V53C364805A
3.3 VOLT 8M X 8 EDO PAGE MODE CMOS DYNAMIC RAM

V53C364805A	40	50	60
Max. $\overline{RAS}$ Access Time, (t_{RAC})	40 ns	50 ns	60 ns
Max. Column Address Access Time, (t_{CAA})	20 ns	25 ns	30 ns
Min. EDO Page Mode Cycle Time, (t_{PC})	16 ns	20 ns	25 ns
Min. Read/Write Cycle Time, (t_{RC})	69 ns	84 ns	104 ns

Features

- 8M x 8-bit organization
- EDO Page Mode for a sustained data rate of 63 MHz
- $\overline{RAS}$ access time: 40, 50, 60 ns
- Low power dissipation
- Read-Modify-Write, $\overline{RAS}$-Only Refresh, $\overline{CAS}$-Before-$\overline{RAS}$ Refresh, Hidden Refresh Self Refresh (L-version)
- Refresh Interval: 8192 cycles/128 ms
- Available in 32-pin 400 mil SOJ, and 32-pin 400 mil TSOP-II
- Single +3.3 V ±0.3 V Power Supply
- LVTTL Interface

Description

The V53C364805A is a 8,388,608 x 8 bit high-performance CMOS dynamic random access memory. The V53C364805A offers Page mode operation with Extended Data Output. The V53C364805A has an asymmetric address, 13-bit row and 10-bit column.

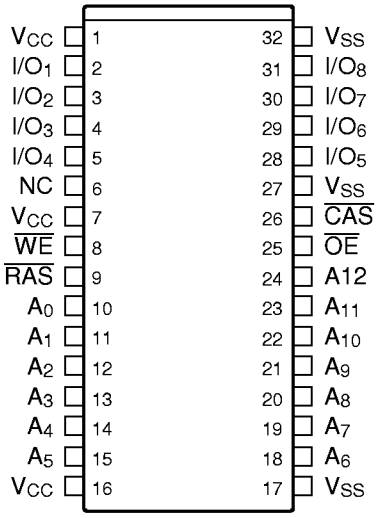
All inputs are LVTTL compatible. Page Mode operation allows random access up to 1024 x 8 bits, within a page, with cycle times as short as 16 ns.

These features make the V53C364805A ideally suited for a wide variety of high performance computer systems and peripheral applications.

Device Usage Chart

Operating Temperature Range	Package Outline		Access Time (ns)			Power		Temperature Mark
	K	T	40	50	60	Std.	L	
0°C to 70°C	•	•	•	•	•	•	•	Blank

32 Pin Plastic SOJ /TSOP-II PIN CONFIGURATION Top View



316580500-02

Pin Names

A_0–A_{12}	Row, Column Address Inputs
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
$\overline{WE}$	Write Enable
$\overline{OE}$	Output Enable
I/O_1–I/O_8	Data Input, Output
V_{CC}	+3.3V Supply
V_{SS}	0V Supply
NC	No Connect

Absolute Maximum Ratings*

Operating temperature range .....0 to 70 °C
Storage temperature range ..... -55 to 150 °C
Soldering temperature .....260 °C
Soldering time.....10 s
Input/output voltage .... -0.5 to min (V_{CC}+0.5, 4.6) V
Power supply voltage .....-0.5V to 4.6 V
Power dissipation ..... 1.0 W
Data out current (short circuit) ..... 50 mA

*Note: Operation above Absolute Maximum Ratings can adversely affect device reliability.

Capacitance*

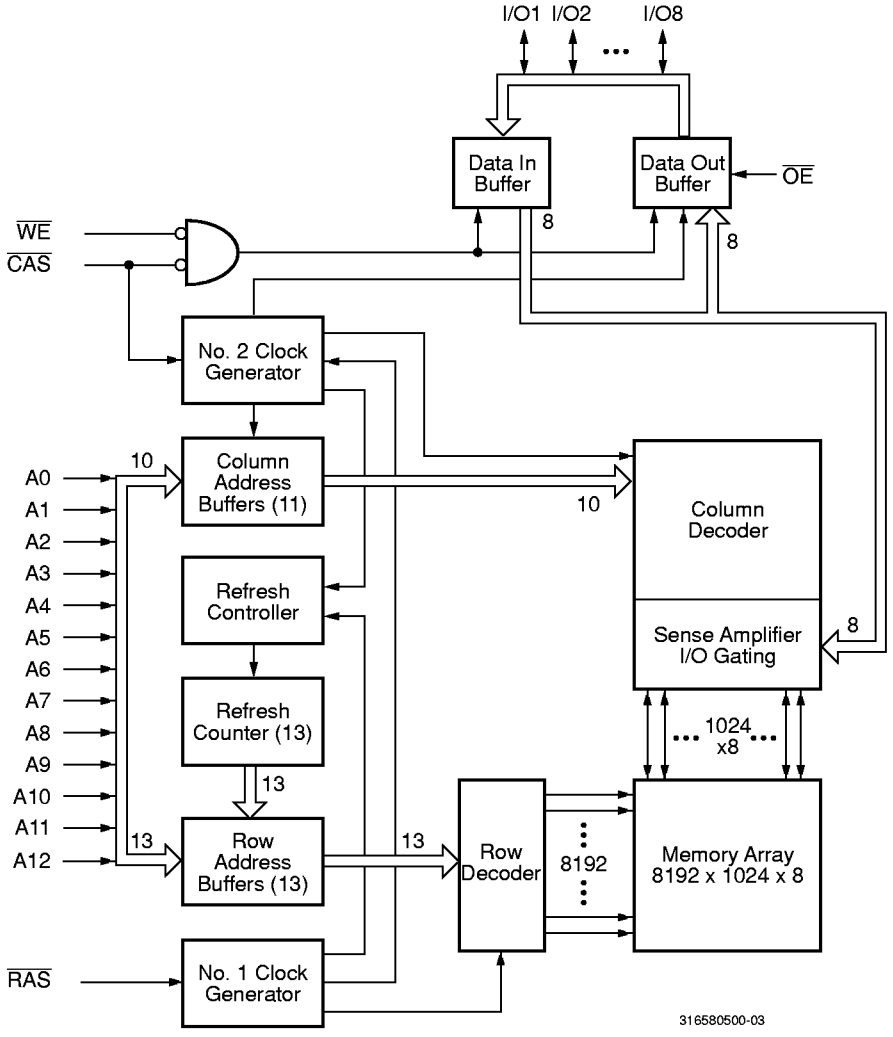
T_A = 25°C, V_{CC} = 3.3 V ± 0.3 V, V_{SS} = 0 V, f = 1 Mhz

Symbol	Parameter	Min.	Max.	Unit
C_{IN1}	Address Input	—	5	pF
C_{IN2}	$\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$	—	7	pF
C_{OUT}	Data Input/Output	—	7	pF

*Note: Capacitance is sampled and not 100% tested.

Block Diagram

8M x 8



DC and Operating Characteristics (1, 2)

T_A = 0°C to 70°C, V_{CC} = 3.3 V ± 0.3 V, V_{SS} = 0 V, unless otherwise specified.

Symbol	Parameter	Access Time	V53C364805A			Unit	Test Conditions	Notes
			Min.	Typ.	Max.			
I_{LI}	Input Leakage Current (any input pin)		–2		2	µA	$V_{SS} \le V_{IN} \le V_{CC}$	
I_{LO}	Output Leakage Current (for High-Z State)		–2		2	µA	$V_{SS} \le V_{OUT} \le V_{CC}$ $\overline{RAS}$, $\overline{CAS}$ at V_{IH}	
I_{CC1}	V_{CC} Supply Current, Operating	40			125	mA	$t_{RC} = t_{RC}$ (min.)	2, 3, 4
		50			100			
		60			85			
I_{CC2}	V_{CC} Supply Current Standby Current				1	mA	$\overline{RAS}$, $\overline{CAS}$ at V_{IH} other inputs ≥ V_{SS}	
I_{CC3}	V_{CC} Supply Current, $\overline{RAS}$-Only Refresh	40			125	mA	$t_{RC} = t_{RC}$ (min.)	2, 4
		50			100			
		60			85			
I_{CC4}	V_{CC} Supply Current, EDO Page Mode Operation	40			140	mA	Minimum Cycle	2, 3, 4
		50			105			
		60			85			
I_{CC5}	V_{CC} Supply Current				500	µA	$\overline{RAS} \ge V_{CC} - 0.2$ V, $\overline{CAS} \ge V_{CC} - 0.2$ V	
	(L-version)				120			
I_{CC6}	V_{CC} Supply Current, during $\overline{CAS}$-before-$\overline{RAS}$ Refresh	40			170	mA		2, 4
		50			140			
		60			115			
I_{CC7}	Self Refresh Current (L-version)				400	µA		
V_{IL}	Input Low Voltage		–0.3		0.8	V		1
V_{IH}	Input High Voltage		2.0		V_{CC}+0.3	V		1
V_{OL}	Output Low Voltage (LVTTL)				0.4	V	I_{OL} = 2 mA	1
V_{OH}	Output High Voltage (LVTTL)		2.4			V	I_{OH} = –2 mA	1
V_{OL}	Output Low Voltage (LVCMOS)				0.2	V	I_{OL} = 100 µA	1
V_{OH}	Output High Voltage (LVCMOS)		V_{CC}–0.2			V	I_{OH} = –100 µA	1

