

**V53C16258H**  
**HIGH PERFORMANCE**  
**256K X 16 EDO PAGE MODE**  
**CMOS DYNAMIC RAM**  
**OPTIONAL SELF REFRESH**

HIGH PERFORMANCE	25	30	35	40	45	50
Max. $\overline{\text{RAS}}$ Access Time, ( $t_{\text{RAC}}$ )	25 ns	30 ns	35 ns	40 ns	45 ns	50 ns
Max. Column Address Access Time, ( $t_{\text{CAA}}$ )	13 ns	16 ns	18 ns	20 ns	22 ns	24 ns
Min. Extended Data Out Mode Cycle Time, ( $t_{\text{PC}}$ )	10 ns	12 ns	14 ns	15 ns	17 ns	19 ns
Min. Read/Write Cycle Time, ( $t_{\text{RC}}$ )	45 ns	60 ns	70 ns	75 ns	80 ns	90 ns

**Features**

- 256K x 16-bit organization
- EDO Page Mode for a sustained data rate of 100 MHz
- $\overline{\text{RAS}}$  access time: 25, 30, 35, 40, 45, 50 ns
- Dual  $\overline{\text{CAS}}$  Inputs
- Low power dissipation
- Read-Modify-Write,  $\overline{\text{RAS}}$ -Only Refresh,  $\overline{\text{CAS}}$ -Before- $\overline{\text{RAS}}$  Refresh
- Optional Self Refresh (V53C16258SH)
- Refresh Interval: 512 cycles/8 ms
- Available in 40-pin 400 mil SOJ and 40/44L-pin 400 mil TSOP-II packages
- Single +5V  $\pm 10\%$  Power Supply
- TTL Interface

**Description**

The V53C16258H is a high speed 262,144 x 16 bit high performance CMOS dynamic random access memory. The V53C16258H offers a combination of unique features including: EDO Page Mode operation for higher sustained bandwidth with Page Mode cycle times as short as 10ns. All inputs are TTL compatible. Input and output capacitance is significantly lowered to increase performance and minimize loading. These features make the V53C16258H ideally suited for a wide variety of high performance computer systems and peripheral applications.

**Device Usage Chart**

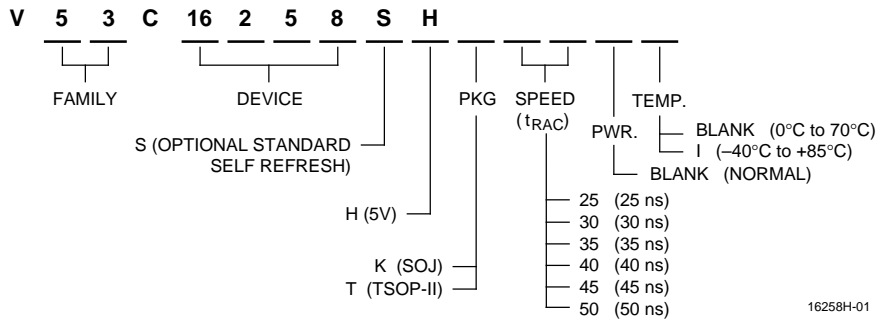
Operating Temperature Range	Package Outline		Access Time (ns)						Power	Temperature Mark
	K	T	25	30	35	40	45	50	Std.	
0°C to 70°C	•	•	•	•	•	•	•	•	•	Blank
-40°C to +85°C	•	•	•	•	•	•	•	•	•	I

Part Name	Self Refresh	Supply Voltage	Package	Speed
V53C16258HKxx	No Self Refresh	5V	SOJ	25/30/35/40/45/50
V53C16258HTxx	No Self Refresh	5V	TSOP	25/30/35/40/45/50
V53C16258SHKxx	Optional Standard Self Refresh (8ms)	5V	SOJ	25/30/35/40/45/50
V53C16258SHTxx	Optional Standard Self Refresh (8ms)	5V	TSOP	25/30/35/40/45/50

### 40-Pin SOJ PIN CONFIGURATION Top View

Vcc	1	40	Vss
I/O1	2	39	I/O16
I/O2	3	38	I/O15
I/O3	4	37	I/O14
I/O4	5	36	I/O13
Vcc	6	35	Vss
I/O5	7	34	I/O12
I/O6	8	33	I/O11
I/O7	9	32	I/O10
I/O8	10	31	I/O9
NC	11	30	NC
NC	12	29	LCAS
WE	13	28	UCAS
RAS	14	27	OE
NC	15	26	A8
A0	16	25	A7
A1	17	24	A6
A2	18	23	A5
A3	19	22	A4
Vcc	20	21	Vss

16258H-02



16258H-01

### 40/44 Pin Plastic TSOP-II PIN CONFIGURATION Top View

Vcc	1	44	Vss
I/O1	2	43	I/O16
I/O2	3	42	I/O15
I/O3	4	41	I/O14
I/O4	5	40	I/O13
Vcc	6	39	Vss
I/O5	7	38	I/O12
I/O6	8	37	I/O11
I/O7	9	36	I/O10
I/O8	10	35	I/O9
NC	13	32	NC
NC	14	31	LCAS
WE	15	30	UCAS
RAS	16	29	OE
NC	17	28	A8
A0	18	27	A7
A1	19	26	A6
A2	20	25	A5
A3	21	24	A4
Vcc	22	23	Vss

16258H-03

### Pin Names

A <sub>0</sub> –A <sub>8</sub>	Address Inputs
RAS	Row Address Strobe
UCAS	Column Address Strobe/Upper Byte Control
LCAS	Column Address Strobe/Lower Byte Control
WE	Write Enable
OE	Output Enable
I/O <sub>1</sub> –I/O <sub>16</sub>	Data Input, Output
V <sub>CC</sub>	+5V Supply
V <sub>SS</sub>	0V Supply
NC	No Connect

**Absolute Maximum Ratings\***

Ambient Temperature

Under Bias ..... -10°C to +80°C

Storage Temperature (plastic) ..... -55°C to +125°C

Voltage Relative to  $V_{SS}$  ..... -1.0 V to +7.0 V

Data Output Current ..... 50 mA

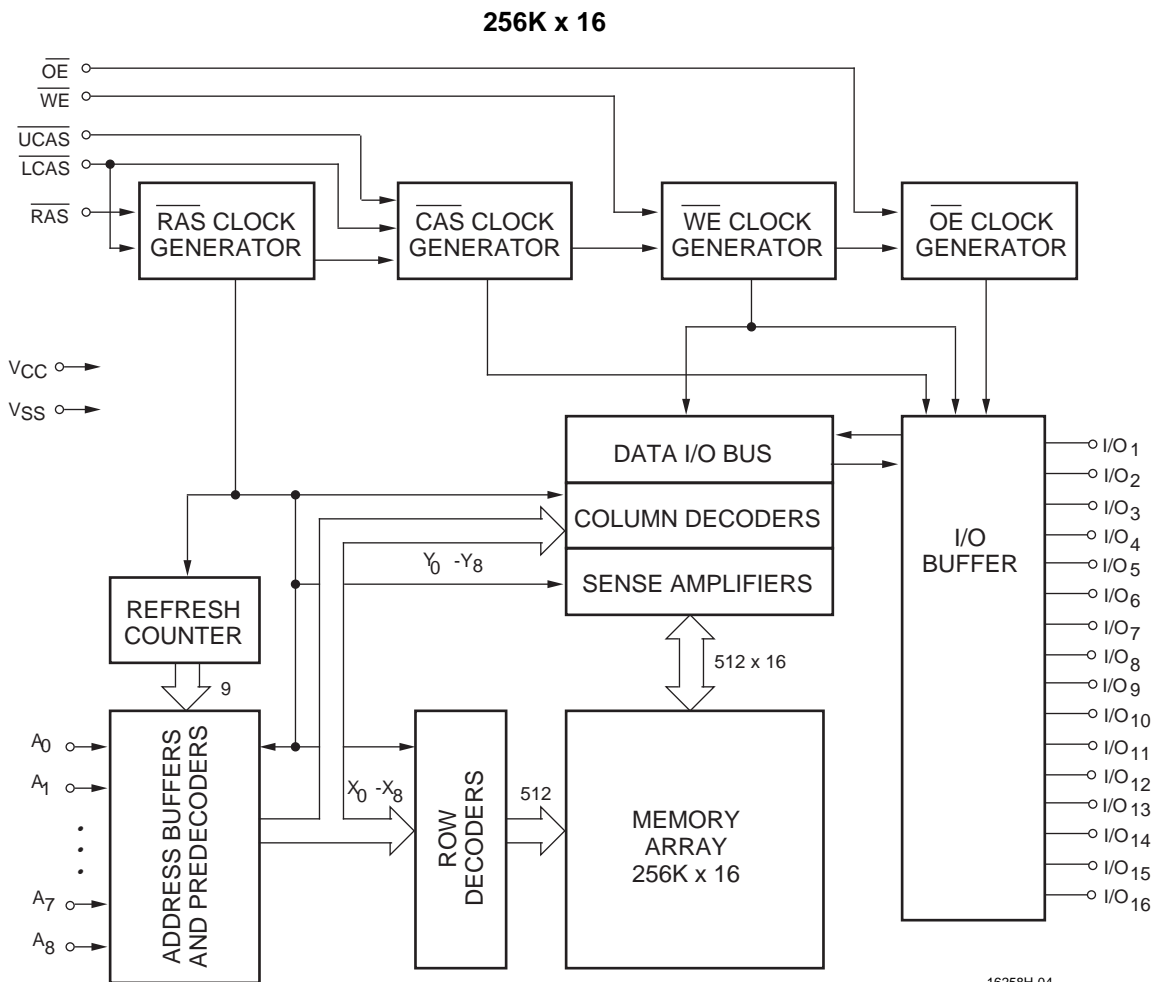
Power Dissipation ..... 1.0 W

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

**Capacitance\*** $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ 

Symbol	Parameter	Typ.	Max.	Unit
$C_{IN1}$	Address Input	3	4	pF
$C_{IN2}$	$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ , $\overline{\text{WE}}$ , $\overline{\text{OE}}$	4	5	pF
$C_{OUT}$	Data Input/Output	5	7	pF

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

**Block Diagram**

**DC and Operating Characteristics (1-2)**

$T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = 5\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ , unless otherwise specified.

