NEC

MOS INTEGRATED CIRCUIT

μPD42S4190, 424190

4 M-BIT DYNAMIC RAM
256K-WORD BY 18-BIT, FAST PAGE MODE, BYTE WRITE MODE

DESCRIPTION

The μPD42S4190, 424190 are 262 144 words by 18 bits dynamic CMOS RAMs. The fast page mode and byte write mode capability realize high speed access and low power consumption.

Besides, the μPD42S4190 can execute $\overline{CAS}$ before $\overline{RAS}$ self refresh.

These are packaged in 44-pin plastic TSOP and 40-pin plastic SOJ.

FEATURES

★

- 262 144 words by 18 bits organization
- Single +5.0 V ± 10 % power supply
- Fast access and cycle time

Part number	Power consumption Active (MAX.)	Access time (MAX.)	R/W cycle time (MIN.)	Fast page mode cycle time (MIN.)
μPD42S4190-70	880.0 mW	70 ns	130 ns	45 ns
μPD424190-70				
μPD42S4190-80	770.0 mW	80 ns	150 ns	50 ns
μPD424190-80				

- μPD42S4190 can execute $\overline{CAS}$ before $\overline{RAS}$ self refresh

Part number	Refresh cycle	Refresh	Power consumption at standby (MAX.)
μPD42S4190	1 024 cycles/128 ms	$\overline{CAS}$ before $\overline{RAS}$ self refresh, $\overline{CAS}$ before $\overline{RAS}$ refresh, $\overline{RAS}$ only refresh, Hidden refresh	1.1 mW (CMOS level input)
μPD424190	1 024 cycles/ 16 ms	$\overline{CAS}$ before $\overline{RAS}$ refresh, $\overline{RAS}$ only refresh, Hidden refresh	5.5 mW (CMOS level input)

- Multiplexed address inputs ····· Row address : A0 to A9, Column address : A0 to A7

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The mark ★ shows revised points.

★ ORDERING INFORMATION

Part number	Access time (MAX.)	Package	Refresh
μPD42S4190G5-70-7JF	70 ns	44-pin Plastic TSOP (400 mil)	$\overline{CAS}$ before $\overline{RAS}$ self refresh $\overline{RAS}$ only refresh $\overline{CAS}$ before $\overline{RAS}$ refresh Hidden refresh
μPD42S4190G5-80-7JF	80 ns		
μPD42S4190G5-70-7KF	70 ns	44-pin Plastic TSOP (Reverse bent) (400 mil)	
μPD42S4190G5-80-7KF	80 ns		
μPD42S4190LE-70	70 ns	40-pin Plastic SOJ (400 mil)	
μPD42S4190LE-80	80 ns		
μPD424190G5-70-7JF	70 ns	44-pin Plastic TSOP (400 mil)	$\overline{RAS}$ only refresh $\overline{CAS}$ before $\overline{RAS}$ refresh Hidden refresh
μPD424190G5-80-7JF	80 ns		
μPD424190G5-70-7KF	70 ns	44-pin Plastic TSOP (Reverse bent) (400 mil)	
μPD424190G5-80-7KF	80 ns		
μPD424190LE-70	70 ns	40-pin Plastic SOJ (400 mil)	
μPD424190LE-80	80 ns		

