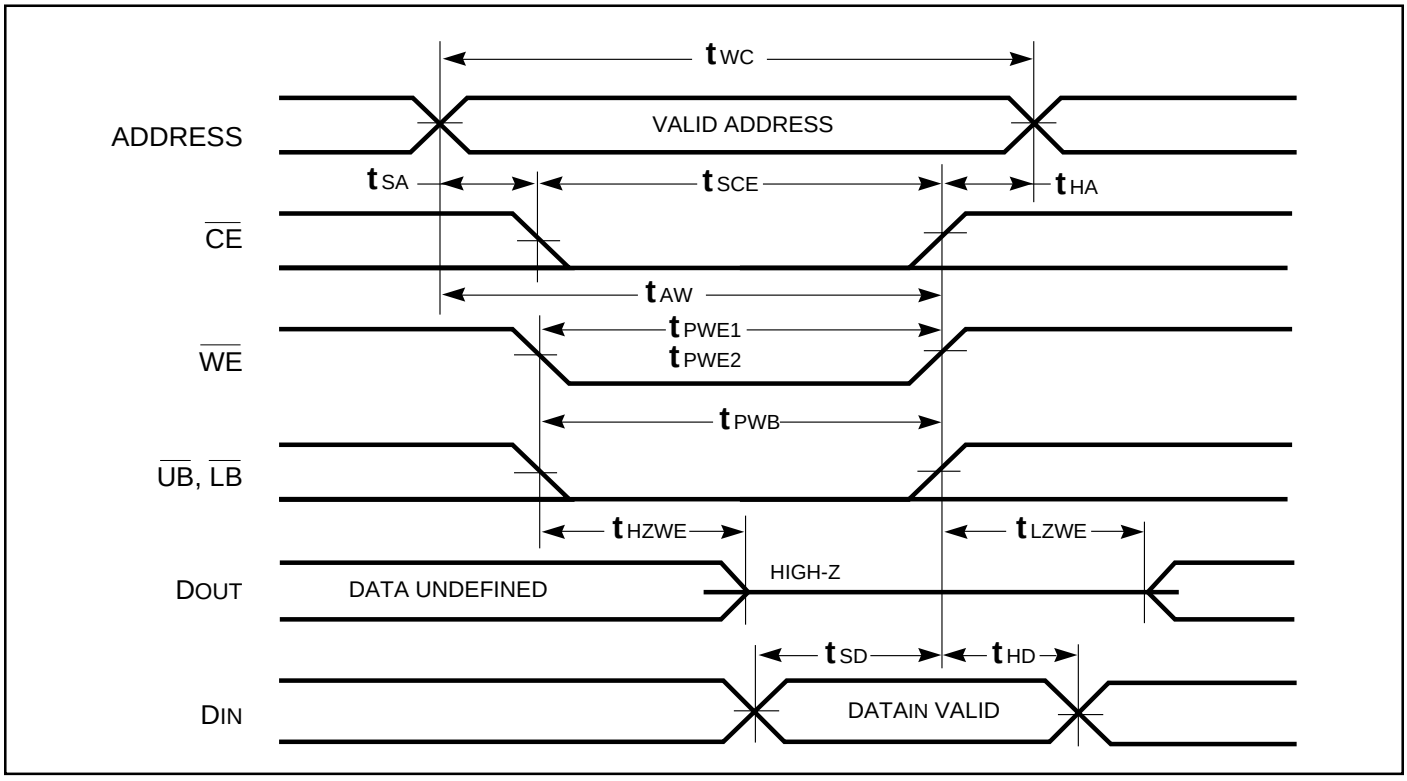
WRITE CYCLE SWITCHING CHARACTERISTICS[1,3] (Over Operating Range)

Symbol	Parameter	-8		-10		-12		-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t_{WC}	Write Cycle Time	8	—	10	—	12	—	15	—	ns
t_{SCE}	$\overline{CE}$ to Write End	7	—	8	—	8	—	10	—	ns
t_{AW}	Address Setup Time to Write End	7	—	8	—	8	—	10	—	ns
t_{HA}	Address Hold from Write End	0	—	0	—	0	—	0	—	ns
t_{SA}	Address Setup Time	0	—	0	—	0	—	0	—	ns
t_{PWB}	$\overline{LB}$, $\overline{UB}$ Valid to End of Write	7	—	8	—	9	—	10	—	ns
t_{PWE}[4]	$\overline{WE}$ Pulse Width	7	—	8	—	9	—	10	—	ns
t_{SD}	Data Setup to Write End	4.5	—	5	—	6	—	7	—	ns
t_{HD}	Data Hold from Write End	0	—	0	—	0	—	0	—	ns
t_{HZWE}[2]	$\overline{WE}$ LOW to High-Z Output	—	3	—	4	—	5	—	6	ns
t_{LZWE}[2]	$\overline{WE}$ HIGH to Low-Z Output	0	—	0	—	0	—	0	—	ns

Notes:
1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.
3. The internal write time is defined by the overlap of $\overline{CE}$ LOW and $\overline{UB}$ or $\overline{LB}$, and $\overline{WE}$ LOW. All signals must be in valid states to initiate a Write, but any one can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the write.
4. Tested with $\overline{OE}$ Hith.

