



## A42L0616 Series

**Preliminary 1M X 16 CMOS DYNAMIC RAM WITH EDO PAGE MODE**

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### Document Title

**1M X 16 CMOS DYNAMIC RAM WITH EDO PAGE MODE**

### Revision History

<u>Rev. No.</u>	<u>History</u>	<u>Issue Date</u>	<u>Remark</u>
0.0	Initial issue	June 13, 2001	Preliminary



# A42L0616 Series

## Preliminary 1M X 16 CMOS DYNAMIC RAM WITH EDO PAGE MODE

### Features

- Organization: 1,048,576 words X 16 bits
- Part Identification
  - A42L0616 (1K Ref.)
  - A42L06161-L (1K Ref. with self-refresh)
- Single 3.3V power supply/built-in VBB generator
- Low power consumption
  - Operating: 130mA (-45 max)
  - Standby: 1mA (TTL), 0.2mA (CMOS)  
250µA (Self-refresh current)
- High speed
  - 45/50/60 ns  $\overline{\text{RAS}}$  access time
  - 23/25/30 ns column address access time
  - 13/15/17 ns  $\overline{\text{CAS}}$  access time
  - 16/20/25 ns EDO Page Mode Cycle Time

- Fast Page Mode with Extended Data Out
- Separate  $\overline{\text{CAS}}$  ( $\overline{\text{UCAS}}$ ,  $\overline{\text{LCAS}}$ ) for byte selection
- Refresh Cycle

Part No.	Refresh cycle	Refresh interval	
		Normal	L-ver
A42L0616	1K	16ms	128ms

- Read-modify-write,  $\overline{\text{RAS}}$  -only,  $\overline{\text{CAS}}$  -before-  $\overline{\text{RAS}}$ , Hidden refresh capability
- TTL-compatible, three-state I/O
- JEDEC standard packages
  - 400mil, 42-pin SOJ
  - 400mil, 50/44 TSOP type II package

### General Description

The A42L0616 is a new generation randomly accessed memory for graphics, organized in a 1,048,576-word by 16-bit configuration. This product can execute Byte Write and Byte Read operation via two  $\overline{\text{CAS}}$  pins.

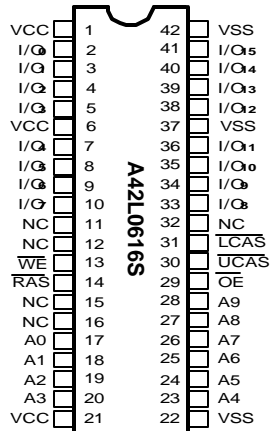
The A42L0616 offers an accelerated Fast Page Mode

cycle with a feature called Extended Data Out (EDO).

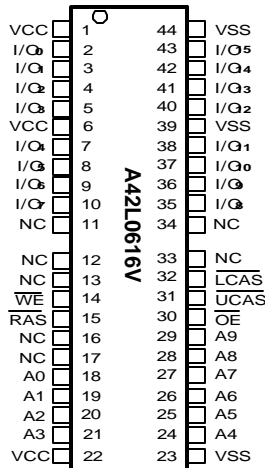
This allow random access of up to 1024 words within a row at a 63/50/40 MHz EDO cycle, making the A42L0616 ideally suited for graphics, digital signal processing and high performance computing systems.

### Pin Configuration

#### ■ SOJ



#### ■ TSOP



### Pin Descriptions

Symbol	Description
A0 – A9	Address Inputs
I/O <sub>0</sub> - I/O <sub>15</sub>	Data Input/Output
$\overline{\text{RAS}}$	Row Address Strobe
$\overline{\text{LCAS}}$	Column Address Strobe for Lower Byte (I/O <sub>0</sub> – I/O <sub>7</sub> )
$\overline{\text{UCAS}}$	Column Address Strobe for Upper Byte (I/O <sub>8</sub> – I/O <sub>15</sub> )
$\overline{\text{WE}}$	Write Enable
$\overline{\text{OE}}$	Output Enable
VCC	3.3V Power Supply
VSS	Ground
NC	No Connection



## Selection Guide

Symbol	Description	-45	-50	-60	Unit
trAC	Maximum $\overline{\text{RAS}}$ Access Time	45	50	60	ns
tAA	Maximum Column Address Access Time	23	25	30	ns
tcAC	Maximum $\overline{\text{CAS}}$ Access Time	13	15	17	ns
toEA	Maximum Output Enable ( $\overline{\text{OE}}$ ) Access Time	13	13	15	ns
trC	Minimum Read or Write Cycle Time	79	84	104	ns
tpC	Minimum EDO Cycle Time	16	20	25	ns

## Functional Description

The A42L0616 reads and writes data by multiplexing an 20-bit address into a 10-bit row and 10-bit column address.  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  are used to strobe the row address and the column address, respectively.

The A42L0616 has two  $\overline{\text{CAS}}$  inputs:  $\overline{\text{LCAS}}$  controls I/O<sub>0</sub>-I/O<sub>7</sub>, and  $\overline{\text{UCAS}}$  controls I/O<sub>8</sub> - I/O<sub>15</sub>.  $\overline{\text{UCAS}}$  and  $\overline{\text{LCAS}}$  function in an identical manner to  $\overline{\text{CAS}}$  in that either will generate an internal  $\overline{\text{CAS}}$  signal. The  $\overline{\text{CAS}}$  function and timing are determined by the first  $\overline{\text{CAS}}$  ( $\overline{\text{UCAS}}$  or  $\overline{\text{LCAS}}$ ) to transition low and by the last to transition high. Byte Read and Byte Write are controlled by using  $\overline{\text{LCAS}}$  and  $\overline{\text{UCAS}}$  separately.

A Read cycle is performed by holding the  $\overline{\text{WE}}$  signal high during  $\overline{\text{RAS}}/\overline{\text{CAS}}$  operation. A Write cycle is executed by holding the  $\overline{\text{WE}}$  signal low during  $\overline{\text{RAS}}/\overline{\text{CAS}}$  operation; the input data is latched by the falling edge of  $\overline{\text{WE}}$  or  $\overline{\text{CAS}}$ , whichever occurs later. The data inputs and outputs are routed through 16 common I/O pins, with  $\overline{\text{RAS}}$ ,  $\overline{\text{CAS}}$ ,  $\overline{\text{WE}}$  and  $\overline{\text{OE}}$  controlling the in direction.

EDO Page Mode operation all 1024(1K) columns within a selected row to be randomly accessed at a high data rate. A EDO Page Mode cycle is initiated with a row address latched by  $\overline{\text{RAS}}$  followed by a column address latched by  $\overline{\text{CAS}}$ . While holding  $\overline{\text{RAS}}$  low,  $\overline{\text{CAS}}$  can be toggled to strobe changing column addresses, thus achieving shorter cycle times.

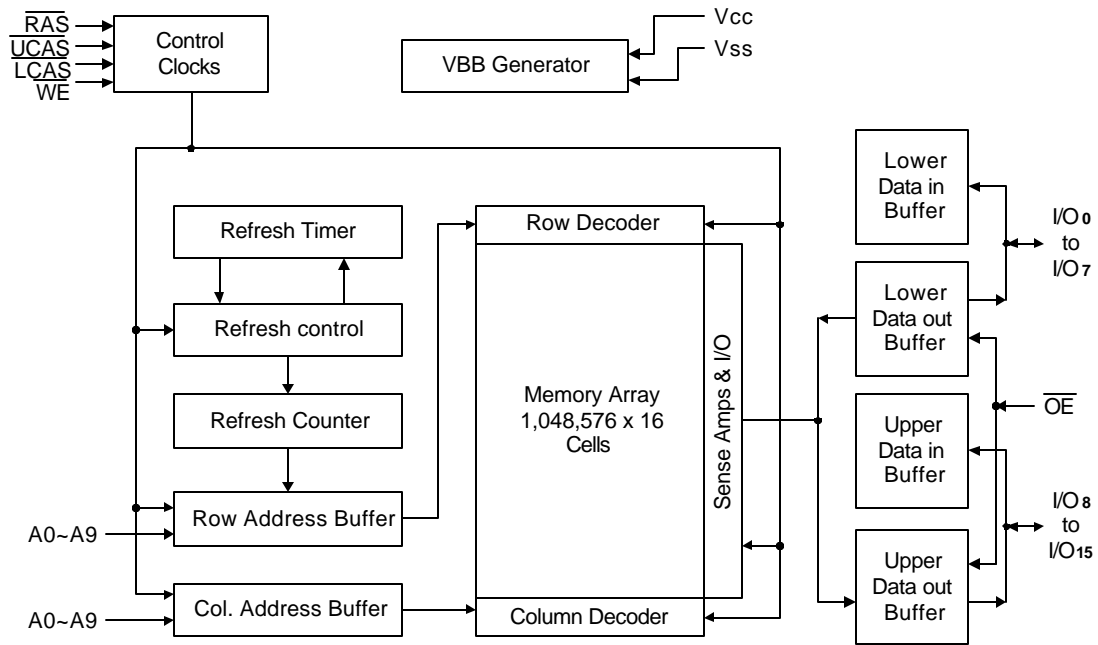
The A42L0616 offers an accelerated Fast Page Mode cycle through a feature called Extended Data Out, which

keeps the output drivers on during the  $\overline{\text{CAS}}$  precharge time ( $t_{\phi}$ ). Since data can be output after  $\overline{\text{CAS}}$  goes high, the user is not required to wait for valid data to appear before starting the next access cycle. Data-out will remain valid as long as  $\overline{\text{RAS}}$  and  $\overline{\text{OE}}$  are low, and  $\overline{\text{WE}}$  is high; this is the only characteristic which differentiates Extended Data Out operation from a standard Read or Fast Page Read.