Truth Table

FUNCTION		$\overline{RAS}$	$\overline{CAS}$	$\overline{WE}$	$\overline{OE}$	ROW ADDR	COL ADDR	I/O1-I/O4
Standby		H	H → X	X	X	X	X	High Impedance
Read		L	L	H	L	ROW	COL	Data Out
Early-Write		L	L	L	X	ROW	COL	Data In
Delayed-Write		L	L	H → L	H	ROW	COL	Data In
Read-Modify-Write		L	L	H → L	L → H	ROW	COL	Data Out, Data In
EDO Page Mode Read	1st Cycle	L	H → L	H	L	ROW	COL	Data Out
	2nd Cycle	L	H → L	H	L	N/A	COL	Data Out
EDO Page Mode Early Write	1st Cycle	L	H → L	L	X	ROW	COL	Data In
	2nd Cycle	L	H → L	L	X	N/A	COL	Data In
EDO Page Mode RMW	1st Cycle	L	H → L	H → L	L → H	ROW	COL	Data Out, Data In
	2nd Cycle	L	H → L	H → L	L → H	N/A	COL	Data Out, Data In
$\overline{RAS}$ only refresh		L	H	X	X	ROW	N/A	High Impedance
$\overline{CAS}$-before-$\overline{RAS}$ refresh		H → L	L	H	X	X	N/A	High Impedance
Test Mode Entry		H → L	L	L	X	X	N/A	High Impedance
Hidden Refresh	READ	L→H→L	L	H	L	ROW	COL	Data Out
	WRITE	L→H→L	L	L	X	ROW	COL	Data In

AC Characteristics (6,7,8)

T_A = 0 to 70 °C, V_{CC} = 3.3 V±0.3V

#	Symbol	Parameter	-40		- 50		- 60		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.		
Common Parameters										
1	t_{RC}	Random read or write cycle time	69	–	84	–	104	–	ns	
2	t_{RAS}	$\overline{RAS}$ pulse width	40	100k	50	100k	60	100k	ns	
3	t_{CAS}	$\overline{CAS}$ pulse width	6	10k	8	10k	10	10k	ns	
4	t_{RP}	$\overline{RAS}$ precharge time	25	–	30	–	40	–	ns	
5	t_{CP}	$\overline{CAS}$ precharge time	6	–	8	–	10	–	ns	
6	t_{ASR}	Row address setup time	0	–	0	–	0	–	ns	
7	t_{RAH}	Row address hold time	5	–	7	–	10	–	ns	
8	t_{ASC}	Column address setup time	0	–	0	–	0	–	ns	
9	t_{CAH}	Column address hold time	5	–	7	–	10	–	ns	
10	t_{RCD}	$\overline{RAS}$ to $\overline{CAS}$ delay time	9	30	11	37	14	45	ns	
11	t_{RAD}	$\overline{RAS}$ to column address delay	7	20	9	25	12	30	ns	
12	t_{RSH}	$\overline{RAS}$ hold time	6	–	8		10	–	ns	
13	t_{CSH}	$\overline{CAS}$ hold time	32	–	40		48	–	ns	
14	t_{CRP}	$\overline{CAS}$ to $\overline{RAS}$ precharge time	5	–	5	–	5	–	ns	
15	t_T	Transition time (rise and fall)	1	50	1	50	1	50	ns	7
16	t_{REF}	Refresh period for 8k-refresh	–	128	–	128	–	128	ms	
		Refresh period for L-version	–	256	–	256	–	256	ms	
Read Cycle										
17	t_{RAC}	Access time from $\overline{RAS}$	–	40	–	50	–	60	ns	8, 9
18	t_{CAC}	Access time from $\overline{CAS}$	–	10	–	13	–	15	ns	8, 9
19	t_{CAA}	Access time from column address	–	20	–	25	–	30	ns	8,10
20	t_{OEA}	$\overline{OE}$ access time	–	10	–	13	–	15	ns	8
21	t_{RAL}	Column address to $\overline{RAS}$ lead time	20	–	25	–	30	–	ns	
22	t_{RCS}	Read command setup time	0	–	0	–	0	–	ns	
23	t_{RCH}	Read command hold time	0	–	0	–	0	–	ns	11
24	t_{RRH}	Read command hold time referenced to $\overline{RAS}$	0	–	0	–	0	–	ns	11
25	t_{CLZ}	$\overline{CAS}$ to output in low-Z	0	–	0	–	0	–	ns	8
26	t_{OFF}	Output buffer turn-off delay	0	10	0	13	0	15	ns	12
27	t_{OEZ}	Output buffer turn-off delay from $\overline{OE}$	0	10	0	13	0	15	ns	12
28	t_{DZC}	Data to $\overline{CAS}$ low delay	0	–	0	–	0	–	0	
29	t_{DZO}	Data to $\overline{OE}$ low delay	0	–	0	–	0	–	ns	13
30	t_{CDD}	$\overline{CAS}$ high to data delay	10	–	13	–	15	–	ns	14
31	t_{ODD}	$\overline{OE}$ high to data delay	10	–	13	–	15	–	ns	14

AC Characteristics [6,7,8] (Continued)

T_A = 0 to 70 °C, V_{CC} = 3.3 V±0.3V

#	Symbol	Parameter	-40		- 50		- 60		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.		
Write Cycle										
32	t_{WCH}	Write command hold time	5	–	7	–	10	–	ns	
33	t_{WP}	Write command pulse width	5	–	7	–	10	–	ns	
34	t_{WCS}	Write command setup time	0	–	0	–	0	–	ns	15
35	t_{RWL}	Write command to $\overline{RAS}$ lead time	6	–	8	–	10	–	ns	
36	t_{CWL}	Write command to $\overline{CAS}$ lead time	6	–	8	–	10	–	ns	
37	t_{DS}	Data setup time	0	–	0	–	0	–	ns	16
38	t_{DH}	Data hold time	5	–	7	–	10	–	ns	16
Read-modify-Write Cycle										
39	t_{RWC}	Read-write cycle time	89	–	109	–	128	–	ns	
40	t_{RWD}	$\overline{RAS}$ to $\overline{WE}$ delay time	52	–	65	–	77	–	ns	15
41	t_{CWD}	$\overline{CAS}$ to $\overline{WE}$ delay time	22	–	28	–	32	–	ns	15
42	t_{AWD}	Column address to $\overline{WE}$ delay time	32	–	40	–	47	–	ns	15
43	t_{OEH}	$\overline{OE}$ command hold time	5	–	7	–	10	–	ns	
EDO Page Mode Cycle										
44	t_{HPC}	EDO Page Mode cycle time	16	–	20	–	24	–	ns	
45	t_{CPA}	Access time from $\overline{CAS}$ precharge	–	22	–	28	–	34	ns	7
46	t_{RAS}	$\overline{RAS}$ pulse width in EDO page mode	40	200k	50	200k	60	200k	ns	
47	t_{RHPC}	$\overline{CAS}$ precharge to $\overline{RAS}$ Delay	25	–	30	–	35	–	ns	
48	t_{COH}	Output Data Hold Time	5	—	5	—	5	—	ns	
49	t_{OEP}	$\overline{OE}$ Pulse Width	5	—	5	—	5	—	ns	
50	t_{OEHC}	$\overline{OE}$ Hold Time from $\overline{CAS}$ High	5	—	5	—	5	—	ns	
51	t_{WEZ}	Output Buffer Turn-off Delay from $\overline{WE}$	0	10	0	13	0	15	ns	
EDO Page Mode Read-Modify-Write Cycle										
52	t_{PRWC}	EDO page mode read-write cycle time	42	–	53	–	63	–	ns	
53	t_{CPWD}	$\overline{CAS}$ precharge to $\overline{WE}$	32	–	41	–	49	–	ns	
$\overline{CAS}$ before $\overline{RAS}$ Refresh Cycle										
54	t_{CSR}	$\overline{CAS}$ setup time	5	–	5	–	5	–	ns	
55	t_{CHR}	$\overline{CAS}$ hold time	5	–	5	–	10	–	ns	
56	t_{RPC}	$\overline{RAS}$ to $\overline{CAS}$ precharge time	0	–	0	–	0	–	ns	
57	t_{WRP}	Write to $\overline{RAS}$ precharge time	5	–	5	–	10	–	ns	
58	t_{WRH}	Write hold time referenced to $\overline{RAS}$	5	–	5	–	10	–	ns	

AC Characteristics [6,7,8] (Continued)

T_A = 0 to 70 °C, V_{CC} = 3.3 V±0.3V

#	Symbol	Parameter	-40		- 50		- 60		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.		
Test Mode Cycle										
59	t_{WTS}	Write command setup time	5	–	5	–	5	–	ns	17
60	t_{WTH}	Write command hold time	5	–	5	–	5	–	ns	17
Self Refresh Cycle (L-version)										
61	t_{RASS}	$\overline{RAS}$ pulse width	100k	–	100k	–	100k	–	ns	18
62	t_{RPS}	$\overline{RAS}$ precharge time	69	–	84	–	104	–	ns	18
63	t_{CHS}	$\overline{CAS}$ hold time	-50	–	-50	–	-50	–	ns	18

Notes:

1) All voltages are referenced to VSS.

   V_{IH} may overshoot to V_{CC} + 0.2V for pulse widths of < 4ns with 3.3V. V_{IL} may undershoot to -2.0V for pulse width < 4.0 ns with 3.3V. Pulse width measured at 50% points with amplitude measured peak to DC reference.

2) I_{CC1}, I_{CC3}, I_{CC4} and I_{CC6} and I_{CC7} depend on cycle rate.

3) I_{CC1} and I_{CC4} depend on output loading. Specified values are measured with the output open.

4) Address can be changed once or less while $\overline{RAS}$ = V_{IL}. In the case of I_{CC4} it can be changed once or less during a edo page mode cycle (t_{PC}).

5) An initial pause of 100 μs is required after power-up followed by 8 $\overline{RAS}$-only-refresh cycles, before proper device operation is achieved. In case of using internal refresh counter, a minimum of 8 $\overline{CAS}$-before-$\overline{RAS}$ initialization cycles instead of 8 $\overline{RAS}$ cycles are required.

6) AC measurements assume t_T = 5 ns.

7) $V_{IH\ (min.)}$ and $V_{IL\ (max.)}$ are reference levels for measuring timing of input signals. Also, transition times are measured between V_{IH} and V_{IL}.

8) Measured with the specified current load and 100 pF at V_{OH} = 2.0 V and V_{OL} = 0.8 V.