AC WAVEFORMS

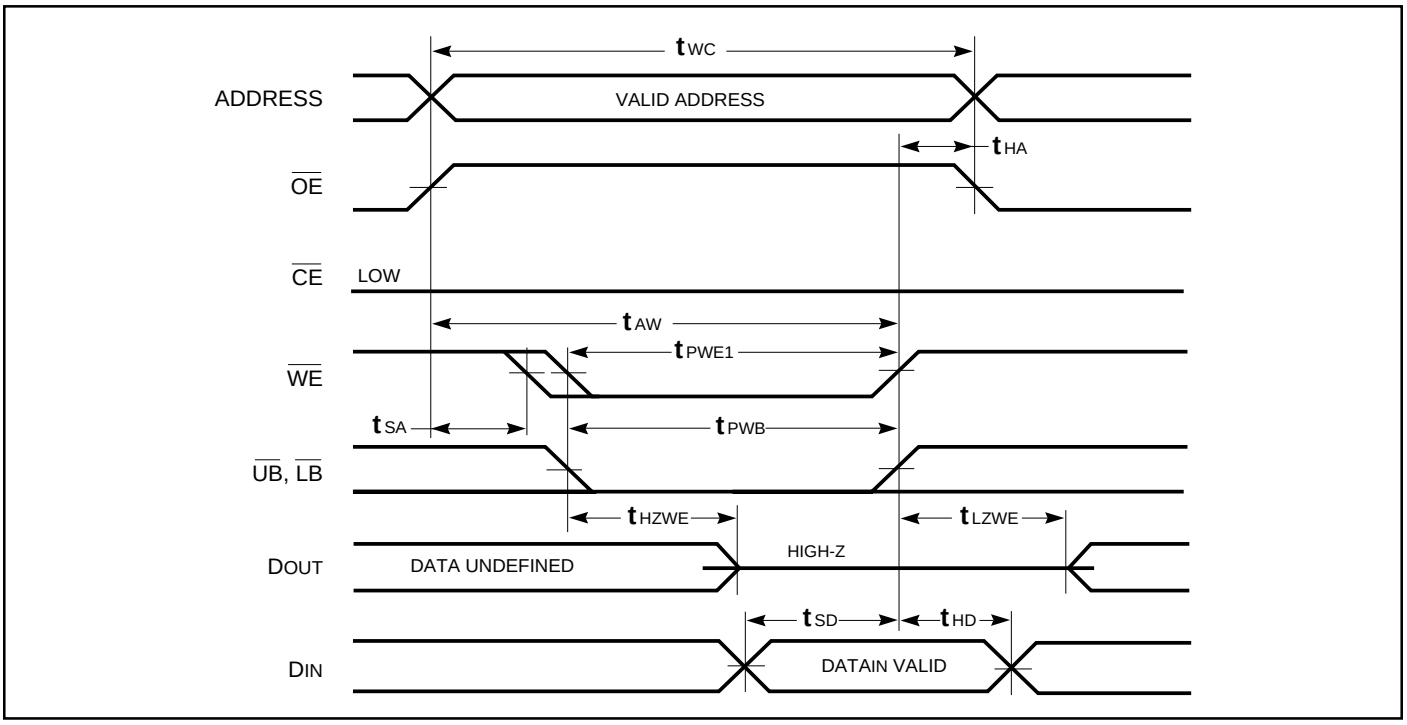
WRITE CYCLE NO. 1 [1,2] ($\overline{CE}$ Controlled, $\overline{OE}$ is HIGH or LOW)