A memory cycle is terminated by returning both  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  high. Memory cell data will retain its correct state by maintaining power and accessing all 1024(1K) combinations of the 10-bit row addresses, regardless of sequence, at least once every 16ms through any  $\overline{\text{RAS}}$  cycle (Read, Write) or  $\overline{\text{RAS}}$  Refresh cycle ( $\overline{\text{RAS}}$ -only, CBR, or Hidden). The CBR Refresh cycle automatically controls the row addresses by invoking the refresh counter and controller.

## Power-On

The initial application of the VCC supply requires a 200  $\mu$ s wait followed by a minimum of any eight initialization cycles containing a  $\overline{\text{RAS}}$  clock. During Power-On, the VCC current is dependent on the input levels of  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$ . It is recommended that  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  track with VCC or be held at a valid  $\text{V}_{\text{H}}$  during Power-On to avoid current surges.

**Block Diagram**

**Recommended Operating Conditions** (Ta = 0°C to +70°C)

Symbol	Description	Min.	Typ.	Max.	Unit	Notes
VCC	Power Supply	3.0	3.3	3.6	V	1
VSS	Input High Voltage	0.0	0.0	0.0	V	1
V <sub>IH</sub>	Input High Voltage	2.0	-	VCC + 0.3	V	1
V <sub>IL</sub>	Input Low Voltage	-1.0	-	0.8	V	1



Truth Table

Function	$\overline{\text{RAS}}$	$\overline{\text{UCAS}}$	$\overline{\text{LCAS}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	Address	I/Os	Notes
Standby	H	X	X	X	X	X	High-Z	
Read: Word	L	L	L	H	L	Row/Col.	Data Out	
Read: Lower Byte	L	H	L	H	L	Row/Col.	I/O <sub>0-7</sub> = Data Out I/O <sub>8-15</sub> = High-Z	
Read: Upper Byte	L	L	H	H	L	Row/Col.	I/O <sub>0-7</sub> = High-Z I/O <sub>8-15</sub> = Data Out	
Write: Word	L	L	L	L	H	Row/Col.	Data In	
Write: Lower Byte	L	H	L	L	H	Row/Col.	I/O <sub>0-7</sub> = Data In I/O <sub>8-15</sub> = X	
Write: Upper Byte	L	L	H	L	H	Row/Col.	I/O <sub>0-7</sub> = X I/O <sub>8-15</sub> = Data In	
Read-Write	L	L	L	H→L	L→H	Row/Col.	Data Out → Data In	1,2
EDO-Page-Mode Read: Hi-Z								
-First cycle	L	H→L	H→L	H	H→L	Row/Col.	Data Out	2
-Subsequent Cycles	L	H→L	H→L	H	H→L	Col.	Data Out	2
EDO-Page-Mode Write								
-First cycle	L	H→L	H→L	L	H	Row/Col.	Data In	1
-Subsequent Cycles	L	H→L	H→L	L	H	Col.	Data In	1
EDO-Page-Mode Read-Write								
-First cycle	L	H→L	H→L	H→L	L→H	Row/Col.	Data Out → Data In	1, 2
-Subsequent Cycles	L	H→L	H→L	H→L	L→H	Col.	Data Out → Data In	1, 2
Hidden Refresh Read	L→H→L	L	L	H	L	Row/Col.	Data Out	2
Hidden Refresh Write	L→H→L	L	L	L	X	Row/Col.	Data In → High-Z	1
$\overline{\text{RAS}}$ -Only Refresh	L	H	H	X	X	Row	High-Z	
CBR Refresh	H→L	L	L	X	X	X	High-Z	3
Self Refresh	H→L	L	L	H	X	X	High-Z	

Note: 1. Byte Write may be executed with either  $\overline{\text{UCAS}}$  or  $\overline{\text{LCAS}}$  active.  
 2. Byte Read may be executed with either  $\overline{\text{UCAS}}$  or  $\overline{\text{LCAS}}$  active.  
 3. Only one  $\overline{\text{CAS}}$  signal ( $\overline{\text{UCAS}}$  or  $\overline{\text{LCAS}}$ ) must be active.



**Absolute Maximum Ratings\***

Input Voltage (Vin) . . . . . -0.5V to +4.6V  
 Output Voltage (Vout) . . . . . -0.5V to +4.6V  
 Power Supply Voltage (VCC) . . . . . -0.5V to +4.6V  
 Operating Temperature (TOPR) . . . . . 0°C to +70°C  
 Storage Temperature (TSTG) . . . . . -55°C to +150°C  
 Soldering Temperature X Time (TSOLDER) . . . . .  
 . . . . . 260°C X 10sec  
 Power Dissipation (PD) . . . . . 1W  
 Short Circuit Output Current (Iout) . . . . . 50mA  
 Latch-up Current . . . . . 200mA

**\*Comments**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to this device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of these specification is not implied or intended. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

**DC Electrical Characteristics** (VCC = 3.3V ± 0.3%, VSS = 0V, Ta = 0°C to +70°C)

Symbol	Parameter	-45		-50		-60		Unit	Test Conditions	Notes
		Min.	Max.	Min.	Max.	Min.	Max.			
IIL	Input Leakage Current	-5	+5	-5	+5	-5	+5	µA	0V ≤ Vin ≤ Vin+0.3V Pins not under Test = 0V	
IoL	Output Leakage Current	-5	+5	-5	+5	-5	+5	µA	DO <sub>UT</sub> disabled, 0V ≤ Vout ≤ VCC	
Icc1	Operating Power Supply Current	-	130	-	120	-	110	mA	$\overline{RAS}$ , $\overline{UCAS}$ , $\overline{LCAS}$ and Address cycling; trc = min.	1, 2
Icc2	TTL Supply Current Supply Current	-	1	-	1	-	1	mA	$\overline{RAS} = \overline{UCAS} = \overline{LCAS} = \overline{WE}$ = VIH	
Icc3	Average Power Supply Current, $\overline{RAS}$ Refresh Mode	-	130	-	120	-	110	mA	$\overline{RAS}$ and Address cycling, $\overline{UCAS} = \overline{LCAS} = V_{IH}$ , trc = min.	1
Icc4	EDO Page Mode Average Power Supply Current	-	110	-	100	-	90	mA	$\overline{RAS}$ and address = V <sub>IL</sub> , $\overline{UCAS}$ , $\overline{LCAS}$ and Address cycling; trc = min.	1, 2
Icc5	$\overline{CAS}$ -before- $\overline{RAS}$ Refresh Power Supply Current	-	120	-	110	-	100	mA	$\overline{RAS}$ , $\overline{UCAS}$ or $\overline{LCAS}$ cycling; trc = min.	1
Icc6	CMOS Standby Power Supply Current	-	0.2	-	0.2	-	0.2	mA	$\overline{RAS} = \overline{UCAS} = \overline{LCAS} = \overline{WE}$ = VCC - 0.2V	
Icc7	Self Refresh Mode Current	-	250	-	250	-	250	µA	$\overline{RAS} = \overline{CAS} \leq V_{SS} + 0.2V$ All other input high levels are VCC-0.2V or input low levels are VSS +0.2V	
VoH	Output Voltage	2.4	-	2.4	-	2.4	-	V	Iout = -2mA	
VoL		-	0.4	-	0.4	-	0.4	V	Iout = 2mA	



**AC Characteristics** (VCC = 3.3V ± 0.3%, VSS = 0V, Ta = 0°C to +70°C)

Test Conditions:

Input timing reference level: V<sub>IH</sub>/V<sub>IL</sub>=2.0V/0.8V

Output reference level: V<sub>OH</sub>/V<sub>OL</sub>=2.0V/0.8V

Output Load: 2TTL gate + CL (50pF)

Assumed t<sub>T</sub>=2ns

#	Std Symbol	Parameter	-45		-50		-60		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.		
	t <sub>T</sub>	Transition Time (Rise and Fall)	1	50	1	50	1	50	ns	4, 5
	t <sub>REF</sub>	Refresh Period	-	16	-	16	-	16	ms	3
1	t <sub>RC</sub>	Random Read or Write Cycle Time	79	-	84	-	104	-	ns	
2	t <sub>RP</sub>	$\overline{\text{RAS}}$ Precharge Time	30	-	30	-	40	-	ns	
3	t <sub>RAS</sub>	$\overline{\text{RAS}}$ Pulse Width	45	10K	50	10K	60	10K	ns	
4	t <sub>CAS</sub>	$\overline{\text{CAS}}$ Pulse Width	7	10K	8	10K	10	10K	ns	
5	t <sub>RCD</sub>	$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Delay Time	19	31	20	35	20	43	ns	6
6	t <sub>RAD</sub>	$\overline{\text{RAS}}$ to Column Address Delay Time	14	22	15	25	15	30	ns	7
7	t <sub>RS</sub>	$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ Hold Time	13	-	13	-	17	-	ns	
8	t <sub>CS</sub>	$\overline{\text{CAS}}$ Hold Time	36	-	40	-	50	-	ns	
9	t <sub>CRP</sub>	$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ Precharge Time	5	-	5	-	5	-	ns	
10	t <sub>ASR</sub>	Row Address Setup Time	0	-	0	-	0	-	ns	
11	t <sub>RAH</sub>	Row Address Hold Time	9	-	10	-	10	-	ns	
12	t <sub>CLZ</sub>	$\overline{\text{CAS}}$ to Output in Low Z	3	-	3	-	3	-	ns	8
13	t <sub>RAC</sub>	Access Time from $\overline{\text{RAS}}$	-	45	-	50	-	60	ns	6,7
14	t <sub>CAC</sub>	Access Time from $\overline{\text{CAS}}$	-	13	-	15	-	17	ns	6, 13
15	t <sub>AA</sub>	Access Time from Column Address	-	23	-	25	-	30	ns	7, 13
16	t <sub>AR</sub>	Column Address Hold Time from $\overline{\text{RAS}}$	23	-	25	-	30	-	ns	
17	t <sub>RCS</sub>	Read Command Setup Time	0	-	0	-	0	-	ns	
18	t <sub>RCH</sub>	Read Command Hold Time	0	-	0	-	0	-	ns	9
19	t <sub>RRH</sub>	Read Command Hold Time Reference to $\overline{\text{RAS}}$	0	-	0	-	0	-	ns	9