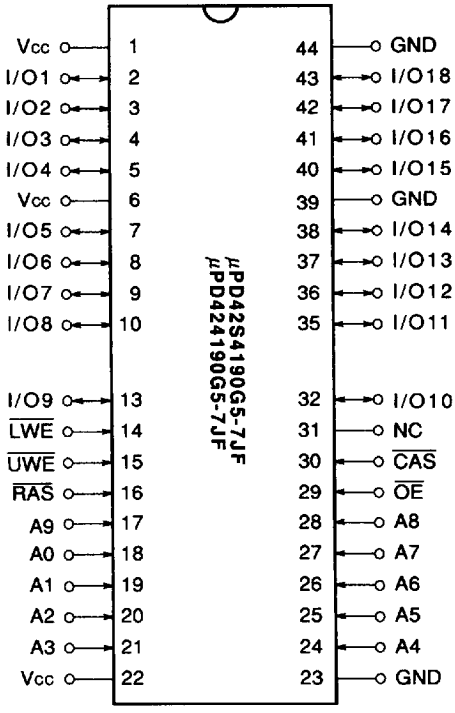
QUALITY GRADE

STANDARD

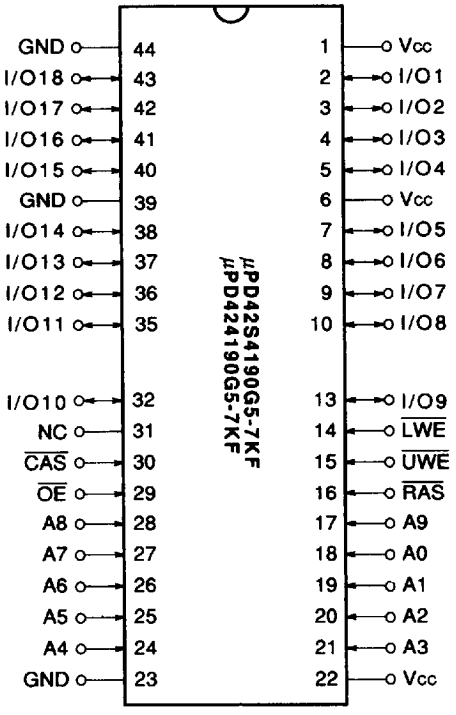
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

PIN CONFIGURATIONS (Marking Side) ★

44-pin Plastic TSOP (400 mil)

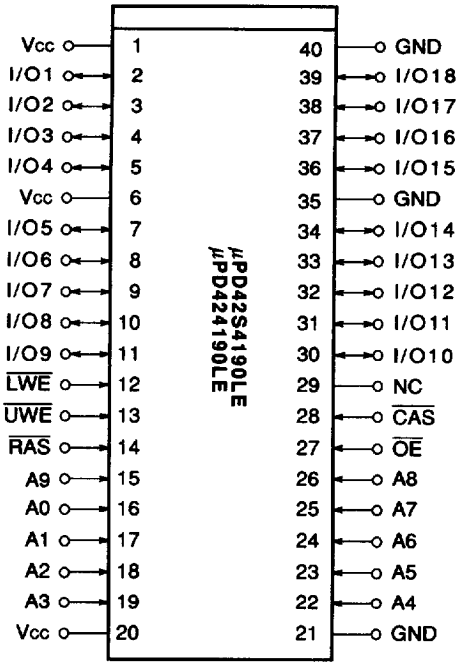


44-pin Plastic TSOP (Reverse bent) (400 mil)



A0 to A9	: Address Inputs
I/O1 to I/O18	: Data Inputs/Outputs
$\overline{RAS}$	: Row Address Strobe
$\overline{CAS}$	: Column Address Strobe
$\overline{UWE}$	: Upper Byte Write Enable
$\overline{LWE}$	: Lower Byte Write Enable
$\overline{OE}$	: Output Enable
Vcc	: Power Supply (+5.0 V ± 10 %)
GND	: Ground
NC	: No Connection

40-pin Plastic SOJ (400 mil)