9) Operation within the $t_{RCD\ (max.)}$ limit ensures that $t_{RAC\ (max.)}$ can be met. $t_{RCD\ (max.)}$ is specified as a reference point only: If t_{RCD} is greater than the specified $t_{RCD\ (max.)}$ limit, then access time is controlled by t_{CAC}.

10) Operation within the $t_{RAD\ (max.)}$ limit ensures that $t_{RAC\ (max.)}$ can be met. $t_{RAD\ (max.)}$ is specified as a reference point only: If t_{RAD} is greater than the specified $t_{RAD\ (max.)}$ limit, then access time is controlled by t_{CAA}.

11) Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.

12) $t_{OFF\ (max.)}$ and $t_{OEZ\ (max.)}$ define the time at which the outputs achieve the open-circuit condition and are not referenced to output voltage levels.

13) Either t_{DZC} or t_{DZO} must be satisfied.

14) Either t_{CDD} or t_{ODD} must be satisfied.

15) t_{WCS}, t_{RWD}, t_{CWD}, t_{AWD} and t_{CPWD} are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If t_{WCS} > t_{WCS} (min.), the cycle is an early write cycle and the I/O pin will remain open-circuit (high impedance) through the entire cycle; if t_{RWD} > $t_{RWD\ (min.)}$, t_{CWD} > $t_{CWD\ (min.)}$, t_{AWD} > $t_{AWD\ (min.)}$ and t_{CPWD} > $t_{CPWD\ (min.)}$, the cycle is a read-write cycle and I/O pins will contain data read from the selected cells. If neither of the above sets of conditions is satisfied, the condition of the I/O pins (at access time) is indeterminate.

16) These parameters are referenced to $\overline{CAS}$ leading edge in early write cycles and to $\overline{WRITE}$ leading edge in Read-Modify-Write cycles.

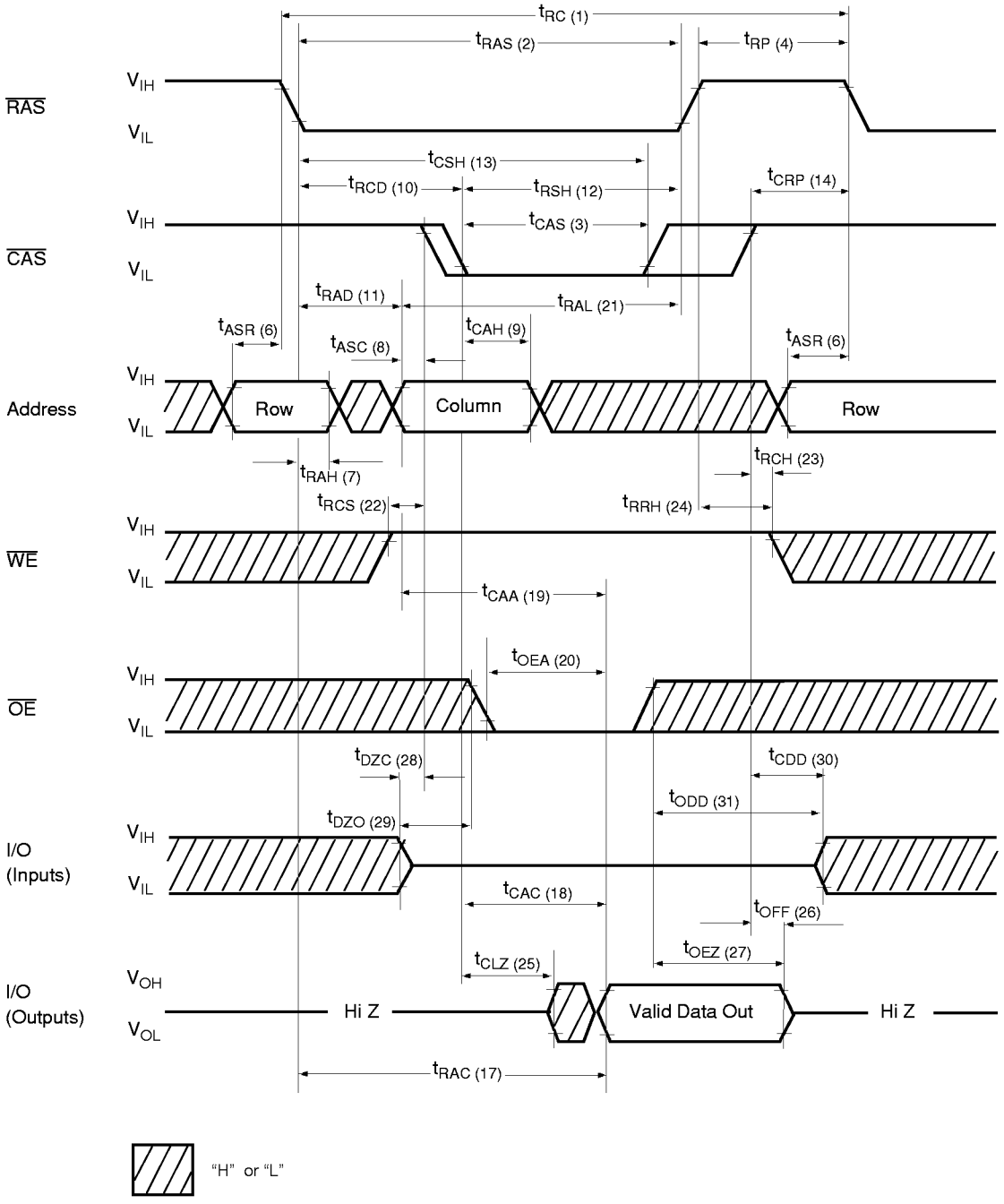
17) In a Test Mode Read Cycle, the value of t_{RAC}, t_{CAA}, t_{CAC} and t_{CPA} are delayed by 5 ns from the specified value. These parameters must be adjusted in Test Mode cycles by adding 5ns to the specified value. Associated timings must be adjusted by 5 ns.

18) When using Self Refresh mode, the following refresh operations must be performed to ensure proper DRAM operation:

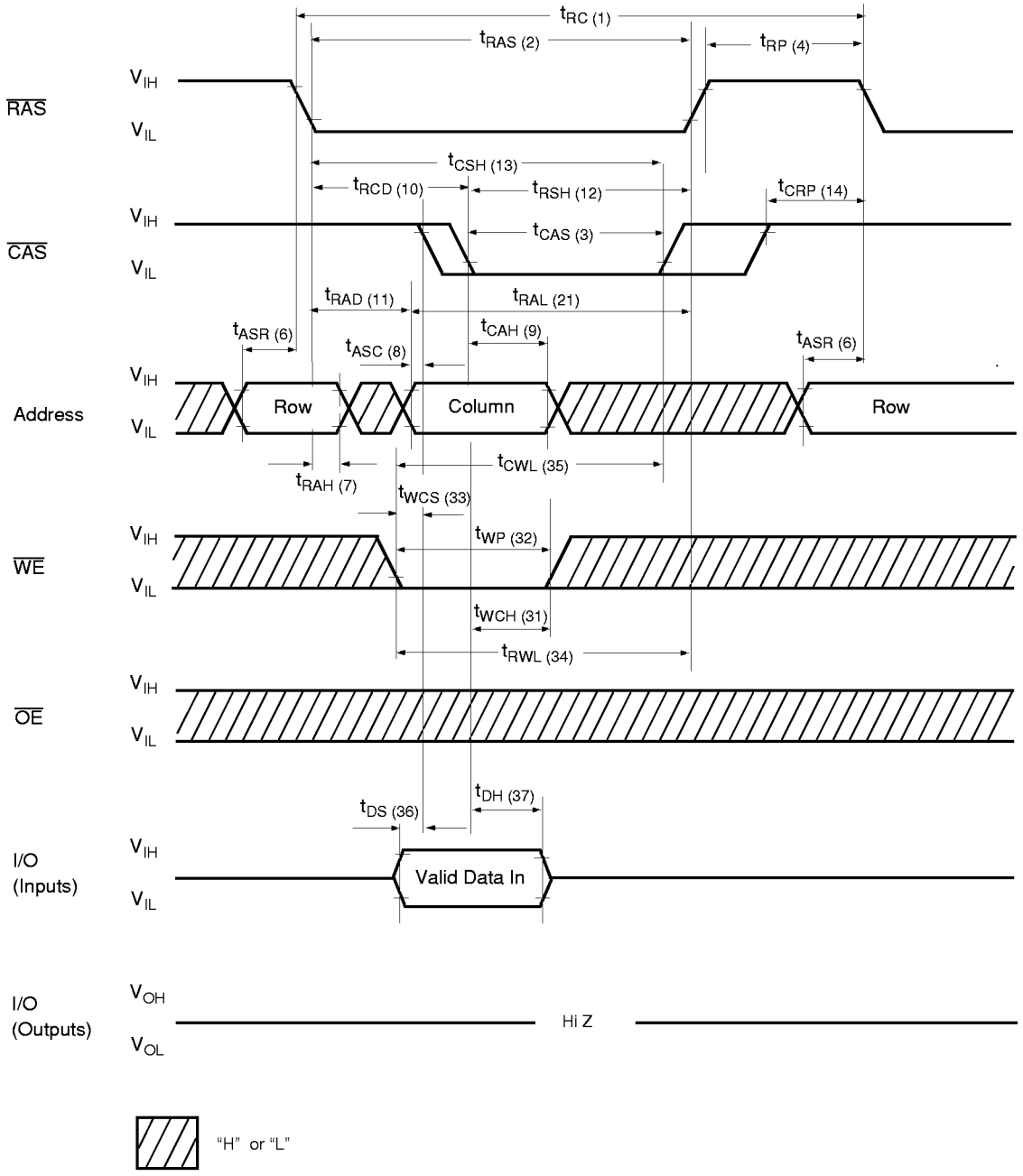
    If row addresses are being refreshed on an evenly distributed manner over the refresh interval using CBR refresh cycles, then only one CBR cycle must be performed immediately after exit from Self Refresh.