**AC Characteristics (continued)** ( $V_{CC} = 3.3V \pm 0.3\%$ ,  $V_{SS} = 0V$ ,  $T_a = 0^{\circ}C$  to  $+70^{\circ}C$ )

Test Conditions:

Input timing reference level:  $V_{IH}/V_{IL}=2.0V/0.8V$

Output reference level:  $V_{OH}/V_{OL}=2.0V/0.8V$

Output Load: 2TTL gate + CL (50pF)

Assumed  $t_T=2ns$

#	Std Symbol	Parameter	-45		-50		-60		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.		
20	trAL	Column Address to $\overline{RAS}$ Lead Time	23	-	25	-	30	-	ns	
21	tCOH	Output Hold After $\overline{CAS}$ Low	4	-	5	-	5	-	ns	
22	tODS	Output Disable Setup Time	0	-	0	-	0	-	ns	
23	toFF	Output Buffer Turn-Off Delay Time	3	13	3	13	3	15	ns	8, 10
24	tASC	Column Address Setup Time	0	-	0	-	0	-	ns	
25	tCAH	Column Address Hold Time	7	-	8	-	10	-	ns	
26	toES	$\overline{OE}$ Low to $\overline{CAS}$ High Set Up	3	-	3	-	3	-	ns	
27	twCS	Write Command Setup Time	0	-	0	-	0	-	ns	11
28	twCH	Write Command Hold Time	8	-	10	-	10	-	ns	11
29	twCR	Write Command Hold Time to $\overline{RAS}$	23	-	25	-	30	-	ns	
30	twP	Write Command Pulse Width	8	-	10	-	10	-	ns	
31	trWL	Write Command to $\overline{RAS}$ Lead Time	10	-	13	-	15	-	ns	
32	tcWL	Write Command to $\overline{CAS}$ Lead Time	7	-	8	-	10	-	ns	
33	tDS	Data-in setup Time	0	-	0	-	0	-	ns	12
34	tDH	Data-in Hold Time	7	-	8	-	10	-	ns	12
35	tDHR	Data-in Hold Time to $\overline{RAS}$	23	-	25	-	30	-	ns	
36	trWC	Read-Modify-Write Cycle Time	105	-	115	-	140	-	ns	
37	trWD	$\overline{RAS}$ to $\overline{WE}$ Delay Time (Read-Modify-Write)	59	-	67	-	79	-	ns	11
38	tcWD	$\overline{CAS}$ to $\overline{WE}$ Delay Time (Read-Modify-Write)	28	-	32	-	36	-	ns	11



**AC Characteristics (continued)** ( $V_{CC} = 3.3V \pm 0.3\%$ ,  $V_{SS} = 0V$ ,  $T_a = 0^\circ C$  to  $+70^\circ C$ )

Test Conditions:

Input timing reference level:  $V_{IH}/V_{IL}=2.0V/0.8V$

Output reference level:  $V_{OH}/V_{OL}=2.0V/0.8V$

Output Load: 2TTL gate + CL (50pF)