Symbol	Parameter	Access Time	V53C16258H			Unit	Test Conditions	Notes
			Min.	Typ.	Max.			
$I_{LI}$	Input Leakage Current (any input pin)		-10		10	$\mu\text{A}$	$V_{SS} \leq V_{IN} \leq V_{CC}$	
$I_{LO}$	Output Leakage Current (for High-Z State)		-10		10	$\mu\text{A}$	$V_{SS} \leq V_{OUT} \leq V_{CC}$ $\overline{\text{RAS}}, \overline{\text{CAS}}$ at $V_{IH}$	
$I_{CC1}$	$V_{CC}$ Supply Current, Operating	25			260	mA	$t_{RC} = t_{RC}(\text{min.})$	1, 2
		30			200			
		35			190			
		40			180			
		45			100			
		50			90			
$I_{CC2}$	$V_{CC}$ Supply Current, TTL Standby				2	mA	$\overline{\text{RAS}}, \overline{\text{CAS}}$ at $V_{IH}$ other inputs $\geq V_{SS}$	
$I_{CC3}$	$V_{CC}$ Supply Current, $\overline{\text{RAS}}$ -Only Refresh	25			260	mA	$t_{RC} = t_{RC}(\text{min.})$	2
		30			200			
		35			190			
		40			180			
		45			100			
		50			90			
$I_{CC4}$	$V_{CC}$ Supply Current, EDO Page Mode Operation	25			200	mA	Minimum Cycle	1, 2
		30			140			
		35			130			
		40			120			
		45			90			
		50			80			
$I_{CC5}$	$V_{CC}$ Supply Current, Standby, Output Enabled other inputs $\geq V_{SS}$				2	mA	$\overline{\text{RAS}} = V_{IH}, \overline{\text{CAS}} = V_{IL}$	1
$I_{CC6}$	$V_{CC}$ Supply Current, CMOS Standby				1	mA	$\overline{\text{RAS}} \geq V_{CC} - 0.2\text{ V}$ , $\overline{\text{CAS}} \geq V_{CC} - 0.2\text{ V}$ , All other inputs $\geq V_{SS}$	
$I_{CC7}$	Self Refresh Current				400	$\mu\text{A}$	CBR Cycle with $t_{RAS} \geq t_{RASS}$ (Min.) and $\text{CAS} = V_{IL}$ ; $\overline{\text{WE}} = V_{CC} - 0.2\text{ V}$ ; $A_0 - A_8$ and $D_{IN} = V_{CC} - 0.2\text{ V}$	
$V_{CC}$	Supply Voltage		4.5	5.0	5.5	V		
$V_{IL}$	Input Low Voltage		-1		0.8	V		3
$V_{IH}$	Input High Voltage		2.4		$V_{CC} + 1$	V		3
$V_{OL}$	Output Low Voltage				0.4	V	$I_{OL} = 2\text{ mA}$	
$V_{OH}$	Output High Voltage		2.4			V	$I_{OH} = -2\text{ mA}$	

**AC Characteristics**

$T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = 5\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$  unless otherwise noted

AC Test conditions, input pulse levels 0 to 3V

#	Symbol	Parameter	25 (100 MHz)		30		35		40		45		50		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
1	$t_{RAS}$	$\overline{RAS}$ Pulse Width	25	75K	30	75K	35	75K	40	75K	45	75K	50	75K	ns	
2	$t_{RC}$	Read or Write Cycle Time	45		60		70		75		80		90		ns	
3	$t_{RP}$	$\overline{RAS}$ Precharge Time	15		20		25		25		25		30		ns	
4	$t_{CSH}$	$\overline{CAS}$ Hold Time	25		30		35		40		45		50		ns	
5	$t_{CAS}$	$\overline{CAS}$ Pulse Width	4		5		6		7		8		9		ns	
6	$t_{RCD}$	$\overline{RAS}$ to $\overline{CAS}$ Delay	10	17	12	20	13	24	15	28	18	32	19	36	ns	4
7	$t_{RCS}$	Read Command Setup Time	0		0		0		0		0		0		ns	
8	$t_{ASR}$	Row Address Setup Time	0		0		0		0		0		0		ns	
9	$t_{RAH}$	Row Address Hold Time	4		5		6		7		8		9		ns	
10	$t_{ASC}$	Column Address Setup Time	0		0		0		0		0		0		ns	
11	$t_{CAH}$	Column Address Hold Time	4		5		5		5		6		7		ns	
12	$t_{RSH(R)}$	$\overline{RAS}$ Hold Time (Read Cycle)	7		9		10		10		10		10		ns	
13	$t_{CRP}$	$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	5		5		5		5		5		5		ns	
14	$t_{RCH}$	Read Command Hold Time Referenced to $\overline{CAS}$	0		0		0		0		0		0		ns	5
15	$t_{RRH}$	Read Command Hold Time Referenced to $\overline{RAS}$	0		0		0		0		0		0		ns	5
16	$t_{ROH}$	$\overline{RAS}$ Hold Time Referenced to $\overline{OE}$	4		6		7		8		9		10		ns	
17	$t_{OAC}$	Access Time from $\overline{OE}$		8		10		11		12		13		14	ns	12
18	$t_{CAC}$	Access Time from $\overline{CAS}$		8		10		11		12		13		14	ns	6, 7, 14
19	$t_{RAC}$	Access Time from $\overline{RAS}$		25		30		35		40		45		50	ns	6, 8, 9
20	$t_{CAA}$	Access Time from Column Address		13		16		18		20		22		24	ns	6, 7, 10
21	$t_{LZ}$	$\overline{OE}$ or $\overline{CAS}$ to Low-Z Output	0		0		0		0		0		0		ns	16
22	$t_{HZ}$	$\overline{OE}$ or $\overline{CAS}$ to High-Z Output	0	5	0	5	0	6	0	6	0	7	0	8	ns	16
23	$t_{AR}$	Column Address Hold Time from $\overline{RAS}$	19		23		25		30		35		40		ns	
24	$t_{RAD}$	$\overline{RAS}$ to Column Address Delay Time	8	13	9	14	10	17	12	20	13	23	14	26	ns	11
25	$t_{RSH(W)}$	$\overline{RAS}$ or $\overline{CAS}$ Hold Time in Write Cycle	7		9		10		10		10		10		ns	
26	$t_{CWL}$	Write Command to $\overline{CAS}$ Lead Time	5		7		8		10		13		14		ns	
27	$t_{WCS}$	Write Command Setup Time	0		0		0		0		0		0		ns	12, 13
28	$t_{WCH}$	Write Command Hold Time	4		5		5		5		6		7		ns	