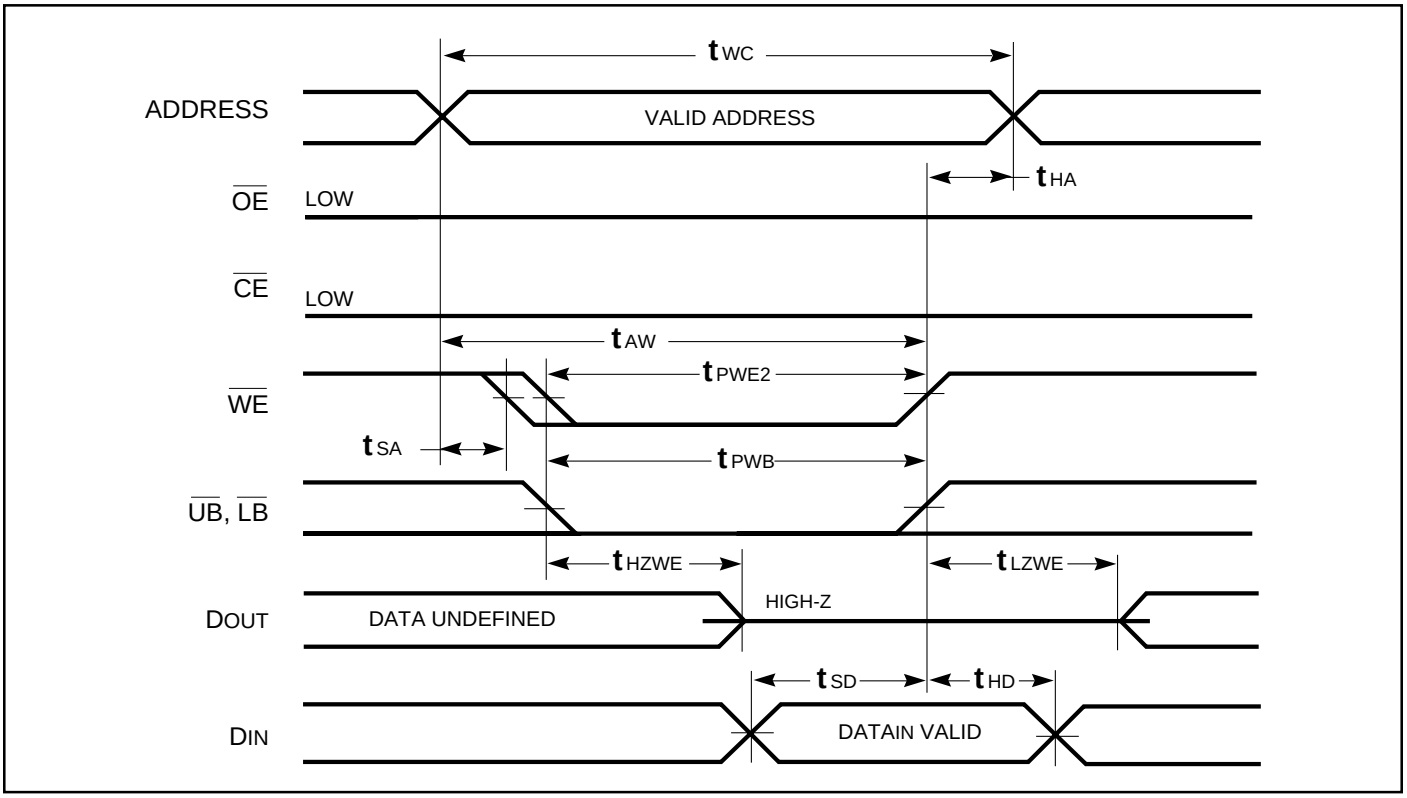
Notes:

1. WRITE is an internally generated signal asserted during an overlap of the LOW states on the $\overline{CE}$ and $\overline{WE}$ inputs and at least one of the $\overline{LB}$ and $\overline{UB}$ inputs being in the LOW state.
2. WRITE = ($\overline{CE}$) [($\overline{LB}$) = ($\overline{UB}$)] ($\overline{WE}$).