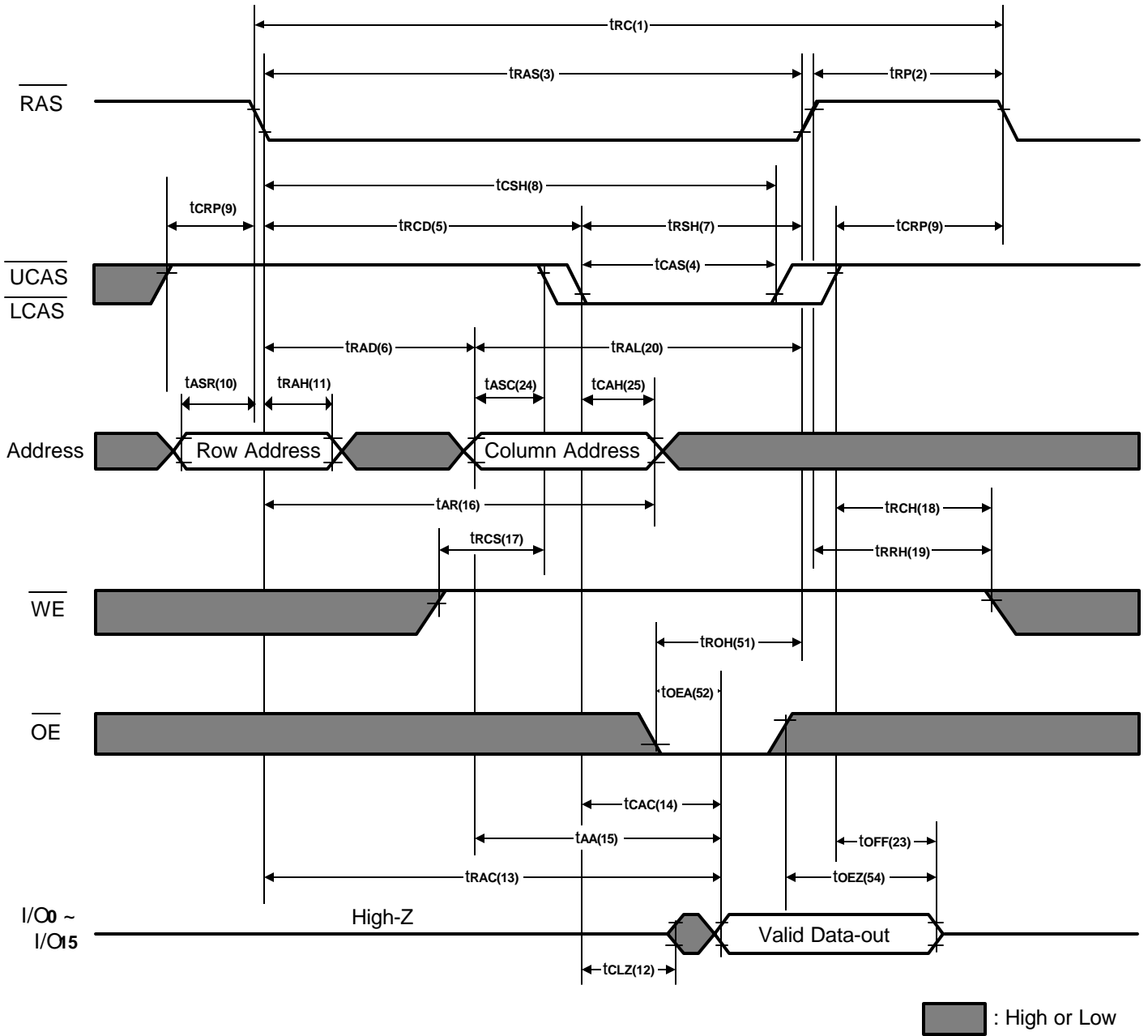
Assumed  $t_T=2ns$

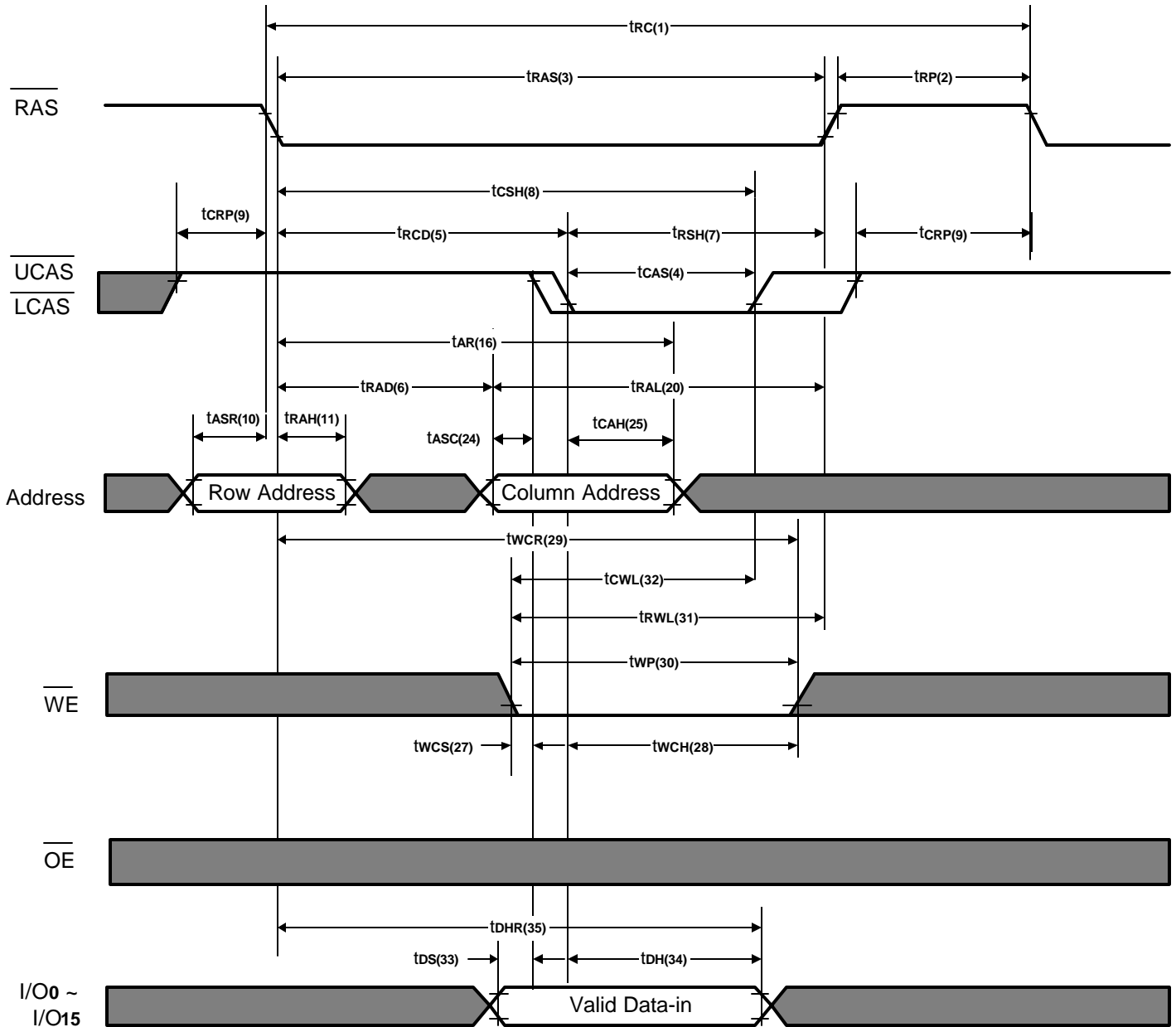
#	Std Symbol	Parameter	-45		-50		-60		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.		
39	t <sub>AWD</sub>	Column Address to $\overline{WE}$ Delay Time (Read-Modify-Write)	37	-	42	-	49	-	ns	11
40	t <sub>OEH</sub>	$\overline{OE}$ Hold Time from $\overline{WE}$ During	10	-	13	-	15	-	ns	
41	t <sub>OE P</sub>	$\overline{OE}$ High Pulse Width	5	-	5	-	5	-	ns	
42	t <sub>PC</sub>	Read or Write Cycle Time (EDO Page)	16	-	20	-	25	-	ns	14
43	t <sub>CPA</sub>	Access Time from $\overline{CAS}$ Precharge (EDO Page)	-	25	-	28	-	35	ns	13
44	t <sub>CP</sub>	$\overline{CAS}$ Precharge Time (EDO Page)	7	-	8	-	10	-	ns	
45	t <sub>PCM</sub>	EDO Page Mode RMW Cycle Time	39	-	47	-	56	-	ns	
46	t <sub>CRW</sub>	EDO Page Mode $\overline{CAS}$ Pulse Width (RMW)	31	-	34	-	38	-	ns	
47	t <sub>RASP</sub>	$\overline{RAS}$ Pulse Width (EDO Page)	45	200K	50	200K	60	200K	ns	
48	t <sub>CSR</sub>	$\overline{CAS}$ Setup Time ( $\overline{CAS}$ -before- $\overline{RAS}$ )	5	-	5	-	5	-	ns	3
49	t <sub>CHR</sub>	$\overline{CAS}$ Hold Time ( $\overline{CAS}$ -before- $\overline{RAS}$ )	10	-	10	-	10	-	ns	3
50	t <sub>RPC</sub>	$\overline{RAS}$ to $\overline{CAS}$ Precharge Time ( $\overline{CAS}$ -before- $\overline{RAS}$ )	5	-	5	-	5	-	ns	
51	t <sub>ROH</sub>	$\overline{RAS}$ Hold Time Reference to $\overline{OE}$	5	-	5	-	5	-	ns	
52	t <sub>OE A</sub>	$\overline{OE}$ Access Time	-	13	-	13	-	15	ns	
53	t <sub>OE D</sub>	$\overline{OE}$ to Data Delay	10	-	13	-	15	-	ns	
54	t <sub>OE Z</sub>	Output Buffer Turn-off Delay from $\overline{OE}$	3	13	3	13	3	13	ns	8
55	t <sub>RASS</sub>	$\overline{RAS}$ pulse width ( $\overline{C}$ -B- $\overline{R}$ self refresh)	100	-	100	-	100	-	$\mu s$	
56	t <sub>RPS</sub>	$\overline{RAS}$ precharge time ( $\overline{C}$ -B- $\overline{R}$ self refresh)	79	-	90	-	110	-	ns	
57	t <sub>CHS</sub>	$\overline{CAS}$ hold time ( $\overline{C}$ -B- $\overline{R}$ self refresh)	-	50	-	50	-	50	ns	



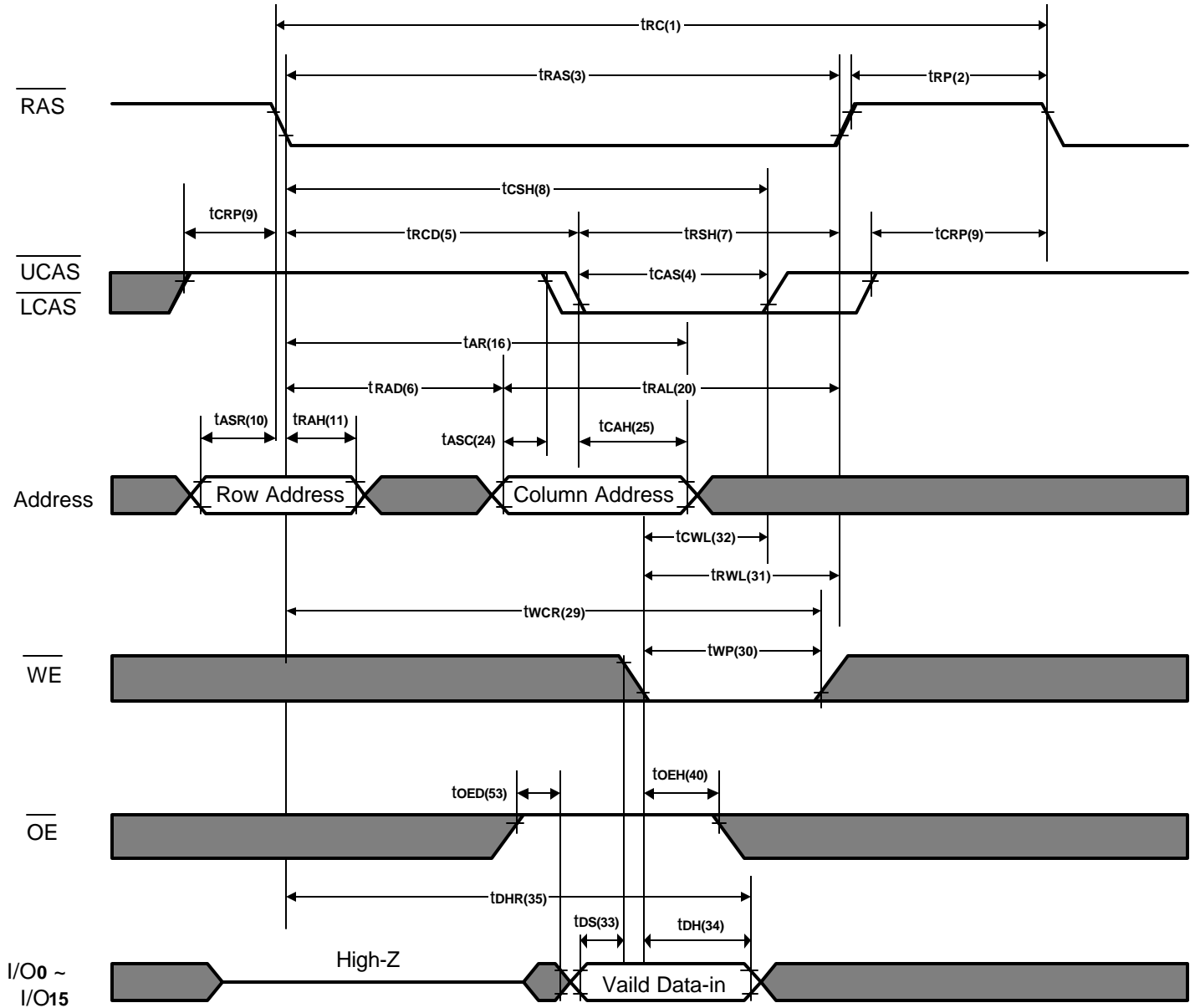
### Notes:

1.  $I_{CC1}$ ,  $I_{CC3}$ ,  $I_{CC4}$ , and  $I_{CC5}$  depend on cycle rate.
2.  $I_{CC1}$  and  $I_{CC4}$  depend on output loading. Specified values are obtained with the outputs open.
3. An initial pause of 200 $\mu$ s is required after power-up followed by any 8  $\overline{RAS}$  cycles before proper device operation is achieved. In the case of an internal refresh counter, a minimum of 8  $\overline{CAS}$  -before-  $\overline{RAS}$  initialization cycles instead of 8  $\overline{RAS}$  cycles are required. 8 initialization cycles are required after extended periods of bias without clocks.
4. AC Characteristics assume  $t_r = 2$ ns. All AC parameters are measured with a load equivalent to two TTL loads and 50pF,  $V_{IL}(\text{min.}) \geq \text{GND}$  and  $V_{IH}(\text{max.}) \leq V_{CC}$ .
5.  $V_{IH}(\text{min.})$  and  $V_{IL}(\text{max.})$  are reference levels for measuring timing of input signals. Transition times are measured between  $V_{IH}$  and  $V_{IL}$ .
6. Operation within the  $t_{RCD}(\text{max.})$  limit insures that  $t_{RAC}(\text{max.})$  can be met.  $t_{RCD}(\text{max.})$  is specified as a reference point only. If  $t_{RCD}$  is greater than the specified  $t_{RCD}(\text{max.})$  limit, then access time is controlled exclusively by  $t_{CAC}$ .
7. Operation within the  $t_{RAD}(\text{max.})$  limit insures that  $t_{RAC}(\text{max.})$  can be met.  $t_{RAD}(\text{max.})$  is specified as a reference point only. If  $t_{RAD}$  is greater than the specified  $t_{RAD}(\text{max.})$  limit, then access time is controlled exclusively by  $t_{AA}$ .
8. Assumes three state test load (5pF and a 500 $\Omega$  Thevenin equivalent).
9. Either  $t_{RCH}$  or  $t_{RRH}$  must be satisfied for a read cycle.
10.  $t_{OFF}(\text{max.})$  defines the time at which the output achieves the open circuit condition; it is not referenced to output voltage levels.
11.  $t_{WCS}$ ,  $t_{WCH}$ ,  $t_{RWD}$ ,  $t_{CWD}$  and  $t_{AWD}$  are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If  $t_{WCS} \geq t_{WCS}(\text{min.})$  and  $t_{WCH} \geq t_{WCH}(\text{min.})$ , the cycle is an early write cycle and data-out pins will remain open circuit, high impedance, throughout the entire cycle. If  $t_{RWD} \geq t_{RWD}(\text{min.})$ ,  $t_{CWD} \geq t_{CWD}(\text{min.})$  and  $t_{AWD} \geq t_{AWD}(\text{min.})$ , the cycle is a read-modify-write cycle and the data out will contain data read from the selected cell. If neither of the above conditions is satisfied, the condition of the data out at access time is indeterminate.
12. These parameters are referenced to  $\overline{UCAS}$  and  $\overline{LCAS}$  leading edge in early write cycles and to  $\overline{WE}$  leading edge in read-modify-write cycles.
13. Access time is determined by the longer of  $t_{AA}$  or  $t_{CAC}$  or  $t_{CPA}$ .
14.  $t_{ASC} \geq t_{CP}$  to achieve  $t_{PC}(\text{min.})$  and  $t_{CPA}(\text{max.})$  values.