**AC Characteristics** (Cont'd)

#	Symbol	Parameter	25 (100 MHz)		30		35		40		45		50		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
29	t <sub>WP</sub>	Write Pulse Width	4		5		5		5		6		7		ns	
30	t <sub>WCR</sub>	Write Command Hold Time from RAS	19		23		25		30		35		40		ns	
31	t <sub>RWL</sub>	Write Command to RAS Lead Time	7		9		10		10		13		14		ns	
32	t <sub>DS</sub>	Data in Setup Time	0		0		0		0		0		0		ns	14
33	t <sub>DH</sub>	Data in Hold Time	4		5		5		5		6		7		ns	14
34	t <sub>WOH</sub>	Write to OE Hold Time	5		5		5		6		7		8		ns	14
35	t <sub>OED</sub>	OE to Data Delay Time	5		5		5		6		7		8		ns	14
36	t <sub>RWC</sub>	Read-Modify-Write Cycle Time	67		79		90		95		115		130		ns	
37	t <sub>RRW</sub>	Read-Modify-Write Cycle RAS Pulse Width	46		53		59		64		80		87		ns	
38	t <sub>CWD</sub>	CAS to WE Delay	19		21		23		25		32		34		ns	12
39	t <sub>RWD</sub>	RAS to WE Delay in Read-Modify-Write Cycle	36		41		46		51		62		68		ns	12
40	t <sub>CRW</sub>	CAS Pulse Width (RMW)	27		31		34		38		50		52		ns	
41	t <sub>AWD</sub>	Col. Address to WE Delay	24		27		29		31		41		42		ns	12
42	t <sub>PC</sub>	EDO Fast Page Mode Read or Write Cycle Time	10		12		14		15		17		19		ns	
43	t <sub>CP</sub>	CAS Precharge Time	3		3		4		5		6		7		ns	
44	t <sub>CAR</sub>	Column Address to RAS Setup Time	13		16		18		20		22		24		ns	
45	t <sub>CAP</sub>	Access Time from Column Precharge		15		18		20		22		25		27	ns	7
46	t <sub>DHR</sub>	Data in Hold Time Referenced to RAS	19		23		25		30		35		40		ns	
47	t <sub>CSR</sub>	CAS Setup Time CAS-before-RAS Refresh	5		7		8		10		10		10		ns	
48	t <sub>RPC</sub>	RAS to CAS Precharge Time	0		0		0		0		0		0		ns	
49	t <sub>CHR</sub>	CAS Hold Time CAS-before-RAS Refresh	6		7		8		8		10		10		ns	
50	t <sub>PCM</sub>	EDO Page Mode Read-Modify-Write Cycle Time	35		40		43		47		65		70		ns	
51	t <sub>COH</sub>	Output Hold After CAS Low	4		5		5		5		5		5		ns	
52	t <sub>OES</sub>	OE Low to CAS High Setup Time	3		3		3		3		5		5		ns	
53	t <sub>OEH</sub>	OE Hold Time from WE during Read-Modify Write Cycle	5		5		5		5		10		10		ns	

**AC Characteristics** (Cont'd)

#	Symbol	Parameter	25 (100 MHz)		30		35		40		45		50		Unit	Notes
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
54	t <sub>OEP</sub>	OE High Pulse Width	4		5		8		10		10		10		ns	
55	t <sub>T</sub>	Transition Time (Rise and Fall)	1.5	50	1.5	50	1.5	50	1.5	50	1.5	50	1.5	50	ns	15
56	t <sub>REF</sub>	Refresh Interval (512 Cycles)		8		8		8		8		8		8	ms	17
Optional Self Refresh																
57	t <sub>RASS</sub>	RAS Pulse Width During Self Refresh	100		100		100		100		100		100		μs	18
58	t <sub>RPS</sub>	RAS Precharge Time During Self Refresh	100		100		100		100		100		100		ns	18
59	t <sub>CHS</sub>	CAS Hold Time Width During Self Refresh	100		100		100		100		100		100		ns	18
60	t <sub>CHD</sub>	CAS Low Time During Self Refresh	100		100		100		100		100		100		μs	18

**Notes:**

1.  $I_{CC}$  is dependent on output loading when the device output is selected. Specified  $I_{CC}$  (max.) is measured with the output open.
2.  $I_{CC}$  is dependent upon the number of address transitions. Specified  $I_{CC}$  (max.) is measured with a maximum of two transitions per address cycle in EDO Page Mode.
3. Specified  $V_{IL}$  (min.) is steady state operating. During transitions,  $V_{IL}$  (min.) may undershoot to  $-1.0$  V for a period not to exceed 20 ns. All AC parameters are measured with  $V_{IL}$  (min.)  $\geq V_{SS}$  and  $V_{IH}$  (max.)  $\leq V_{CC}$ .
4.  $t_{RCD}$  (max.) is specified for reference only. Operation within  $t_{RCD}$  (max.) limits insures that  $t_{RAC}$  (max.) and  $t_{CAA}$  (max.) can be met. If  $t_{RCD}$  is greater than the specified  $t_{RCD}$  (max.), the access time is controlled by  $t_{CAA}$  and  $t_{CAC}$ .
5. Either  $t_{RRH}$  or  $t_{RCH}$  must be satisfied for a Read Cycle to occur.
6. Measured with a load equivalent to one TTL input and 50 pF.
7. Access time is determined by the longest of  $t_{CAA}$ ,  $t_{CAC}$  and  $t_{CAP}$ .
8. Assumes that  $t_{RAD} \leq t_{RAD}$  (max.). If  $t_{RAD}$  is greater than  $t_{RAD}$  (max.),  $t_{RAC}$  will increase by the amount that  $t_{RAD}$  exceeds  $t_{RAD}$  (max.).
9. Assumes that  $t_{RCD} \leq t_{RCD}$  (max.). If  $t_{RCD}$  is greater than  $t_{RCD}$  (max.),  $t_{RAC}$  will increase by the amount that  $t_{RCD}$  exceeds  $t_{RCD}$  (max.).
10. Assumes that  $t_{RAD} \geq t_{RAD}$  (max.).
11. 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, the access time is controlled by  $t_{CAA}$  and  $t_{CAC}$ .
12.  $t_{WCS}$ ,  $t_{RWD}$ ,  $t_{AWD}$  and  $t_{CWD}$  are not restrictive operating parameters.
13.  $t_{WCS}$  (min.) must be satisfied in an Early Write Cycle.
14.  $t_{DS}$  and  $t_{DH}$  are referenced to the latter occurrence of  $\overline{CAS}$  or  $\overline{WE}$ .
15.  $t_T$  is measured between  $V_{IH}$  (min.) and  $V_{IL}$  (max.). AC-measurements assume  $t_T = 3$  ns.
16. Assumes a three-state test load (5 pF and a 500 Ohm Thevenin equivalent).
17. An initial 200  $\mu$ s pause and 8  $\overline{RAS}$ -containing cycles are required when exiting an extended period of bias without clocks. An extended period of time without clocks is defined as one that exceeds the specified Refresh Interval.
18. One CBR refresh or complete set of row refresh cycles must be completed upon exiting Self Refresh Mode.

**Truth Table**

Function	RAS	LCAS	UCAS	WE	OE	ADDRESS	I/O	Notes
Standby	H	H	H	X	X	X	High-Z	
Read: Word	L	L	L	H	L	ROW/COL	Data Out	
Read: Lower Byte	L	L	H	H	L	ROW/COL	Lower Byte, Data-Out Upper Byte, High-Z	
Read: Upper Byte	L	H	L	H	L	ROW/COL	Lower Byte, High-Z Upper Byte, Data-Out	
Write: Word (Early-Write)	L	L	L	L	X	ROW/COL	Data-In	
Write: Lower Byte (Early)	L	L	H	L	X	ROW/COL	Lower Byte, Data-In Upper Byte, High-Z	
Read: Upper Byte (Early)	L	H	L	L	X	ROW/COL	Lower Byte, High-Z Upper Byte, Data-In	
Read-Write	L	L	L	H→L	L→H	ROW/COL	Data-Out, Data-In	1, 2
EDO Page-Mode Read	L	H→L	H→L	H	L	COL	Data-Out	2
EDO Page-Mode Write	L	H→L	H→L	L	X	COL	Data-In	2
EDO Page-Mode Read-Write	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
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	H	X	X	X	High-Z	

**Notes:**

1. Byte Write cycles  $\overline{\text{LCAS}}$  or  $\overline{\text{UCAS}}$  active.
2. Byte Read cycles  $\overline{\text{LCAS}}$  or  $\overline{\text{UCAS}}$  active.
3. Only one of the two  $\overline{\text{CAS}}$  must be active ( $\overline{\text{LCAS}}$  or  $\overline{\text{UCAS}}$ ).