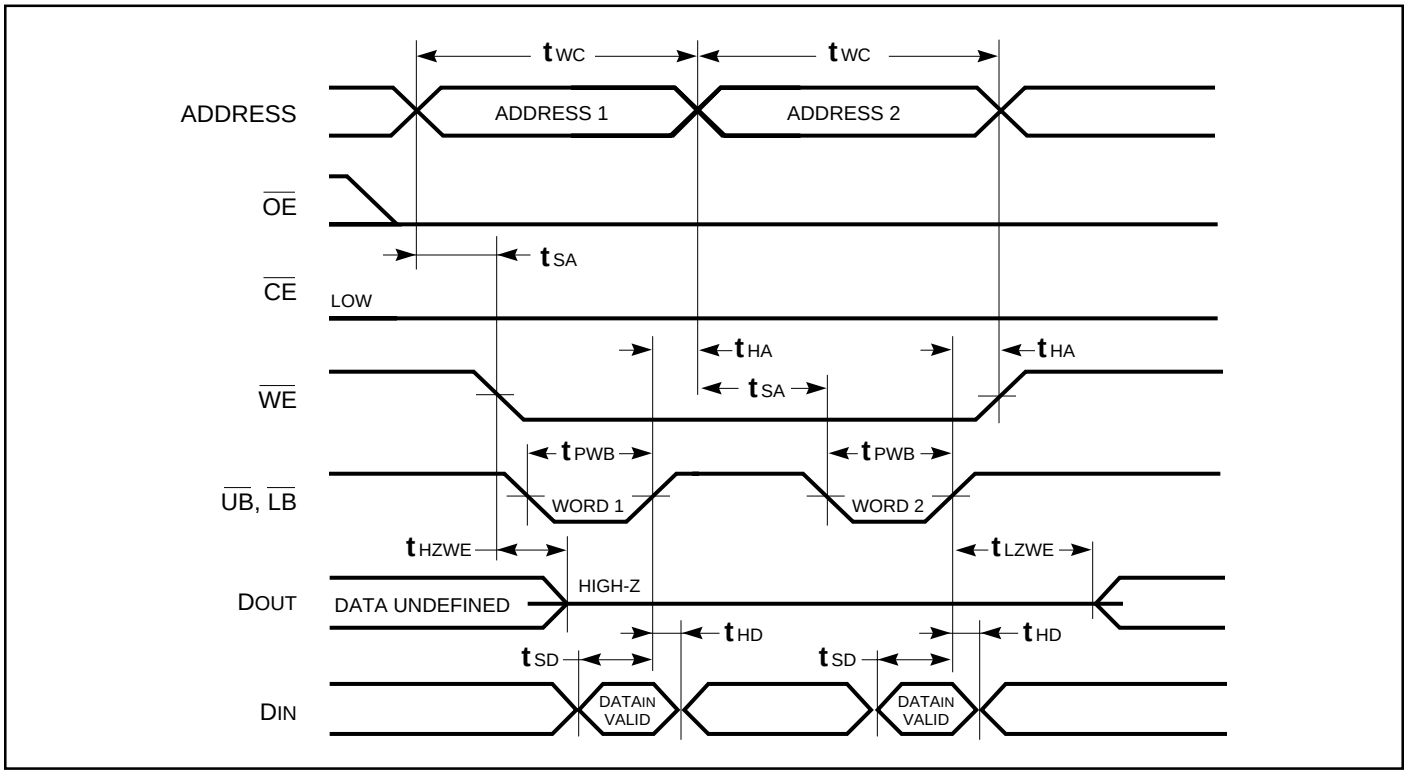
WRITE CYCLE NO. 2[1] ($\overline{WE}$ Controlled. $\overline{OE}$ is HIGH During Write Cycle)



WRITE CYCLE NO. 3 ($\overline{WE}$ Controlled. $\overline{OE}$ is LOW During Write Cycle)



WRITE CYCLE NO. 4 [1,3]($\overline{LB}$, $\overline{UB}$ Controlled, Back-to-Back Write)



Notes:

1. The internal Write time is defined by the overlap of $\overline{CE}$ = LOW, $\overline{UB}$ and/or $\overline{LB}$ = LOW, and $\overline{WE}$ = LOW. All signals must be in valid states to initiate a Write, but any can be deasserted to terminate the Write. The t_{SA}, t_{HA}, t_{SD}, and t_{HD} timing is referenced to the rising or falling edge of the signal that terminates the Write.
2. Tested with $\overline{OE}$ HIGH for a minimum of 4 ns before $\overline{WE}$ = LOW to place the I/O in a HIGH-Z state.
3. $\overline{WE}$ may be held LOW across many address cycles and the $\overline{LB}$, $\overline{UB}$ pins can be used to control the Write function.

ORDERING INFORMATION
Commercial Range: 0°C to +70°C

Speed (ns)	Order Part No.	Package
8	IC61LV12816-8B	6*8mm TF-BGA
8	IC61LV12816-8K	400mil SOJ
8	IC61LV12816-8T	400mil TSOP-2
10	IC61LV12816-10B	6*8mm TF-BGA
10	IC61LV12816-10K	400mil SOJ
10	IC61LV12816-10T	400mil TSOP-2
12	IC61LV12816-12B	6*8mm TF-BGA
12	IC61LV12816-12K	400mil SOJ
12	IC61LV12816-12T	400mil TSOP-2
15	IC61LV12816-15B	6*8mm TF-BGA
15	IC61LV12816-15K	400mil SOJ
15	IC61LV12816-15T	400mil TSOP-2

ORDERING INFORMATION
Industrial Range: –40°C to +85°C

Speed (ns)	Order Part No.	Package
8	IC61LV12816-8BI	6*8mm TF-BGA
8	IC61LV12816-8KI	400mil SOJ
8	IC61LV12816-8TI	400mil TSOP-2
10	IC61LV12816-10BI	6*8mm TF-BGA
10	IC61LV12816-10KI	400mil SOJ
10	IC61LV12816-10TI	400mil TSOP-2
12	IC61LV12816-12BI	6*8mm TF-BGA
12	IC61LV12816-12KI	400mil SOJ
12	IC61LV12816-12TI	400mil TSOP-2
15	IC61LV12816-15BI	6*8mm TF-BGA
15	IC61LV12816-15KI	400mil SOJ
15	IC61LV12816-15TI	400mil TSOP-2

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