    If row addresses are being refreshed in any other manner (ROR – Distributed/Burst; or CBR – Burst) over the refresh interval, then a full set of row refreshes must be performed immediately before entry to and immediately after exit from Self Refresh.

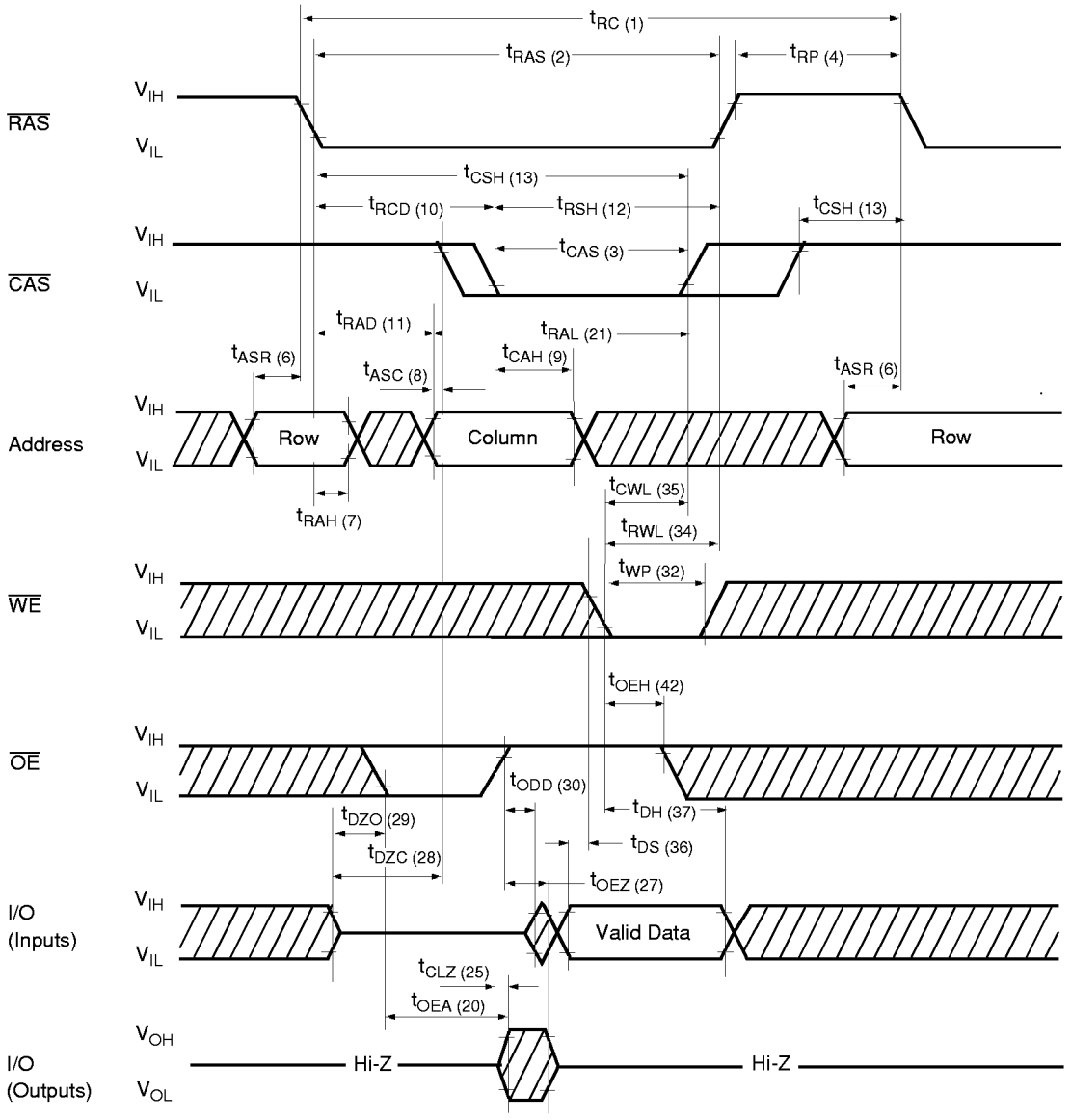
Waveforms of Read Cycle



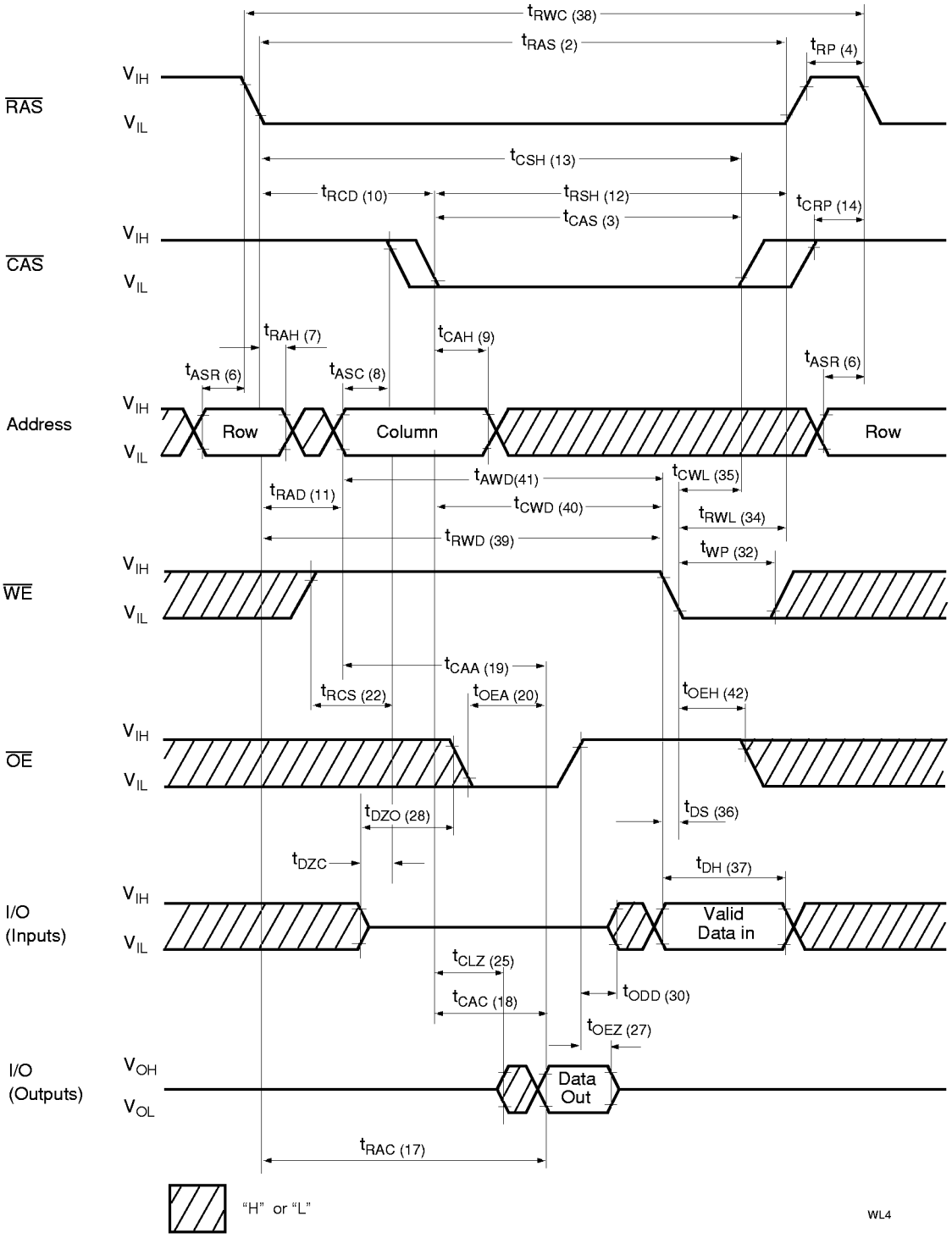
Waveforms of Write Cycle (Early Write)