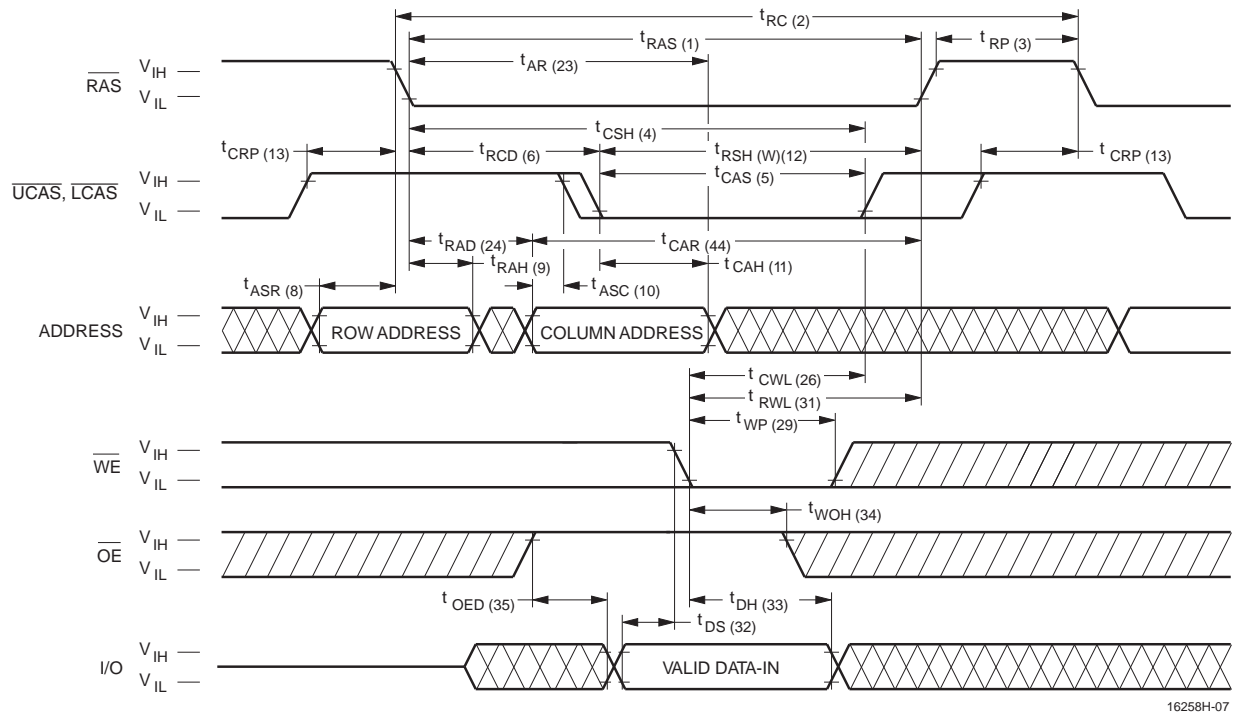
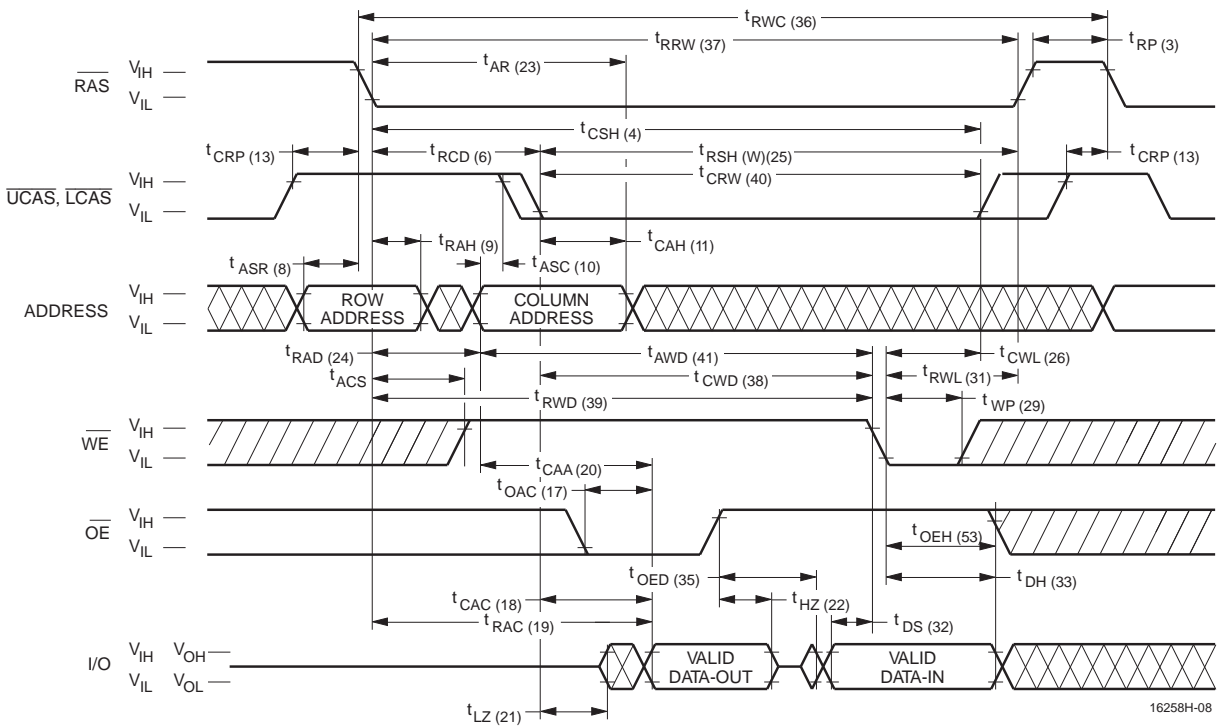
The timing diagram illustrates the relationship between several control and data signals for the 16258H-05 device. The signals shown are:

- RAS**: Row Address Strobe, active low. Timing parameters include  $t_{AR}$  (23),  $t_{RAS}$  (1),  $t_{RC}$  (2), and  $t_{RP}$  (3).
- UCAS, LCAS**: User/Column Address Strobe, active low. Timing parameters include  $t_{CRP}$  (13),  $t_{RCD}$  (6),  $t_{CSH}$  (4),  $t_{RSH}$  (R) (12),  $t_{CAS}$  (5), and  $t_{RAD}$  (24).
- ADDRESS**: Data bus address. It is divided into **ROW ADDRESS** and **COLUMN ADDRESS** phases. Timing parameters include  $t_{ASR}$  (8),  $t_{RAH}$  (9),  $t_{ASC}$  (10),  $t_{CAH}$  (11),  $t_{CAR}$  (44),  $t_{RRH}$  (15), and  $t_{RCH}$  (14).
- WE**: Write Enable, active low. Timing parameters include  $t_{RCS}$  (7) and  $t_{ROH}$  (16).
- OE**: Output Enable, active low. Timing parameters include  $t_{CAA}$  (20),  $t_{OAC}$  (17),  $t_{OES}$  (52), and  $t_{HZ}$  (22).
- I/O**: Data bus. It shows **VALID DATA-OUT** and **VALID DATA-IN** periods. Timing parameters include  $t_{CAC}$  (18),  $t_{RAC}$  (19),  $t_{LZ}$  (21), and  $t_{HZ}$  (22).

The diagram uses standard logic level symbols:  $V_{IH}$  for high-level input,  $V_{IL}$  for low-level input,  $V_{OH}$  for high-level output, and  $V_{OL}$  for low-level output. Shaded regions indicate periods where the signal is in a high-impedance state.

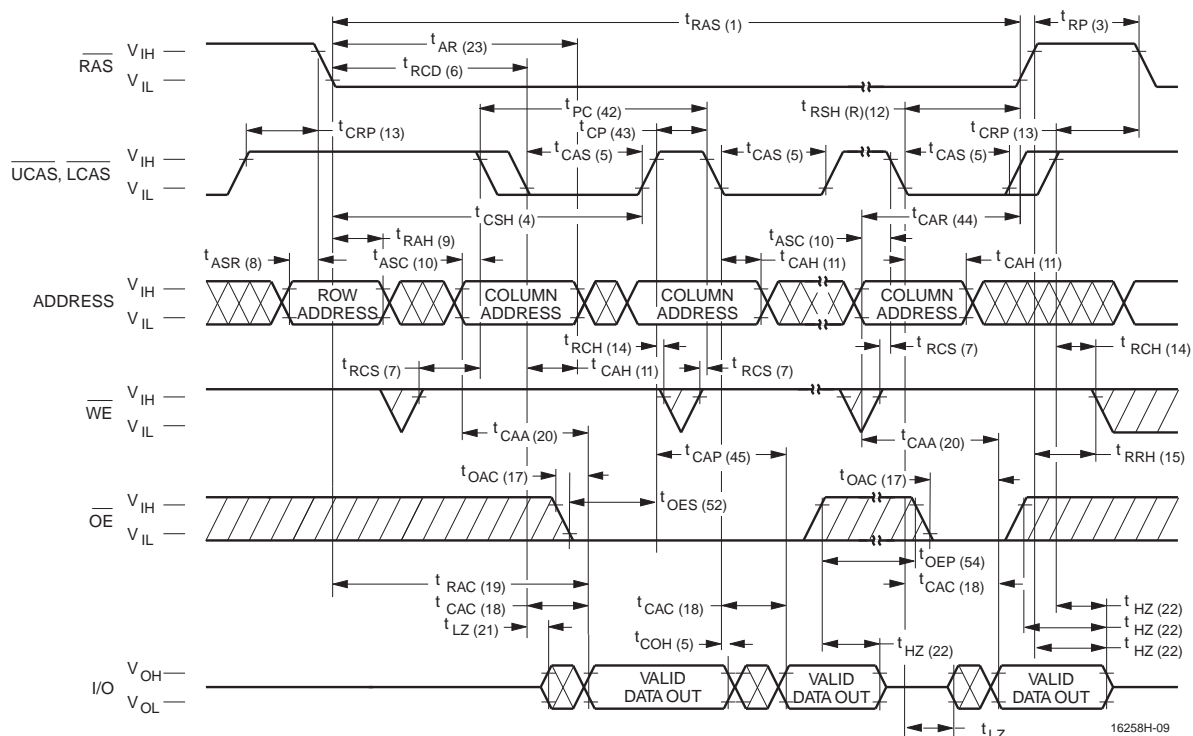
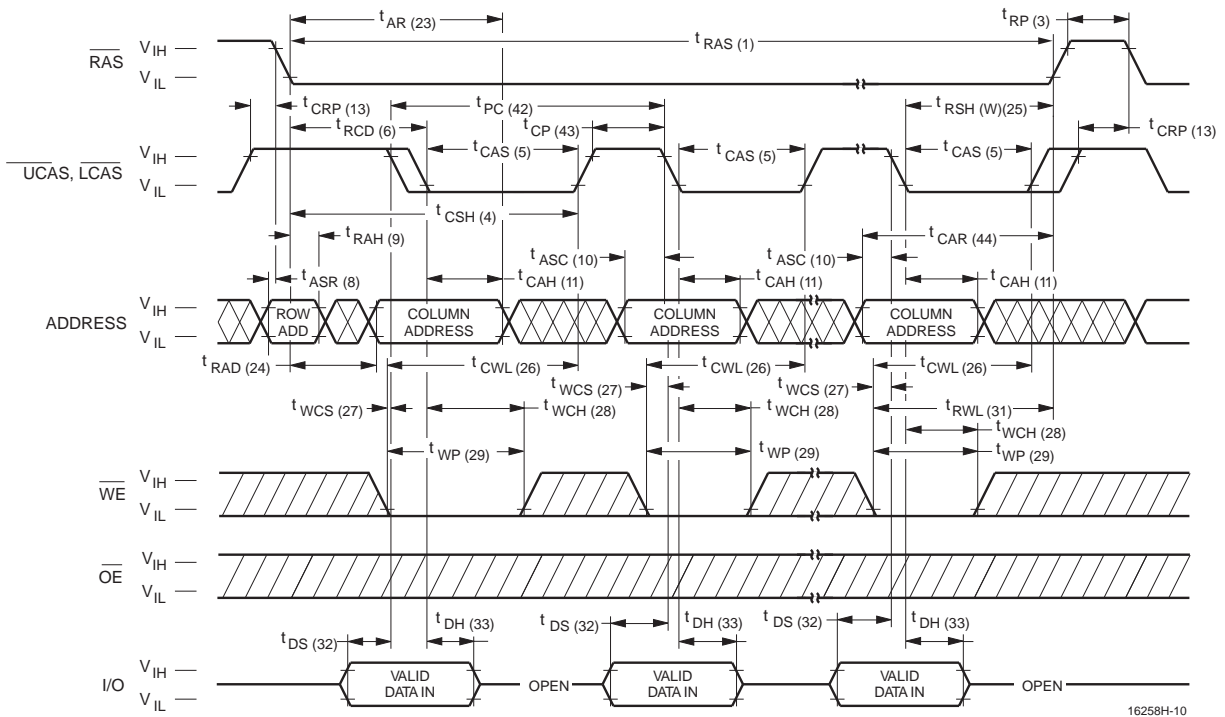
The timing diagram illustrates the relationship between several signals and their timing parameters:

- RAS:** Shows  $t_{AR}$  (23),  $t_{RAS}$  (1),  $t_{RC}$  (2), and  $t_{RP}$  (3).
- UCAS, LCAS:** Shows  $t_{CRP}$  (13),  $t_{RCD}$  (6),  $t_{CSH}$  (4),  $t_{RSH}$  (W/25),  $t_{CAS}$  (5), and  $t_{CAR}$  (44).
- ADDRESS:** Shows  $t_{ASR}$  (8),  $t_{RAH}$  (9),  $t_{ASC}$  (10),  $t_{CAH}$  (11),  $t_{RAD}$  (24),  $t_{CWL}$  (26), and  $t_{WCH}$  (28).
- WE:** Shows  $t_{WP}$  (29),  $t_{WCS}$  (27),  $t_{WCR}$  (30), and  $t_{RWL}$  (31).
- OE:** Shows  $t_{DHR}$  (46),  $t_{DS}$  (32), and  $t_{DH}$  (33).
- I/O:** Shows the **VALID DATA-IN** period.

**Waveforms of  $\overline{OE}$ -Controlled Write Cycle****Waveforms of Read-Modify-Write Cycle**

Don't Care

Undefined

**Waveforms of EDO Page Mode Read Cycle****Waveforms of EDO Page Mode Write Cycle**

 Don't Care
  Undefined


The timing diagram illustrates the relationship between several control and data signals for the 16258H-11 device. The signals and their associated timing parameters are as follows:

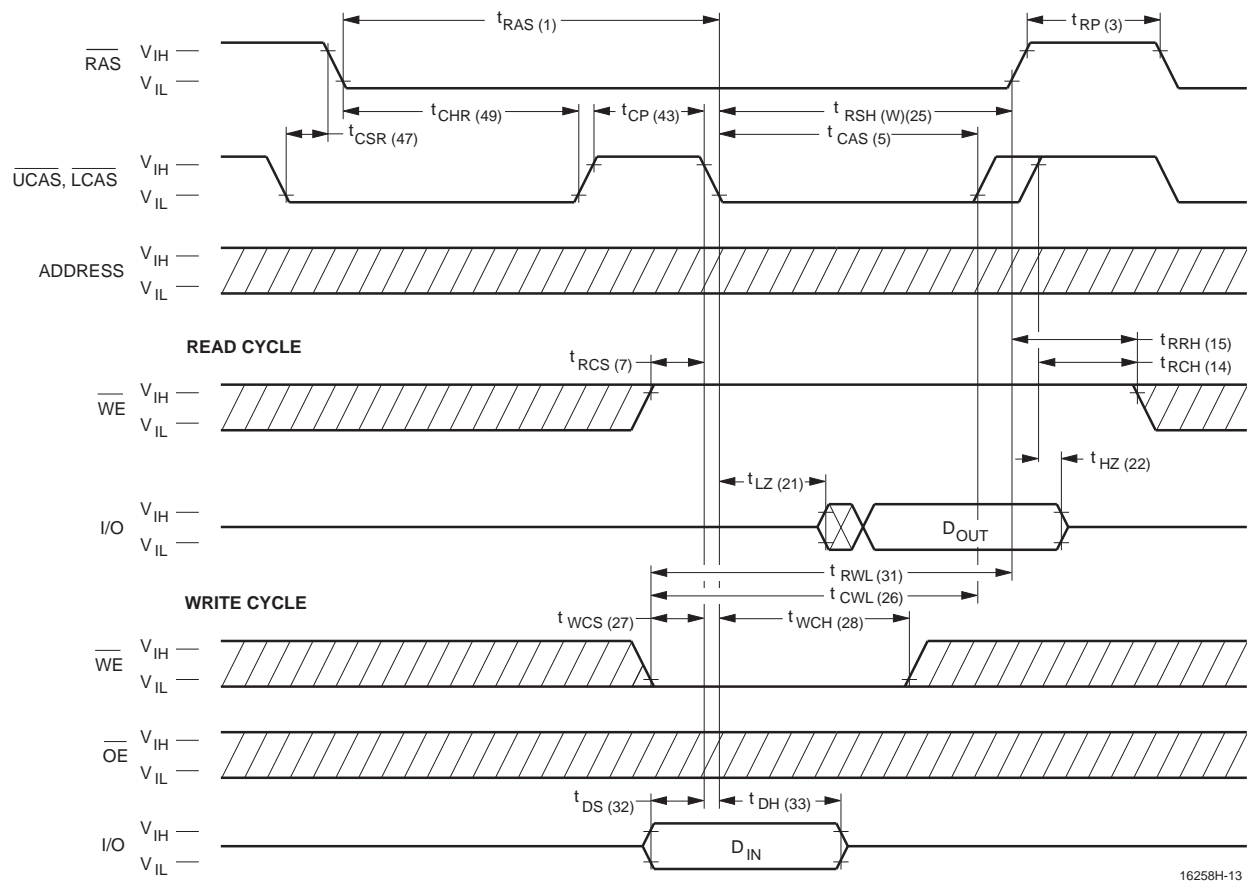
- RAS:**  $\overline{\text{RAS}}$  signal with parameters  $t_{\text{RAS}} (1)$ ,  $t_{\text{RCD}} (6)$ ,  $t_{\text{CSH}} (4)$ ,  $t_{\text{PCM}} (50)$ ,  $t_{\text{CP}} (43)$ ,  $t_{\text{RSH}} (W) (25)$ ,  $t_{\text{CRP}} (13)$ , and  $t_{\text{RP}} (3)$ .
- UCAS, LCAS:**  $\overline{\text{UCAS, LCAS}}$  signal with parameters  $t_{\text{RAD}} (24)$ ,  $t_{\text{CAS}} (5)$ ,  $t_{\text{RAH}} (9)$ ,  $t_{\text{ASC}} (10)$ ,  $t_{\text{CAH}} (11)$ ,  $t_{\text{CAR}} (44)$ , and  $t_{\text{CAH}} (11)$ .
- ADDRESS:** Signal showing ROW ADDRESS and COLUMN ADDRESS with parameters  $t_{\text{ASR}} (8)$ ,  $t_{\text{ASC}} (10)$ ,  $t_{\text{CAH}} (11)$ ,  $t_{\text{CWD}} (38)$ ,  $t_{\text{RWD}} (39)$ ,  $t_{\text{CWL}} (26)$ ,  $t_{\text{CWD}} (38)$ ,  $t_{\text{RWL}} (31)$ , and  $t_{\text{CWL}} (26)$ .
- WE:**  $\overline{\text{WE}}$  signal with parameters  $t_{\text{CAA}} (20)$ ,  $t_{\text{AWD}} (41)$ ,  $t_{\text{WP}} (29)$ ,  $t_{\text{OAC}} (17)$ ,  $t_{\text{OEH}} (53)$ ,  $t_{\text{CAP}} (43)$ ,  $t_{\text{OED}} (35)$ ,  $t_{\text{CAC}} (18)$ ,  $t_{\text{RAC}} (19)$ ,  $t_{\text{HZ}} (22)$ ,  $t_{\text{DH}} (33)$ , and  $t_{\text{DS}} (32)$ .
- OE:**  $\overline{\text{OE}}$  signal with parameters  $t_{\text{OAC}} (17)$ ,  $t_{\text{OEH}} (53)$ ,  $t_{\text{CAP}} (43)$ ,  $t_{\text{OED}} (35)$ ,  $t_{\text{CAC}} (18)$ ,  $t_{\text{RAC}} (19)$ ,  $t_{\text{HZ}} (22)$ ,  $t_{\text{DH}} (33)$ , and  $t_{\text{DS}} (32)$ .
- I/O:** Signal showing OUT and IN data with parameters  $t_{\text{LZ}} (21)$ ,  $t_{\text{LZ}}$ , and  $t_{\text{LZ}}$ .