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$\overline{UWE}$	: Upper Byte Write Enable
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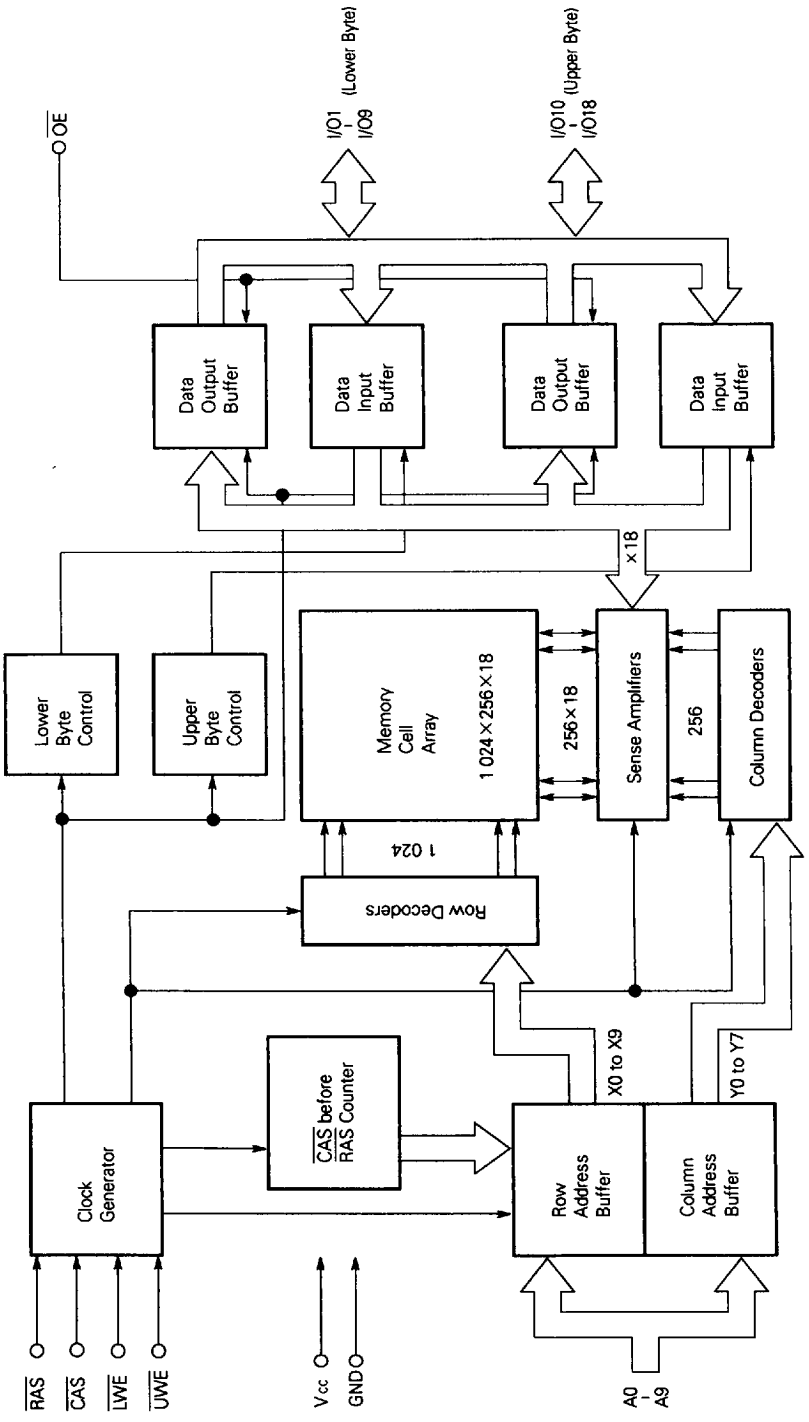
Vcc	: Power Supply (+5.0 V ± 10 %)
GND	: Ground
NC	: No Connection

BLOCK DIAGRAM



★ INPUT/OUTPUT PIN FUNCTIONS

The μPD42S4190, 424190 have input pins $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$[Note], $\overline{OE}$, A0 to A9 and input/output pins I/O1 to I/O18.