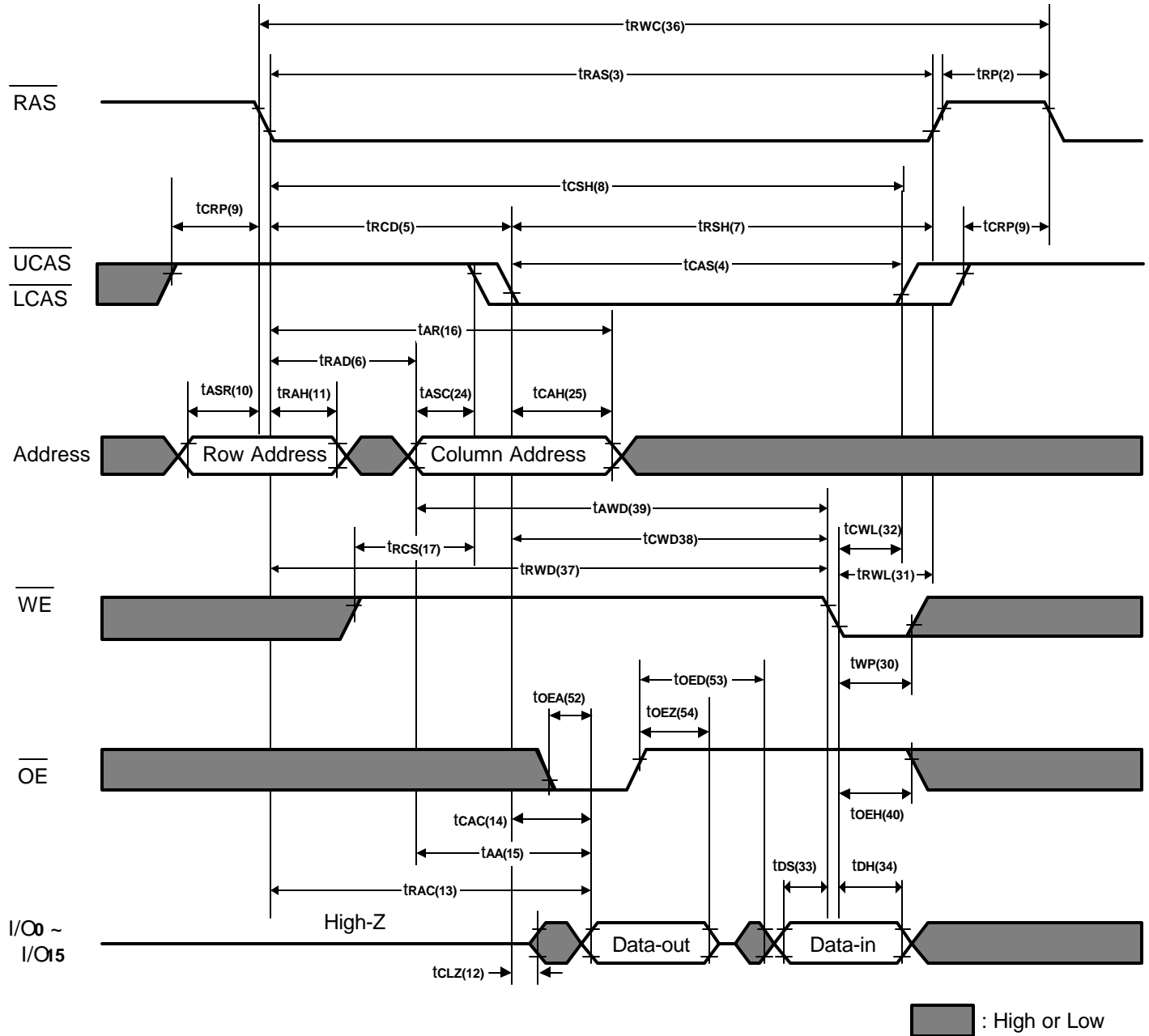
**Word Read Cycle**


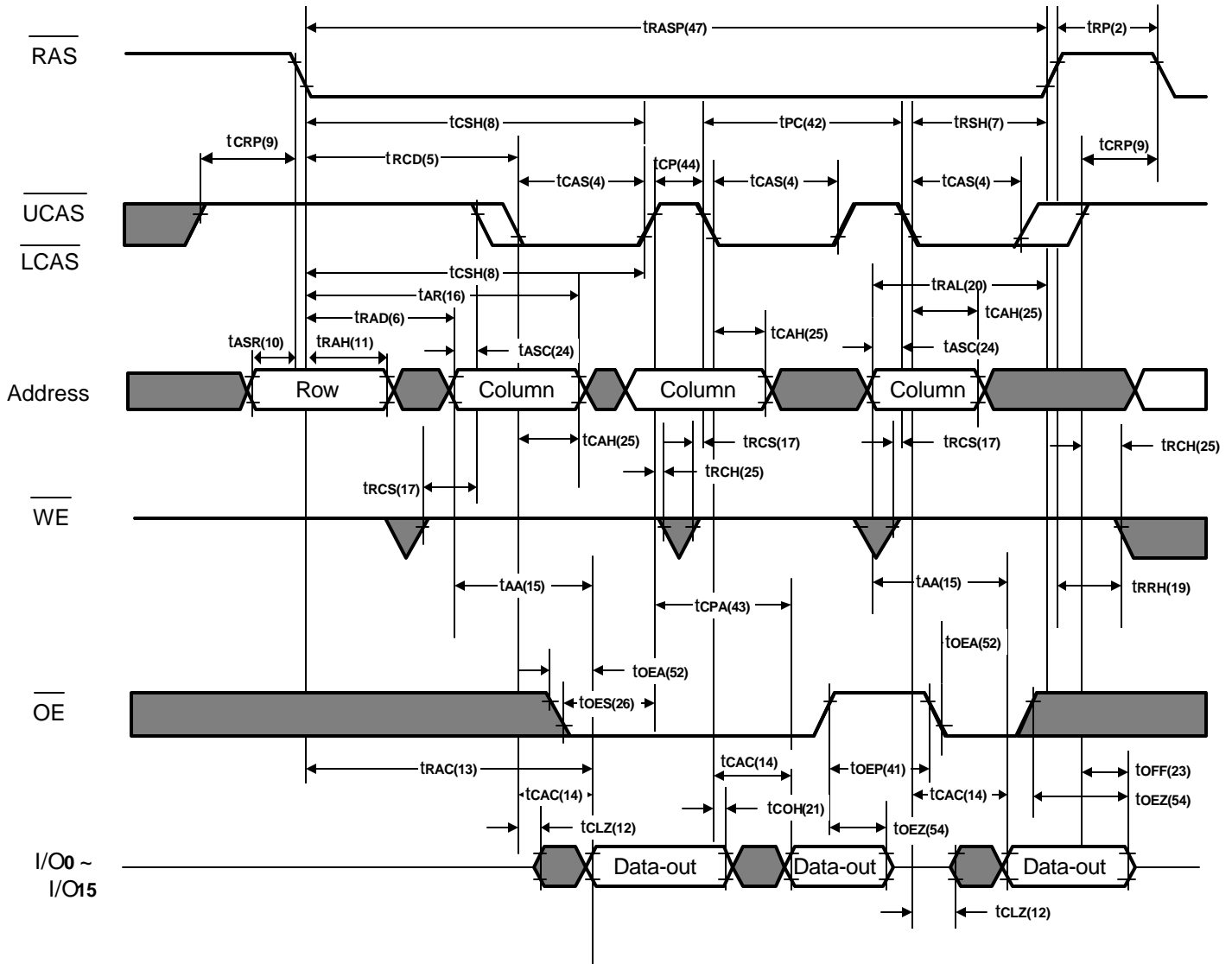
**Word Write Cycle (Early Write)**


 : High or Low

**Word Write Cycle (Late Write)**


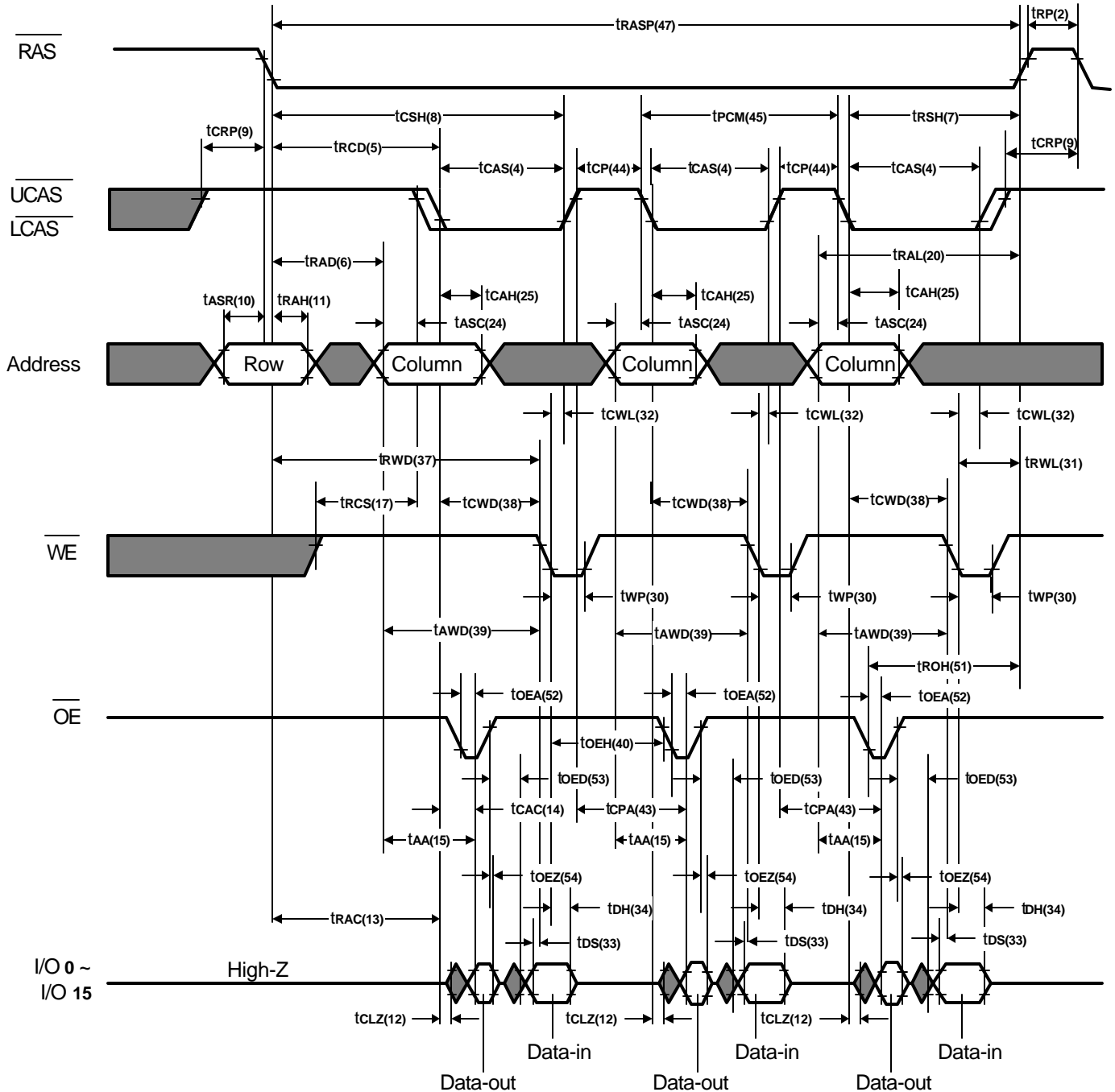
 : High or Low

**Word Read-Modify-Write Cycle**


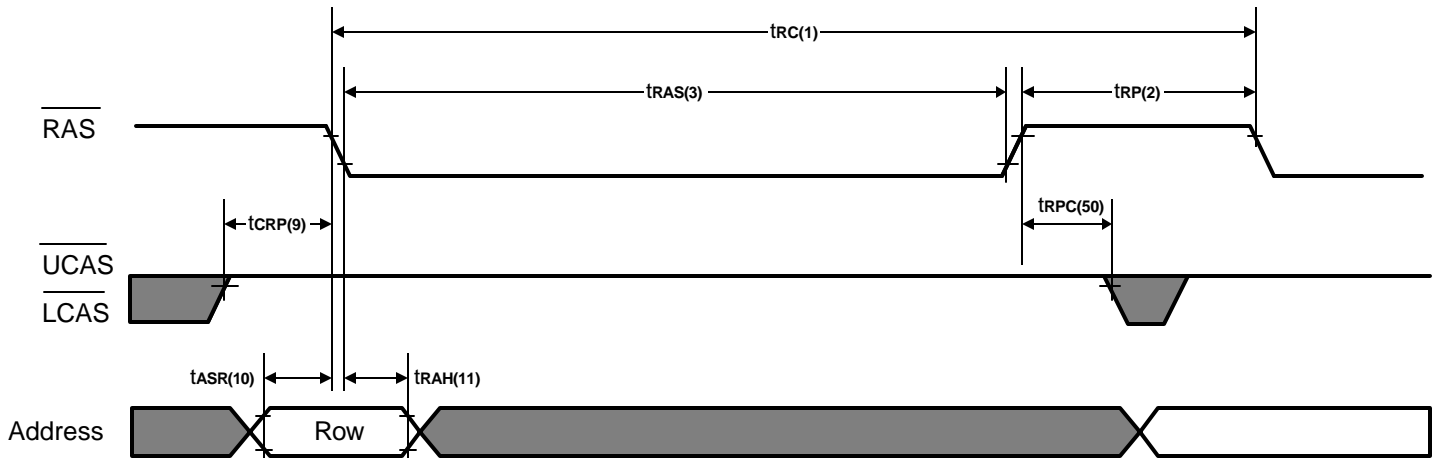
**EDO Page Mode Word Read Cycle**


 : High or Low



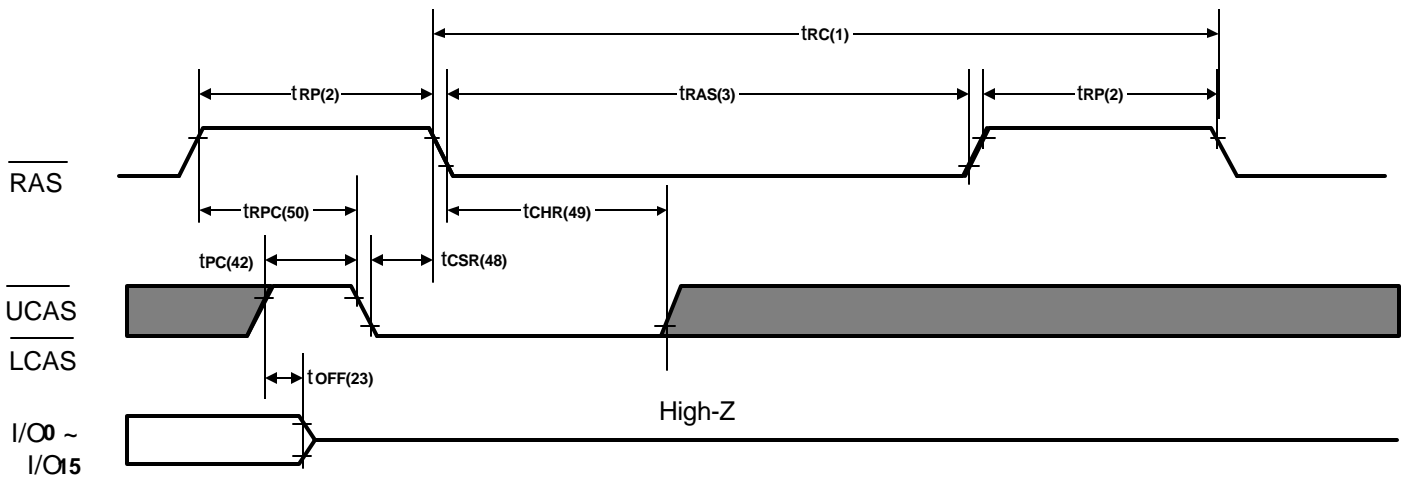
**EDO Page Mode Word Read-Modify-Write Cycle**