The timing diagram illustrates the relationship between the RAS, UCAS/LCAS, and ADDRESS signals during a memory access cycle. The signals are shown as voltage levels over time, with specific timing parameters labeled:

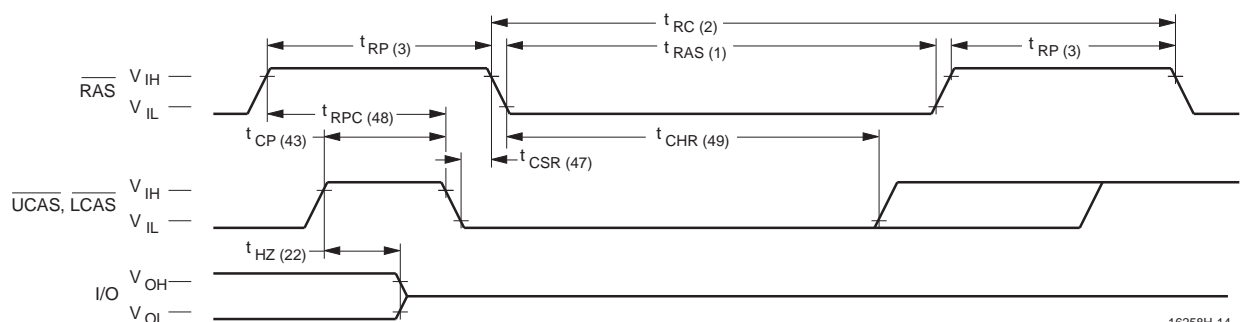
- RAS:** The RAS signal is shown as a high-to-low transition followed by a low-to-high transition. The timing parameters for RAS are:
  - $t_{RAS} (1)$ : RAS pulse width (low to high).
  - $t_{RC} (2)$ : RAS to column address strobe (CAS) delay.
  - $t_{RP} (3)$ : RAS precharge time (high to low).
- UCAS, LCAS:** The UCAS/LCAS signal is shown as a high-to-low transition followed by a low-to-high transition. The timing parameter for UCAS/LCAS is:
  - $t_{CRP} (13)$ : UCAS/LCAS to RAS precharge time.
- ADDRESS:** The ADDRESS signal is shown as a high-to-low transition followed by a low-to-high transition. The timing parameters for ADDRESS are:
  - $t_{ASR} (8)$ : Address strobe (AS) to RAS precharge time.
  - $t_{RAH} (9)$ : RAS to address high time.

The diagram also shows the signal levels for  $V_{IH}$  (high input voltage) and  $V_{IL}$  (low input voltage) for each signal.

 Don't Care       Undefined

**Waveforms of  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  Refresh Counter Test Cycle**

16258H-13

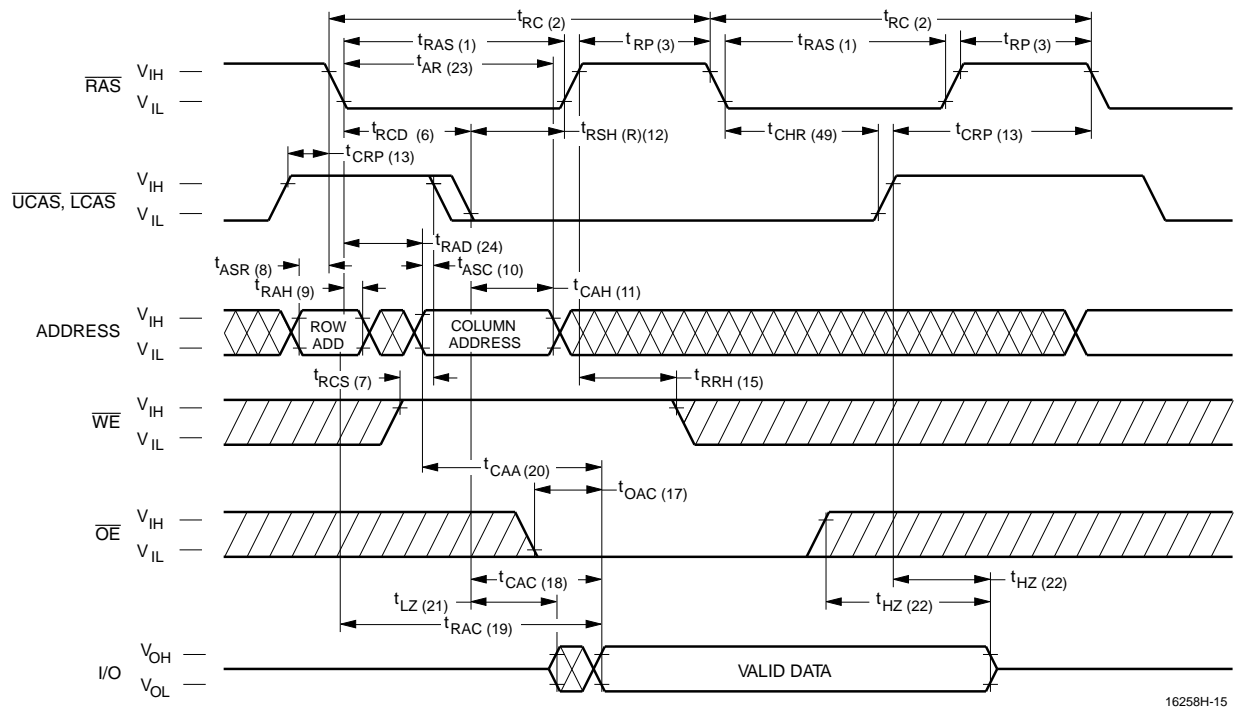
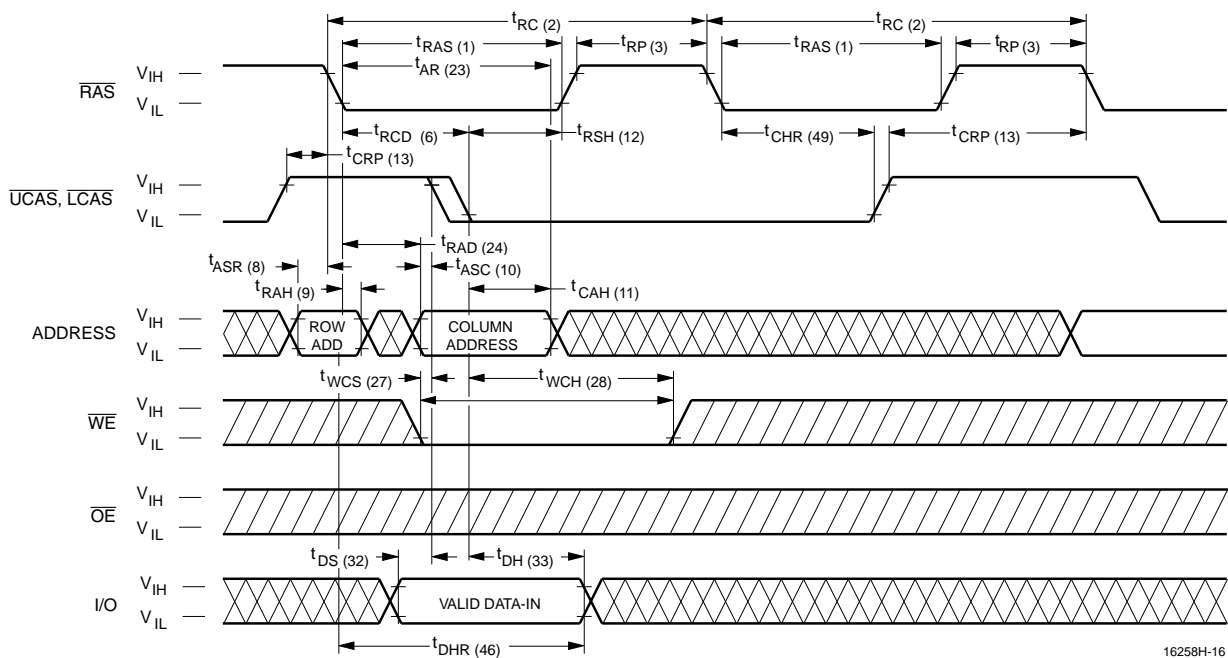
**Waveforms of  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  Refresh Cycle**