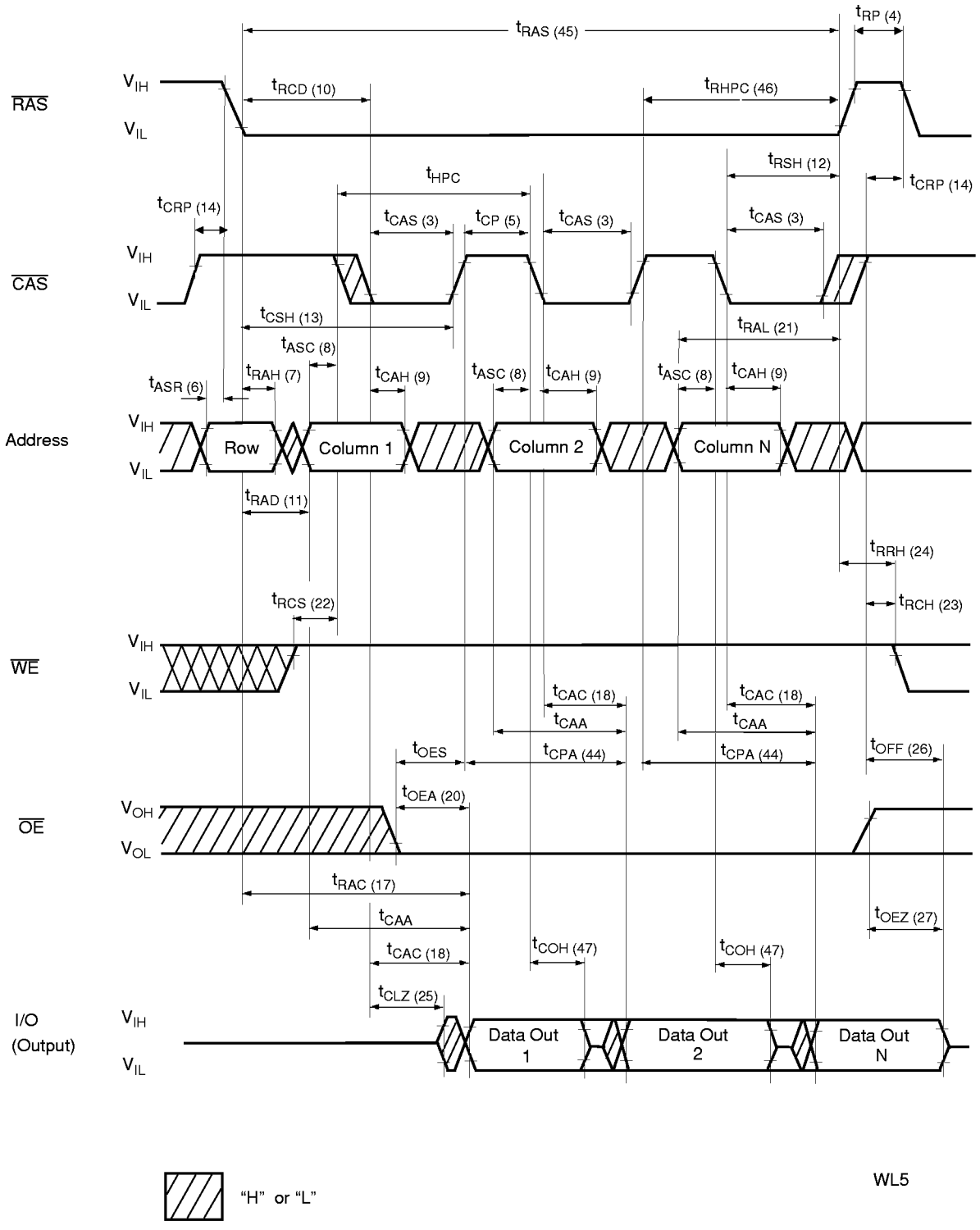
Waveforms of Write Cycle ($\overline{OE}$ Controlled Write)



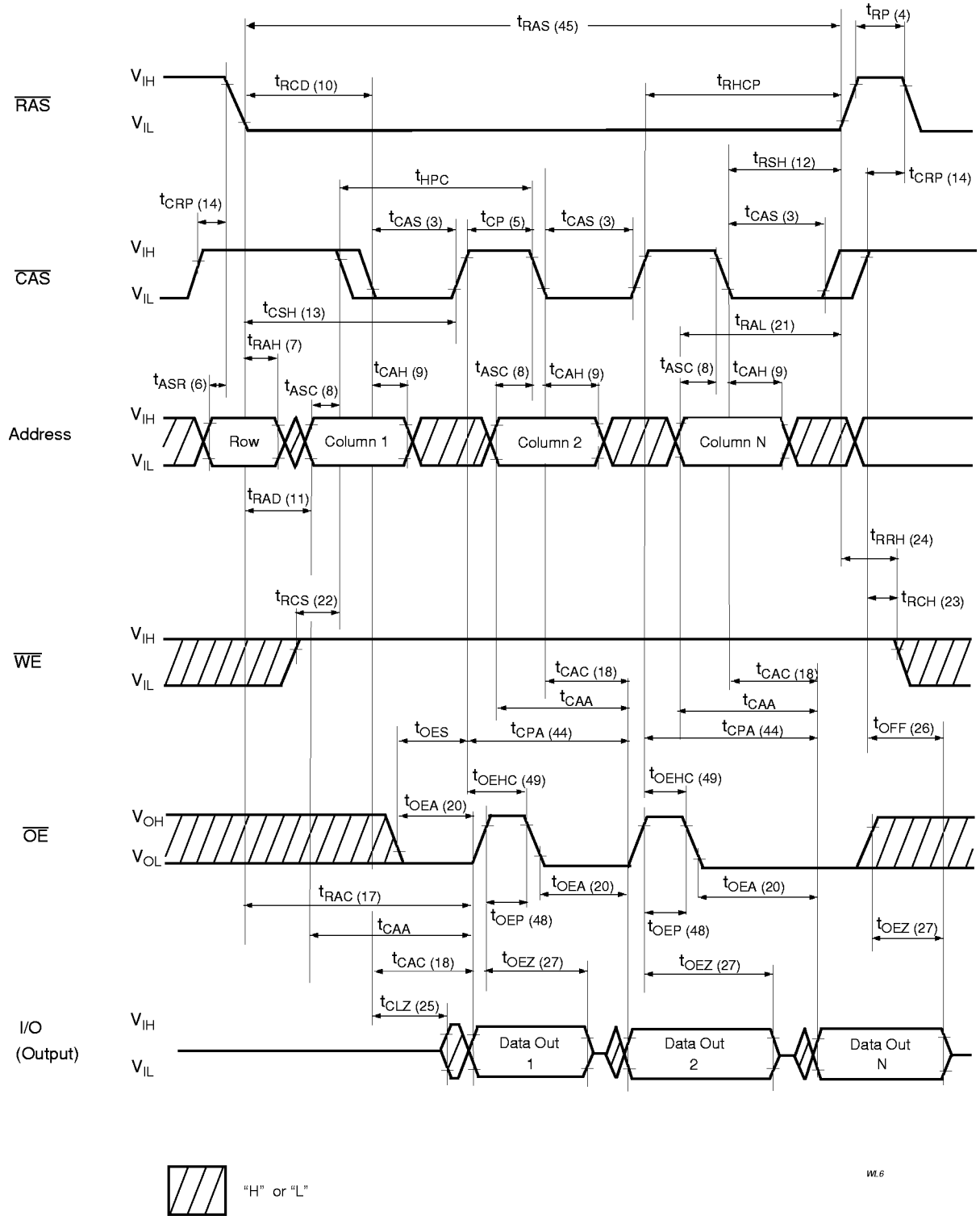
Waveforms of Read-Write (Read-Modify-Write) Cycle