 : High or Low

**$\overline{\text{RAS}}$  Only Refresh Cycle**


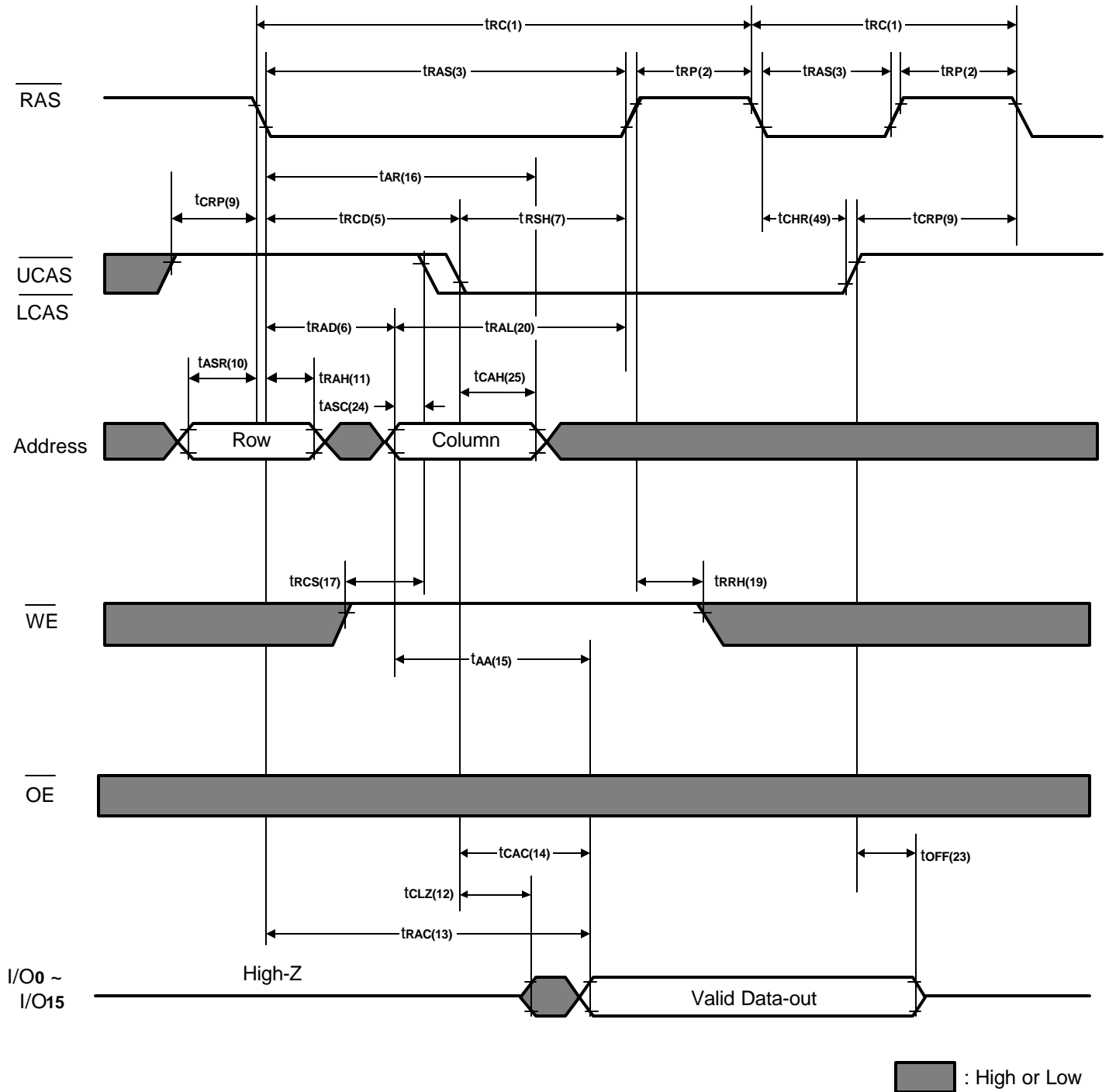
Note:  $\overline{\text{WE}}$ ,  $\overline{\text{OE}}$  = Don't care.

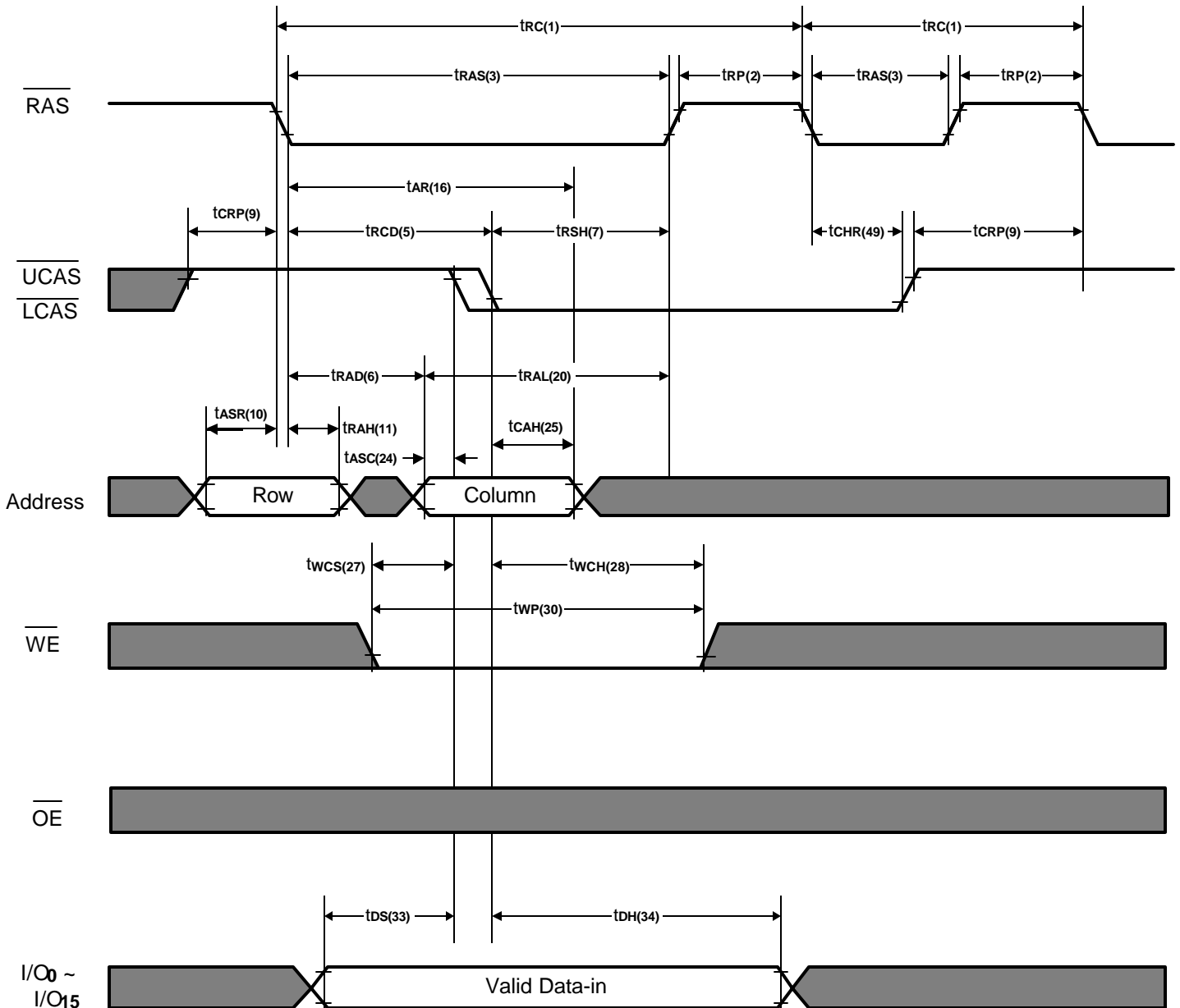
 : High or Low

 **$\overline{\text{CAS}}$  Before  $\overline{\text{RAS}}$  Refresh Cycle**


Note:  $\overline{\text{WE}}$ ,  $\overline{\text{OE}}$ , Address = Don't care.

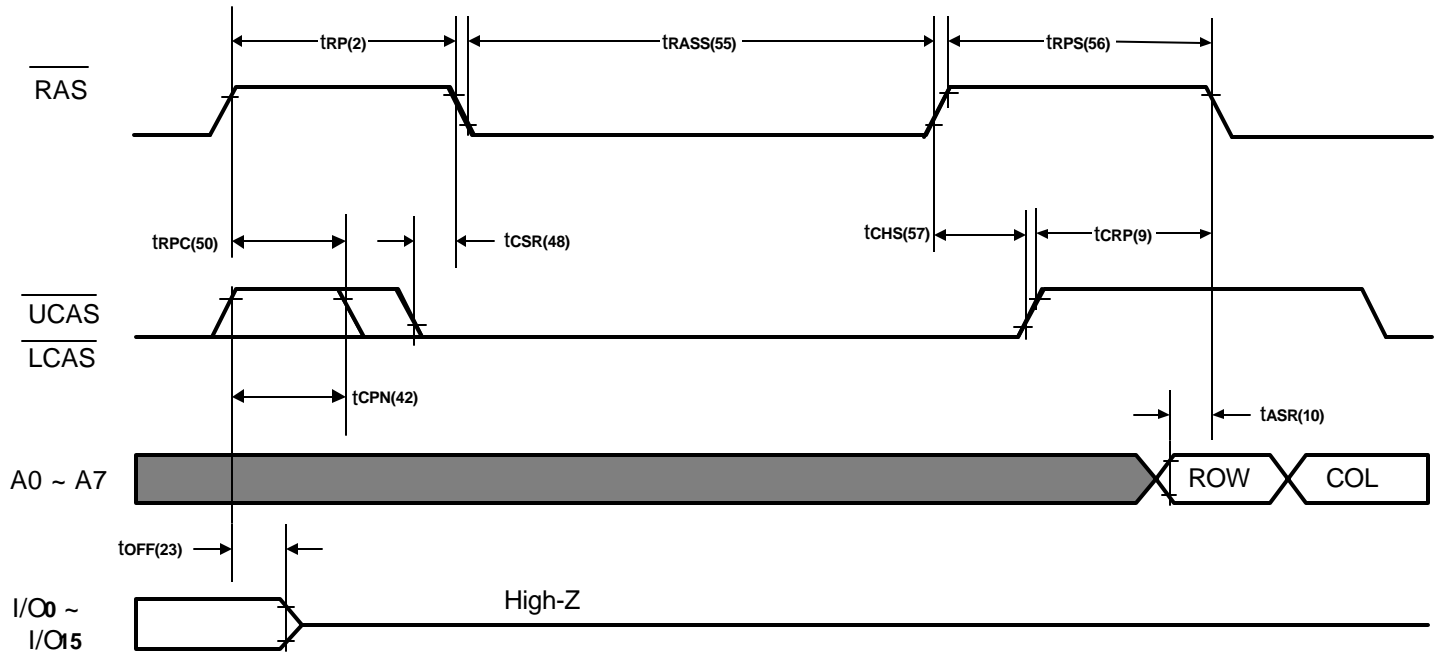
 : High or Low

**Hidden Refresh Cycle (Word Read)**


**Hidden Refresh Cycle (Early Word Write)**


 : High or Low



**Self Refresh Mode (A42L06161-L Only)**


Note:  $\overline{WE}$ ,  $\overline{OE}$  = Don't care.