16258H-14

NOTE:  $\overline{\text{WE}}$ ,  $\overline{\text{OE}}$ ,  $A_0$ - $A_8$  = Don't care

Don't Care

Undefined

**Waveforms of Hidden Refresh Cycle (Read)****Waveforms of Hidden Refresh Cycle (Write)**

Don't Care

Undefined

The timing diagram illustrates the relationship between several control and data signals for the 16258H-17 device. The signals shown are:

- RAS**: Row Address Strobe, active low. Timing parameters include  $t_{RAS}$  (pulse width),  $t_{CRP}$  (setup before CAS),  $t_{RCD}$  (delay after CAS),  $t_{RSH}$  (hold after CAS), and  $t_{RP}$  (return to high after pulse).
- UCAS, LCAS**: Column Address Strobe/Latch Enable, active low. Timing parameters include  $t_{CSH}$  (setup before CAS),  $t_{PC}$  (pulse width),  $t_{CAS}$  (setup before CAS),  $t_{CP}$  (hold after CAS), and  $t_{CAR}$  (hold after CAS).
- ADDRESS**: Data bus address. Timing parameters include  $t_{ASR}$  (setup before CAS),  $t_{RAH}$  (hold after CAS),  $t_{ASC}$  (setup before CAS),  $t_{CAH}$  (hold after CAS), and  $t_{RCH}$  (hold after CAS).
- WE**: Write Enable, active low. Timing parameters include  $t_{RCS}$  (setup before CAS),  $t_{CAA}$  (setup before CAS),  $t_{CAC}$  (hold after CAS), and  $t_{OE}$  (hold after CAS).
- OE**: Output Enable, active low. Timing parameters include  $t_{DS}$  (setup before CAS),  $t_{DH}$  (hold after CAS), and  $t_{COH}$  (hold after CAS).
- I/O**: Data bus. Timing parameters include  $t_{VDO}$  (valid data out),  $t_{VDI}$  (valid data in), and  $t_{VDO}$  (valid data out).

The diagram shows the sequence of operations for a memory access, including row address strobe, column address strobe, and data bus activity. The timing parameters are defined relative to the signal transitions.

The timing diagram illustrates the relationship between several signals and their timing parameters:

- RAS:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{RP}$  (3),  $t_{RASS}$  (57),  $t_{RPS}$  (58), and  $t_{RPC}$  (48).
- UCAS, LCAS:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{CP}$  (43),  $t_{CSR}$  (47),  $t_{CHD}$  (60),  $t_{CHS}$  (59), and  $t_{RPC}$  (48).
- ADDRESS:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{OH}$  (10) and  $t_{OL}$  (10).
- I/O:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{OH}$  (10) and  $t_{OL}$  (10).
- WE:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{OH}$  (10) and  $t_{OL}$  (10).
- OE:** Shows a high-to-low transition followed by a low-to-high transition. Timing parameters include  $t_{OH}$  (10) and  $t_{OL}$  (10).

### Functional Description

The V53C16258H is a CMOS dynamic RAM optimized for high data bandwidth, low power applications. It is functionally similar to a traditional dynamic RAM. The V53C16258H reads and writes data by multiplexing an 18-bit address into a 9-bit row and a 9-bit column address. The row address is latched by the Row Address Strobe (RAS). The column address "flows through" an internal address buffer and is latched by the Column Address Strobe (CAS). Because access time is primarily dependent on a valid column address rather than the precise time that the CAS edge occurs, the delay time from RAS to CAS has little effect on the access time.

### Memory Cycle

A memory cycle is initiated by bringing  $\overline{\text{RAS}}$  low. Any memory cycle, once initiated, must not be ended or aborted before the minimum  $t_{\text{RAS}}$  time has expired. This ensures proper device operation and data integrity. A new cycle must not be initiated until the minimum precharge time  $t_{\text{RP}}/t_{\text{CP}}$  has elapsed.

### Read Cycle

A Read cycle is performed by holding the Write Enable ( $\overline{\text{WE}}$ ) signal High during a RAS/CAS operation. The column address must be held for a minimum specified by  $t_{\text{AR}}$ . Data Out becomes valid only when  $t_{\text{OAC}}$ ,  $t_{\text{RAC}}$ ,  $t_{\text{CAA}}$  and  $t_{\text{CAC}}$  are all satisfied. As a result, the access time is dependent on the timing relationships between these parameters. For example, the access time is limited by  $t_{\text{CAA}}$  when  $t_{\text{RAC}}$ ,  $t_{\text{CAC}}$  and  $t_{\text{OAC}}$  are all satisfied.

### Write Cycle

A Write Cycle is performed by taking  $\overline{\text{WE}}$  and  $\overline{\text{CAS}}$  low during a RAS operation. The column address is latched by  $\overline{\text{CAS}}$ . The Write Cycle can be  $\overline{\text{WE}}$  controlled or  $\overline{\text{CAS}}$  controlled depending on whether  $\overline{\text{WE}}$  or  $\overline{\text{CAS}}$  falls later. Consequently, the input data must be valid at or before the falling edge of  $\overline{\text{WE}}$  or  $\overline{\text{CAS}}$ , whichever occurs last. In the  $\overline{\text{CAS}}$ -controlled Write Cycle, when the leading edge of  $\overline{\text{WE}}$  occurs prior to the  $\overline{\text{CAS}}$  low transition, the I/O data pins will be in the High-Z state at the beginning of the Write function. Ending the Write with RAS or  $\overline{\text{CAS}}$  will maintain the output in the High-Z state.

In the  $\overline{\text{WE}}$  controlled Write Cycle,  $\overline{\text{OE}}$  must be in the high state and  $t_{\text{OED}}$  must be satisfied.

### Extended Data Output Page Mode

EDO Page operation permits all 512 columns within a selected row of the device to be randomly accessed at a high data rate. Maintaining  $\overline{\text{RAS}}$  low while performing successive CAS cycles retains the row address internally and eliminates the need to reapply it for each cycle. The column address buffer acts as a transparent or flow-through latch while  $\overline{\text{CAS}}$  is high. Thus, access begins from the occurrence of a valid column address rather than from the falling edge of  $\overline{\text{CAS}}$ , eliminating  $t_{\text{ASC}}$  and  $t_{\text{T}}$  from the critical timing path.  $\overline{\text{CAS}}$  latches the address into the column address buffer. During EDO operation, Read, Write, Read-Modify-Write or Read-Write-Read cycles are possible at random addresses within a row. Following the initial entry cycle into Hyper Page Mode, access is  $t_{\text{CAA}}$  or  $t_{\text{CAP}}$  controlled. If the column address is valid prior to the rising edge of  $\overline{\text{CAS}}$ , the access time is referenced to the  $\overline{\text{CAS}}$  rising edge and is specified by  $t_{\text{CAP}}$ . If the column address is valid after the rising  $\overline{\text{CAS}}$  edge, access is timed from the occurrence of a valid address and is specified by  $t_{\text{CAA}}$ . In both cases, the falling edge of  $\overline{\text{CAS}}$  latches the address and enables the output.

EDO provides a sustained data rate of 83 MHz for applications that require high bandwidth such as bit-mapped graphics or high-speed signal processing. The following equation can be used to calculate the maximum data rate:

$$\text{Data Rate} = \frac{512}{t_{\text{RC}} + 511 \times t_{\text{PC}}}$$

### Self Refresh

Self Refresh mode provides internal refresh control signals to the DRAM during extended periods of inactivity. Device operation in this mode provides additional power savings and design ease by elimination of external refresh control signals. Self Refresh mode is initiated with a  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  (CBR) Refresh cycle, holding both  $\overline{\text{RAS}}$  low ( $t_{\text{RASS}}$ ) and  $\overline{\text{CAS}}$  low ( $t_{\text{CHD}}$ ) for a specified period. Both of these parameters are specified with minimum values to guarantee entry into Self Refresh operation. Once the device has been placed in to Self Refresh mode the  $\overline{\text{CAS}}$  clock is no longer required to maintain Self Refresh operation.



The Self Refresh mode is terminated by returning the  $\overline{\text{RAS}}$  clock to a high level for a specified ( $t_{\text{RPS}}$ ) minimum time. After termination of the Self Refresh cycle normal accesses to the device may be initiated immediately, providing that subsequent refresh cycles utilize the  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  (CBR) mode of operation.