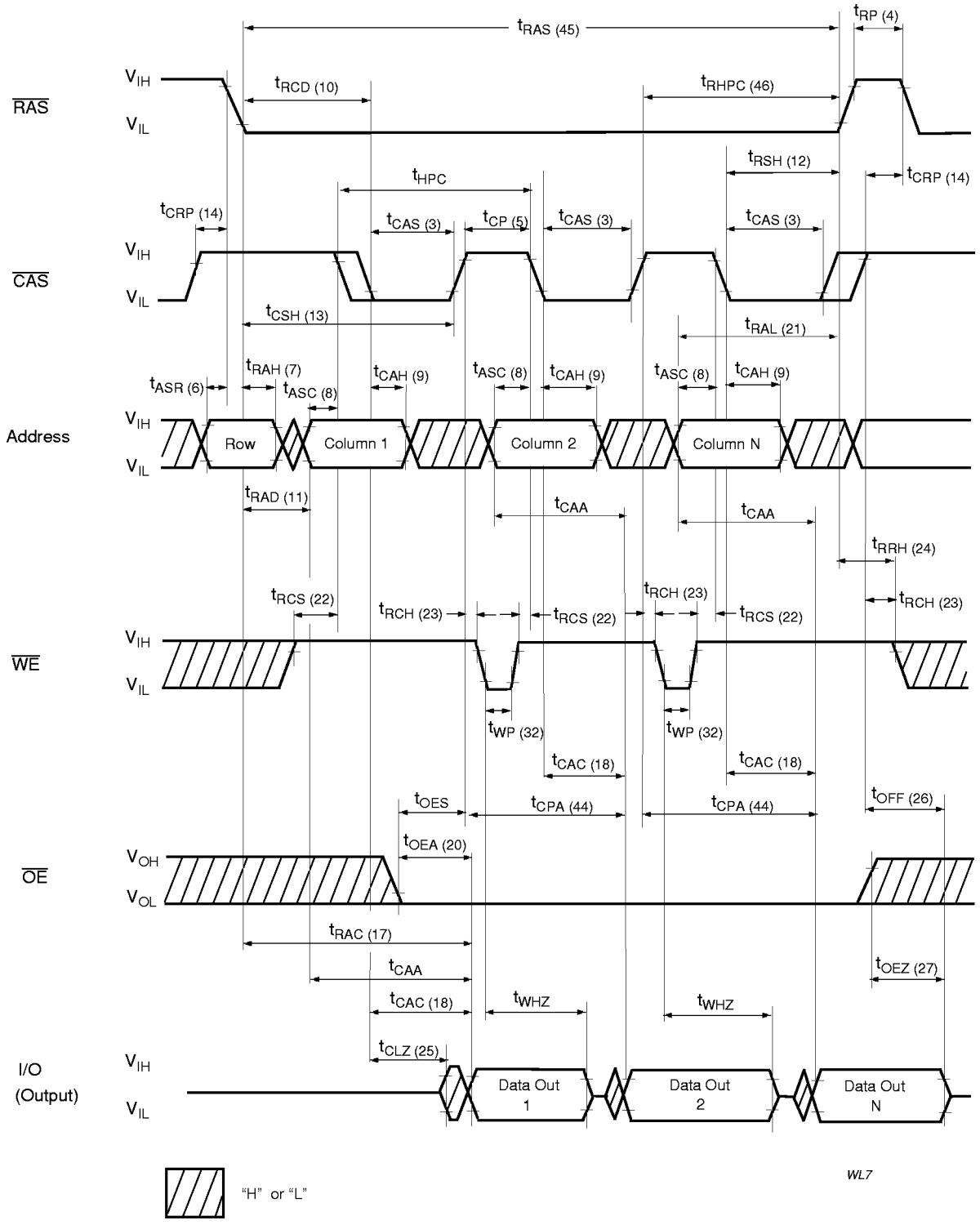
Waveforms of EDO Page Mode Read Cycle



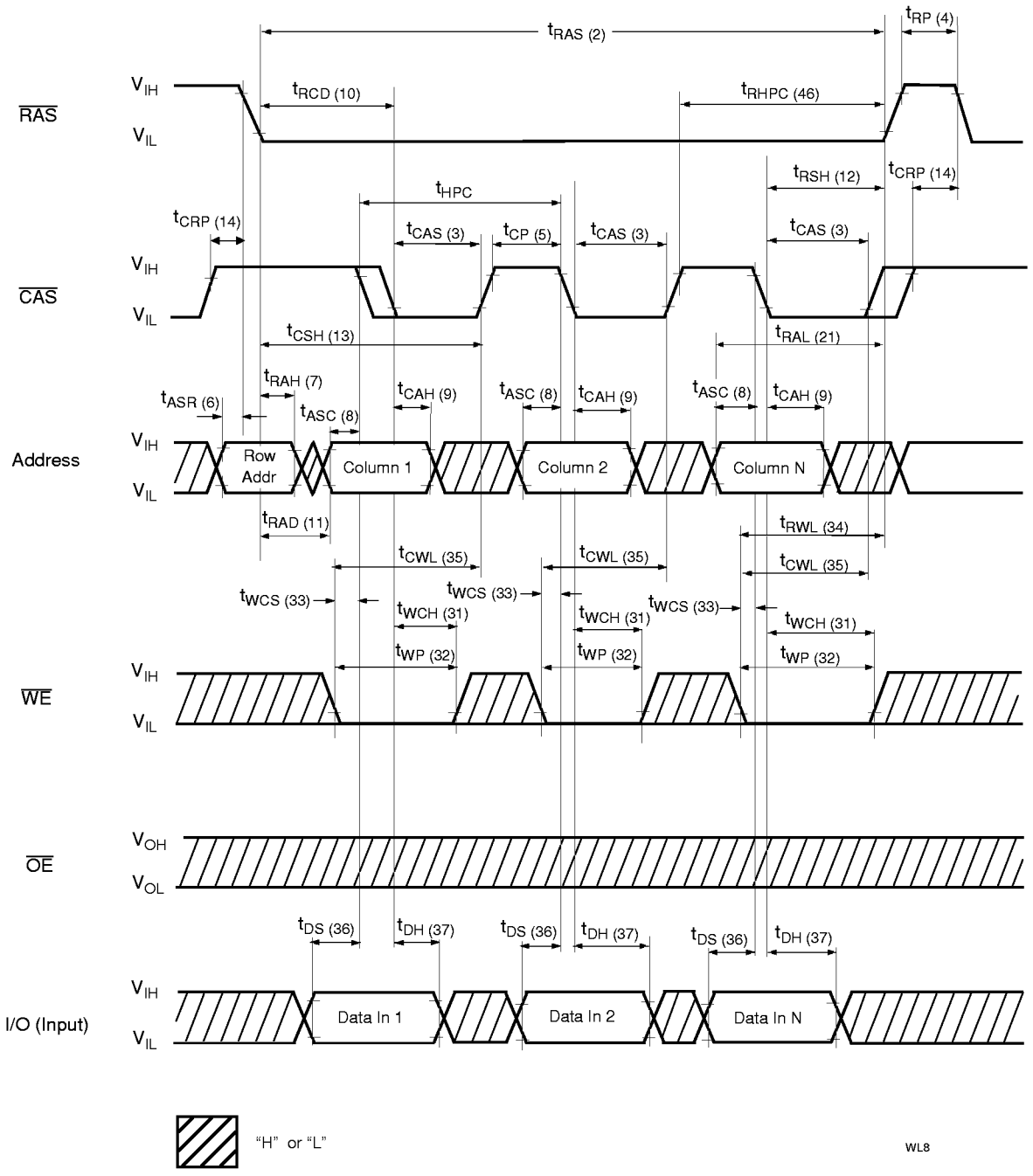
Waveforms of EDO Page Mode Read Cycle ($\overline{OE}$ Control)



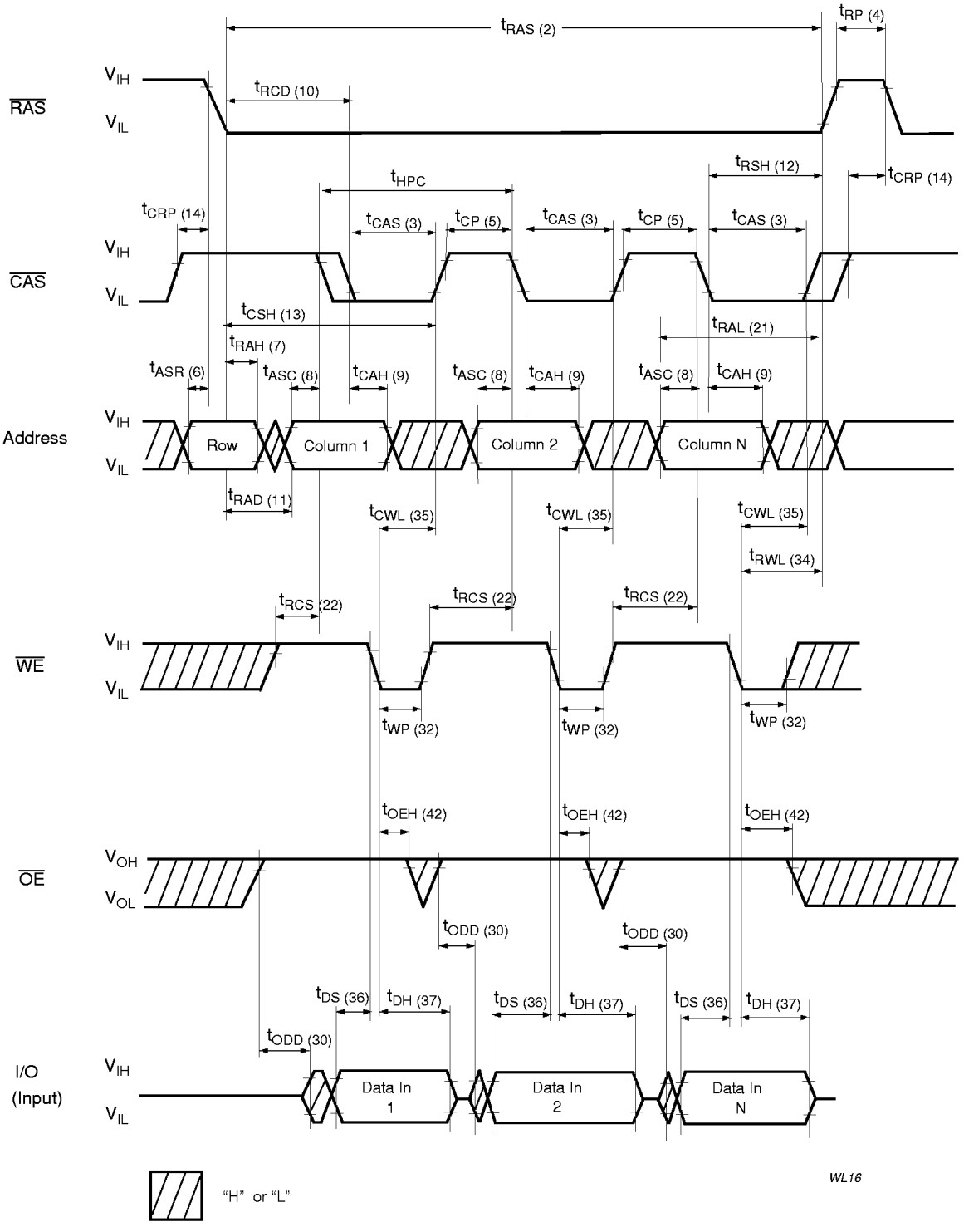
Waveforms of EDO Page Mode Read Cycle ($\overline{WE}$ Control)



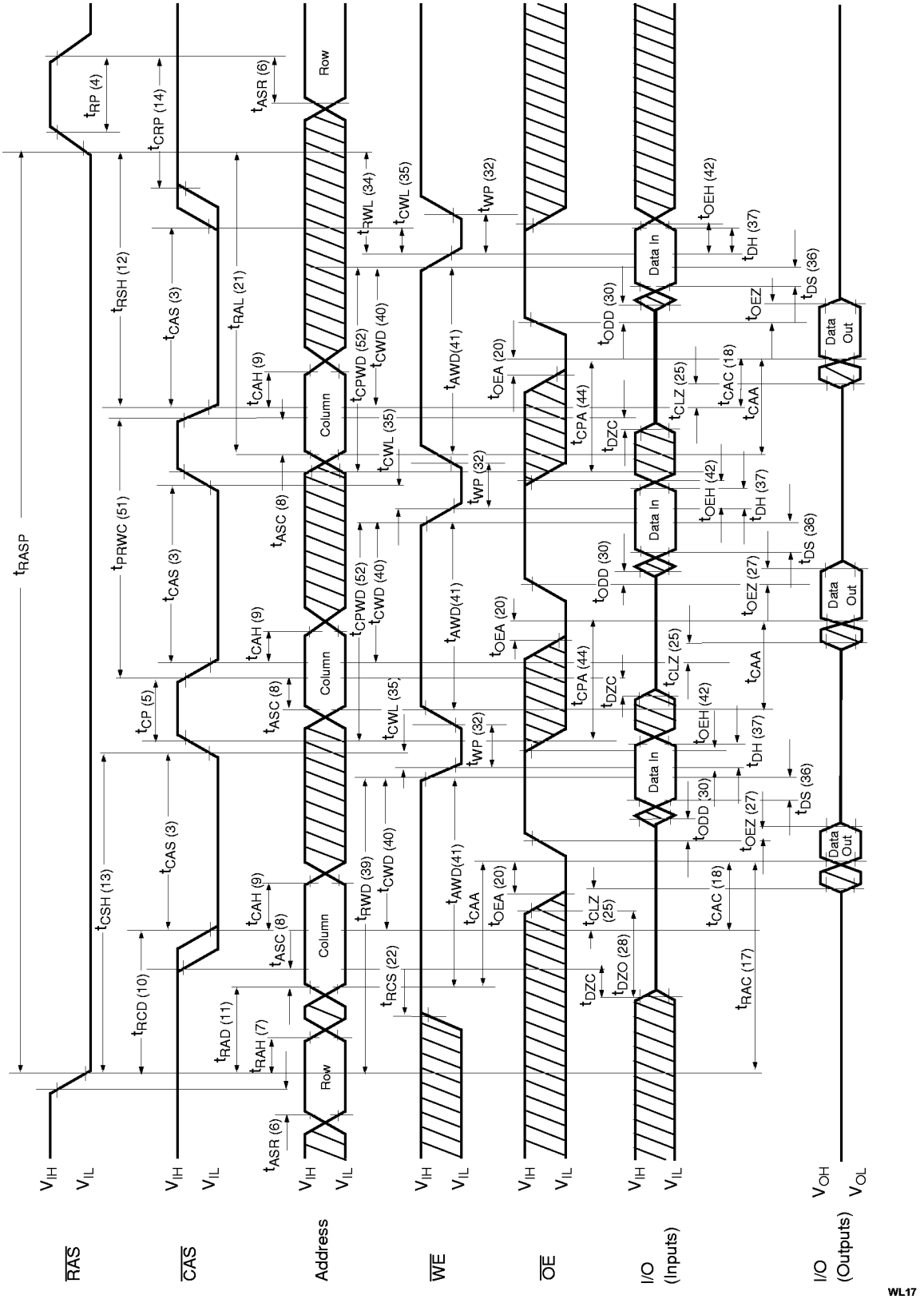
Waveforms of $\overline{EDO}$ Page Mode Early Write Cycle