 : High or Low

**■ Self Refresh Mode.**
**a. Entering the Self Refresh Mode:**

The A42L06161-L Self Refresh Mode is entered by using  $\overline{CAS}$  before  $\overline{RAS}$  cycle and holding  $\overline{RAS}$  and  $\overline{CAS}$  signal "low" longer than 100 $\mu$ s.

**b. Continuing the Self Refresh Mode:**

The Self Refresh Mode is continued by holding  $\overline{RAS}$  "low" after entering the Self Refresh Mode.

It does not depend on  $\overline{CAS}$  being "high" or "low" after entering the Self Refresh Mode continue the Self Refresh Mode.

**c. Exiting the Self Refresh Mode:**

The A42L06161 exits the Self Refresh Mode when the  $\overline{RAS}$  signal is brought "high".



## A42L0616 Series

**Capacitance** (f = 1MHz, Ta = Room Temperature, VCC = 3.3V ± 0.3%)

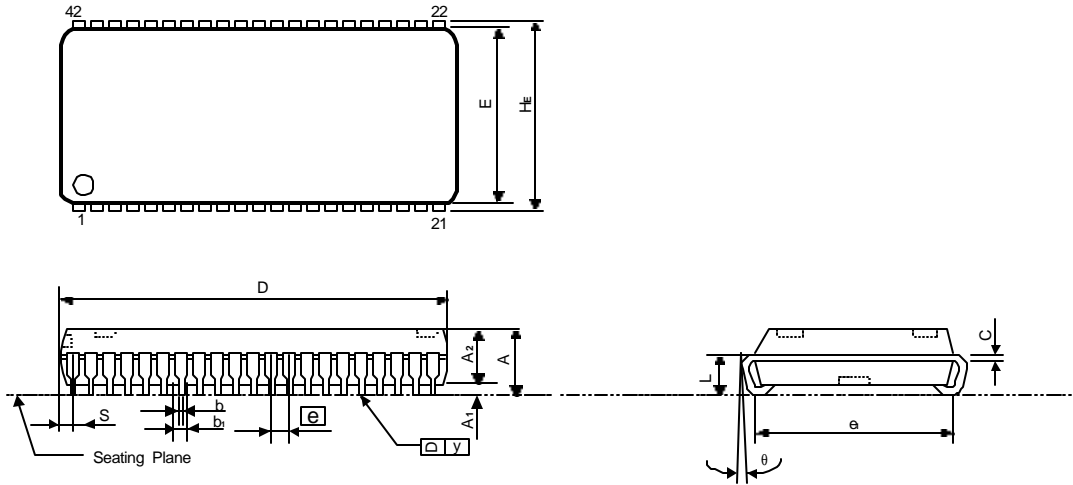
Symbol	Signals	Parameter	Max.	Unit	Test Conditions
CIN1	A0 – A9	Input Capacitance	5	pF	Vin = 0V
CIN2	$\overline{RAS}$ , $\overline{UCAS}$ , $\overline{LCAS}$ , $\overline{WE}$ , $\overline{OE}$		7	pF	Vin = 0V
C <sub>I/O</sub>	I/O <sub>0</sub> - I/O <sub>15</sub>	I/O Capacitance	7	pF	Vin = Vout = 0V

### Ordering Codes

Package \ $\overline{RAS}$ Access Time	45ns	50ns	60ns	Refresh Cycle	Self-Refresh
42L SOJ (400mil)	A42L0616S-45	A42L0616S-50	A42L0616S-60	1K	No
50(44)L TSOP type II (400mil)	A42L0616V-45	A42L0616V-50	A42L0616V-60	1K	No
42L SOJ (400mil)	A42L0616S-45L	A42L0616S-50L	A42L0616S-60L	1K	Yes
50(44)L TSOP type II (400mil)	A42L0616V-45L	A42L0616V-50L	A42L0616V-60L	1K	Yes

**Package Information**
**SOJ 42L Outline Dimensions**

unit: inches/mm



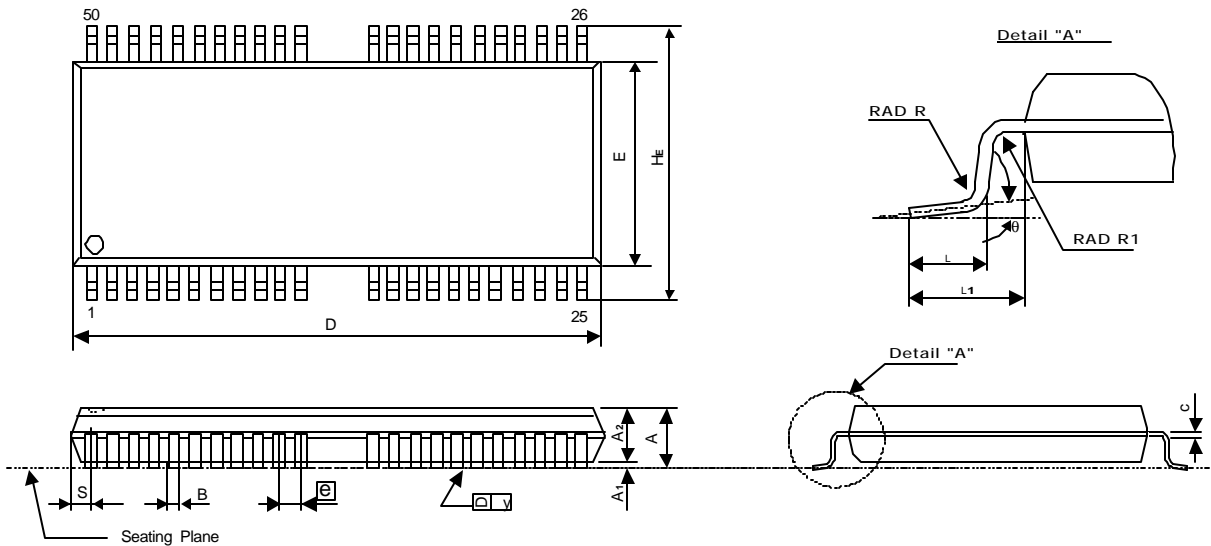
Symbol	Dimensions in inches			Dimensions in mm		
	Min	Nom	Max	Min	Nom	Max
A	0.128	0.138	0.148	3.25	3.51	3.76
A1	0.025	-	-	0.64	-	-
A2	0.105	0.110	0.115	2.67	2.79	2.92
b <sub>1</sub>	0.026	0.028	0.032	0.66	0.71	0.81
b	0.015	0.018	0.020	0.38	0.46	0.51
C	0.007	0.008	0.013	0.18	0.20	0.33
D	1.075	1.080	1.085	27.31	27.43	27.56
E	0.395	0.400	0.405	10.03	10.16	10.29
e	-	0.050	-	-	1.27	-
e <sub>1</sub>	-	0.370	-	-	9.4	-
HE	0.435	0.440	0.445	11.05	11.18	11.30
L	0.082	-	-	2.08	-	-
S	-	-	0.045	-	-	1.14
y	-	-	0.003	-	-	0.075
θ	0°	-	10°	0°	-	10°

**Notes:**

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension e<sub>1</sub> is for PC Board surface mount pad pitch design reference only.
4. Dimension S includes end flash.

**Package Information**
**TSOP 50/44L (Type II) Outline Dimensions**

unit: inches/mm



Symbol	Dimensions in inches			Dimensions in mm		
	Min	Nom	Max	Min	Nom	Max
A	-	-	0.048	-	-	1.20
A1	0.002	-	0.006	0.05	-	0.15
A2	0.037	0.039	0.042	0.95	1.00	1.05
B	0.012	-	0.018	0.30	-	0.45
c	0.005	-	0.008	0.12	-	0.21
D	0.820	0.825	0.830	20.82	20.95	21.08
E	0.395	0.400	0.405	10.03	10.16	10.29
[e]	0.0315 BSC			0.80 BSC		
HE	0.455	0.463	0.471	11.56	11.76	11.96
L	0.016	0.020	0.024	0.40	0.50	0.60
R	0.005	-	0.010	0.12	-	0.25
R1	0.005	-	-	0.12	-	-
S	0.0435 REF			0.875 BSC		
θ	0°	-	5°	0°	-	5°
y	-	-	0.004	-	-	0.1

**Notes:**

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension S includes end flash.