### Data Output Operation

The V53C16258H Input/Output is controlled by  $\overline{\text{OE}}$ ,  $\overline{\text{CAS}}$ ,  $\overline{\text{WE}}$  and  $\overline{\text{RAS}}$ . A  $\overline{\text{RAS}}$  low transition enables the transfer of data to and from the selected row address in the Memory Array. A  $\overline{\text{RAS}}$  high transition disables data transfer and latches the output data if the output is enabled. After a memory cycle is initiated with a  $\overline{\text{RAS}}$  low transition, a  $\overline{\text{CAS}}$  low transition or  $\overline{\text{CAS}}$  low level enables the internal I/O path. A  $\overline{\text{CAS}}$  high transition or a  $\overline{\text{CAS}}$  high level disables the I/O path and the output driver if it is enabled. A  $\overline{\text{CAS}}$  low transition while  $\overline{\text{RAS}}$  is high has no effect on the I/O data path or on the output drivers. The output drivers, when otherwise enabled, can be disabled by holding  $\overline{\text{OE}}$  high. The  $\overline{\text{OE}}$  signal has no effect on any data stored in the output latches. A  $\overline{\text{WE}}$  low level can also disable the output drivers when  $\overline{\text{CAS}}$  is low. During a Write cycle, if  $\overline{\text{WE}}$  goes low at a time in relationship to  $\overline{\text{CAS}}$  that would normally cause the outputs to be active, it is necessary to use  $\overline{\text{OE}}$  to disable the output drivers prior to the  $\overline{\text{WE}}$  low transition to allow Data In Setup Time ( $t_{\text{DS}}$ ) to be satisfied.

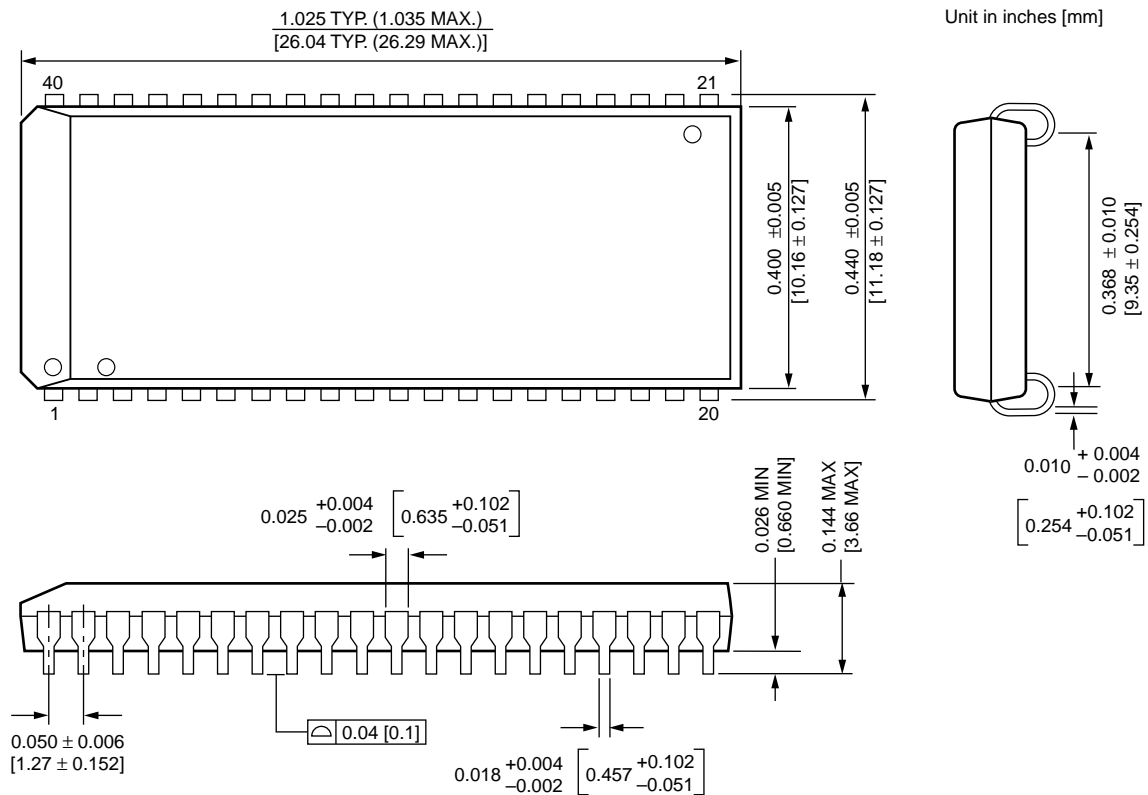
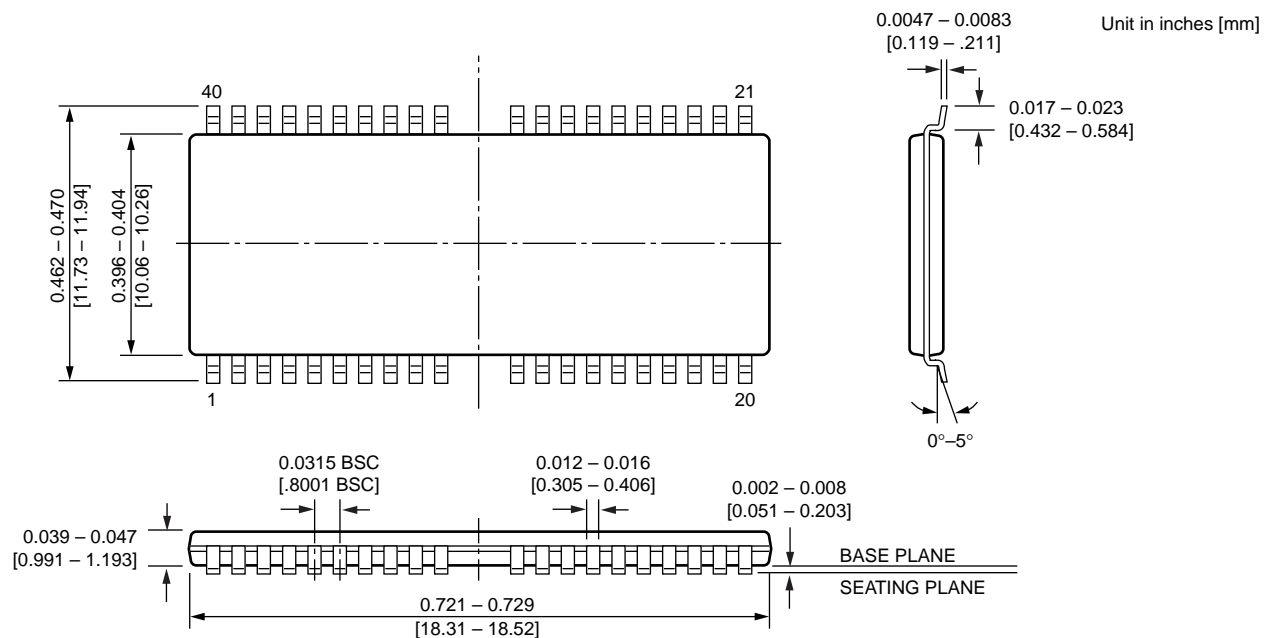
### Power-On

After application of the  $V_{\text{CC}}$  supply, an initial pause of 200  $\mu\text{s}$  is required followed by a minimum of 8 initialization cycles (any combination of cycles containing a  $\overline{\text{RAS}}$  clock). Eight initialization cycles are required after extended periods of bias without clocks (greater than the Refresh Interval).

During Power-On, the  $V_{\text{CC}}$  current requirement of the V53C16258H is dependent on the input levels of  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$ . If  $\overline{\text{RAS}}$  is low during Power-On, the device will go into an active cycle and  $I_{\text{CC}}$  will exhibit current transients. It is recommended that  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  track with  $V_{\text{CC}}$  or be held at a valid  $V_{\text{IH}}$  during Power-On to avoid current surges.

**Table 1. V53C16258H Data Output Operation for Various Cycle Types**

Cycle Type	I/O State
Read Cycles	Data from Addressed Memory Cell
$\overline{\text{CAS}}$ -Controlled Write Cycle (Early Write)	High-Z
$\overline{\text{WE}}$ -Controlled Write Cycle (Late Write)	$\overline{\text{OE}}$ Controlled. High $\overline{\text{OE}}$ = High-Z I/Os
Read-Modify-Write Cycles	Data from Addressed Memory Cell
EDO Read Cycle	Data from Addressed Memory Cell
EDO Write Cycle (Early Write)	High-Z
EDO Read-Modify-Write Cycle	Data from Addressed Memory Cell
$\overline{\text{RAS}}$ -only Refresh	High-Z
$\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ Refresh Cycle	Data remains as in previous cycle
$\overline{\text{CAS}}$ -only Cycles	High-Z

**Package Outlines****40-Pin Plastic SOJ****40/44L-Pin TSOP-II**

***Notes***

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