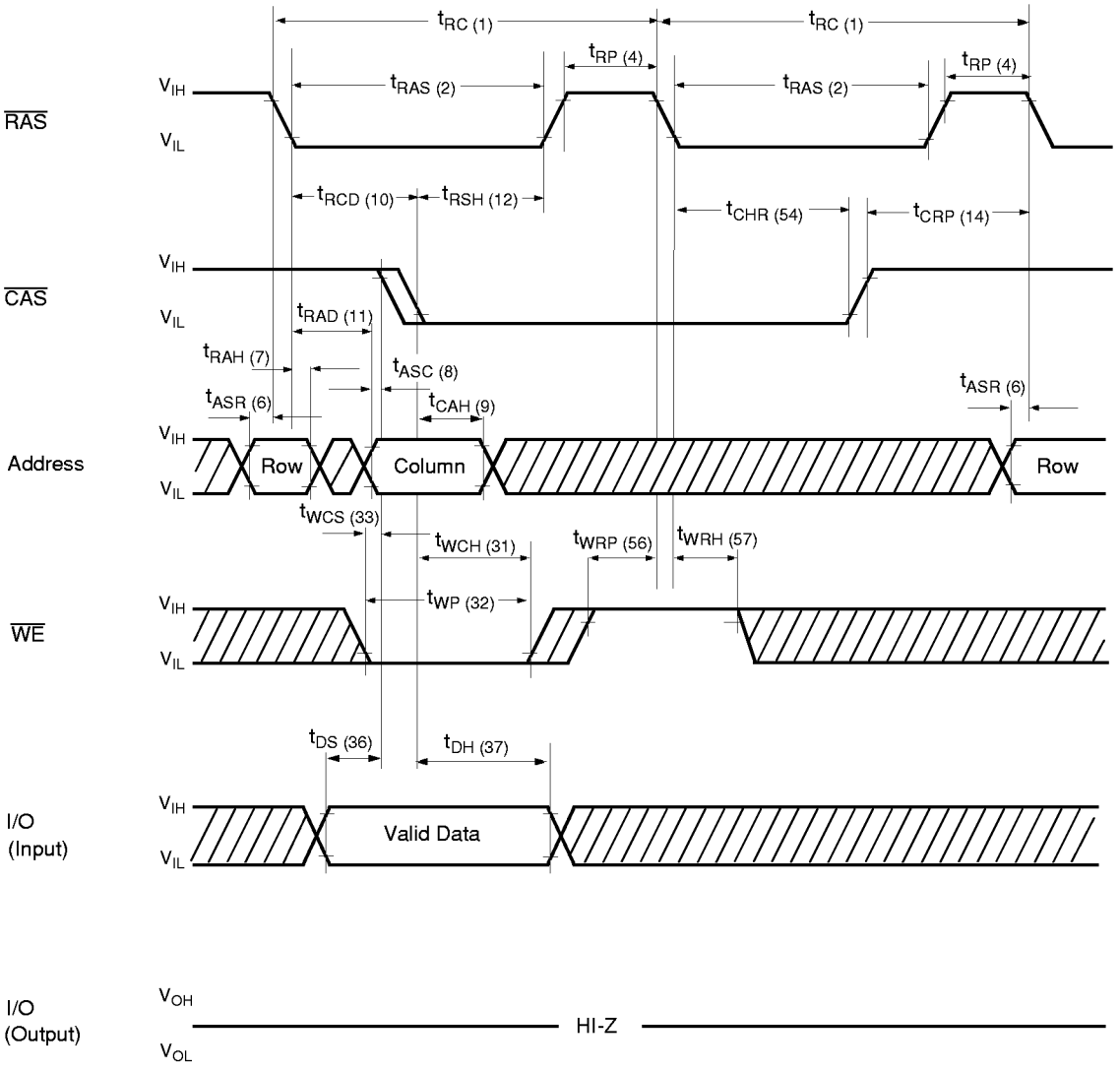
Waveforms of EDO Page Mode Late Write Cycle



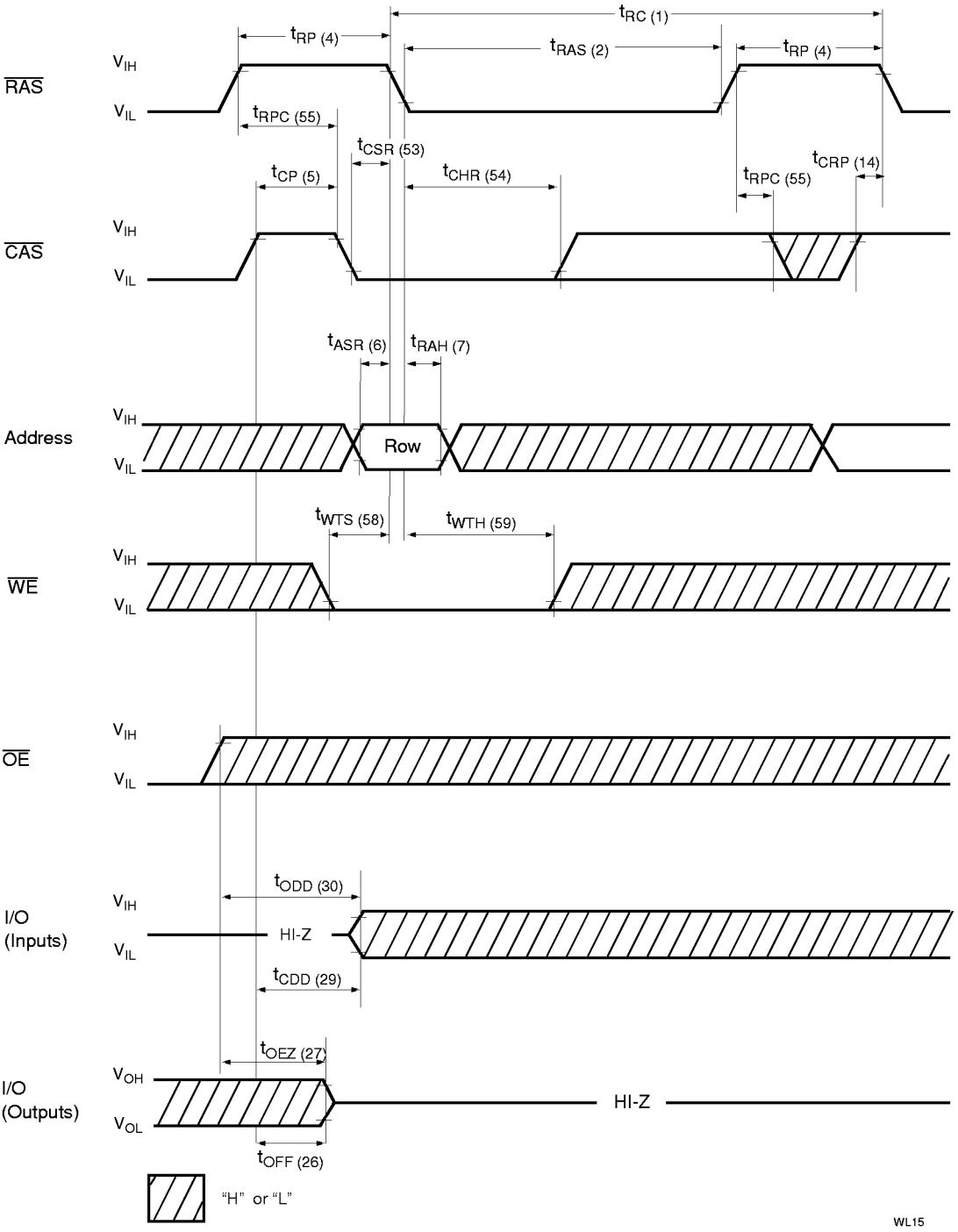
Waveforms of EDO Page Mode Read-Modify-Write Cycle



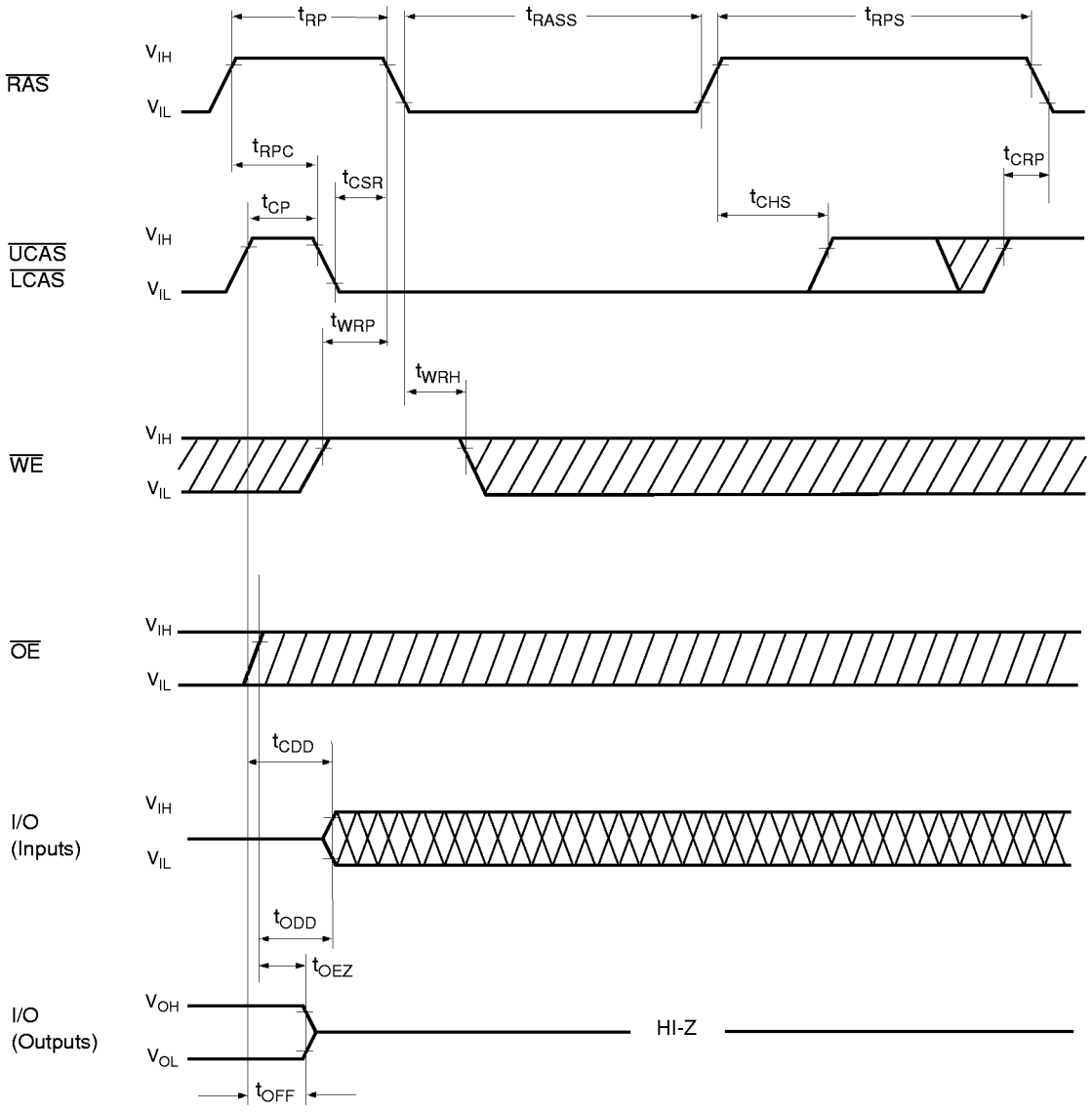
Waveforms of Hidden Refresh Cycle (Early Write)



Waveforms of Test Mode Entry Cycle

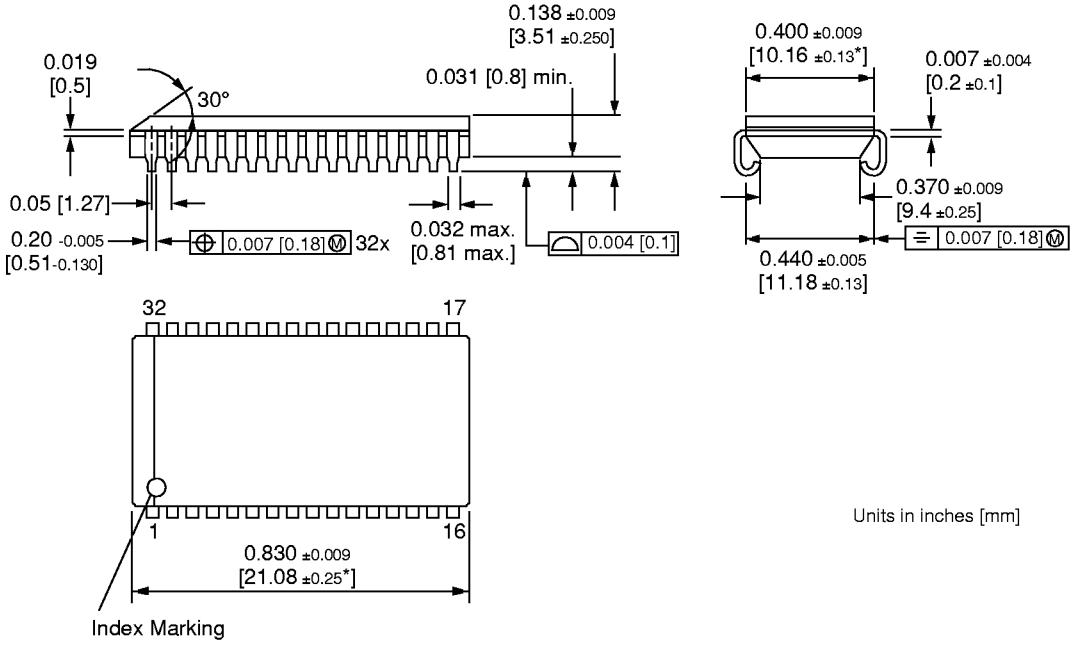


Waveforms of $\overline{CAS}$-before-$\overline{RAS}$ Self Refresh Cycle (L-version)



Package Diagrams

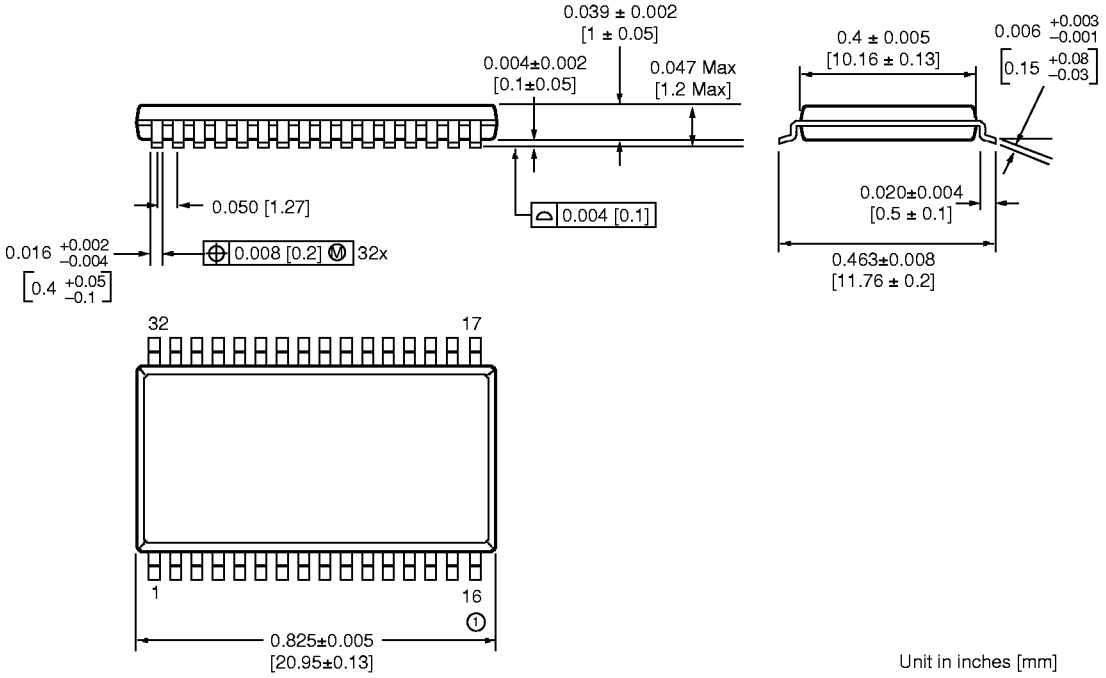
32-pin 400 mil SOJ



Units in inches [mm]

* Does not include plastic or metal protrusion of 0.15 max. per side

32-pin 400 mil TSOP-II



Unit in inches [mm]

① Does not include plastic or metal protrusion of 0.010 [0.25] max. per side

Notes:

U.S.A.
3910 NORTH FIRST STREET
SAN JOSE, CA 95134
PHONE: 408-433-6000
FAX: 408-433-0185

HONG KONG
19 DAI FU STREET
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FAX: 81-43-299-6555

IRELAND & UK
BLOCK A UNIT 2
BROOMFIELD BUSINESS PARK
MALAHIDE
CO. DUBLIN, IRELAND
PHONE: +353 1 8038020
FAX: +353 1 8038049

GERMANY (CONTINENTAL EUROPE & ISRAEL)
71083 HERRENBERG
BENZSTR. 32
GERMANY
PHONE: +49 7032 2796-0
FAX: +49 7032 2796 22

U.S. SALES OFFICES

NORTHWESTERN
3910 NORTH FIRST STREET
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FAX: 408-433-0185

NORTHEASTERN
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20 TRAFALGAR SQUARE
NASHUA, NH 03063
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FAX: 603-889-9347

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5150 E. PACIFIC COAST HWY.
LONG BEACH, CA 90804
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