Pin name	Input/ output	Function
$\overline{RAS}$ (Row address strobe)	Input	$\overline{RAS}$ activates the sense amplifier by latching a row address (A0 to A9) and selecting a corresponding word line. It refreshes memory cell array of one line (4 608-bit) selected by the row address (A0 to A9). It also selects the following function. • $\overline{CAS}$ before $\overline{RAS}$ refresh.
$\overline{CAS}$ (Column address strobe)	Input	$\overline{CAS}$ activates data input/output circuit by latching column address (A0 to A7) and selecting a digit line connected with the sense amplifier.
A0 to A9 (Address input)	Input	10-bit address bus. Input total 18-bit of address signal, upper 10-bit and lower 8-bit in sequence (address multiplex method). Therefore, one word (18-bit) is selected from 262 144-word by 18-bit memory cell array. In actual operation, latch row address by specifying row address and activating $\overline{RAS}$. Then, switch the address bus to column address and activate $\overline{CAS}$. Each address is taken into the device when $\overline{RAS}$ and $\overline{CAS}$ are activated. Therefore, the address input setup time (t_{ASR}, t_{ASC}) and hold time (t_{RAH}, t_{CAH}) are specified for the activation of $\overline{RAS}$ and $\overline{CAS}$.
$\overline{WE}$ (Write enable)	Input	Write control signal. Write operation is executed by activating $\overline{RAS}$, $\overline{CAS}$ and $\overline{WE}$.
$\overline{OE}$ (Output enable)	Input	Read control signal. Read operation can be executed by activating $\overline{RAS}$, $\overline{CAS}$ and $\overline{OE}$. If $\overline{WE}$ is activated during read operation, $\overline{OE}$ is to be ineffective in the device. Therefore, read operation cannot be executed.
I/O1 to I/O18 (Data input/output)	Input/ Output	18-bit data bus. I/O1 to I/O18 are used to input/output data.

Note $\overline{WE}$ means $\overline{UWE}$ and $\overline{LWE}$.

ELECTRICAL SPECIFICATIONS NOTE 1

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	CONDITION	RATING	UNIT
Voltage on Any Pin Relative to GND	V_T		−1.0 to +7.0	V
Supply Voltage	V_{CC}		−1.0 to +7.0	V
Output Current	I_O		50	mA
Power Dissipation	P_D		1	W
Operating Temperature	T_{opt}		0 to +70	°C
Storage Temperature	T_{stg}		−55 to +125	°C

Remark Exposing the device to stress above those listed in Absolute Maximum Ratings could cause permanent damage. The device is not meant to be operated under conditions outside the limits described in the operational section of this specification. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS NOTE 2, 3

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
High Level Input Voltage	V_{IH}		2.4		V_{CC} +1.0	V
Low Level Input Voltage	V_{IL}		−1.0		+0.8	V
Ambient Temperature	T_a		0		70	°C

CAPACITANCE (T_a = +25 °C, f = 1 MHz)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Capacitance	C_{I1}	Address			5	pF
	C_{I2}	$\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$			7	pF
Data Input/Output Capacitance	C_D	I/O1 to I/O18			7	pF

★ DC CHARACTERISTICS (Recommended Operating Conditions unless otherwise noted)

PARAMETER		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT	NOTE
Operating current		I_{CC1}	$\overline{RAS}$, $\overline{CAS}$ Cycling $t_{RC} = t_{RC(MIN.)}$, I_O = 0 mA	t_{RAC} = 70 ns		160	mA	4, 5
				t_{RAC} = 80 ns		140		
Standby current	μPD42S4190	I_{CC2}	$V_{IH(MIN)} \leqq \overline{RAS}, \overline{CAS}$	I_O = 0 mA		2	mA	
			V_{CC}–0.2 V $\leqq \overline{RAS}, \overline{CAS}$	I_O = 0 mA		0.2		
	μPD424190		$V_{IH(MIN)} \leqq \overline{RAS}, \overline{CAS}$	I_O = 0 mA		2		
			V_{CC}–0.2 V $\leqq \overline{RAS}, \overline{CAS}$	I_O = 0 mA		1		
$\overline{RAS}$ only refresh current		I_{CC3}	$\overline{RAS}$ Cycling, $V_{IH(MIN)} \leqq \overline{CAS}$ $t_{RC} = t_{RC(MIN.)}$, I_O = 0 mA	t_{RAC} = 70 ns		160	mA	4, 5
				t_{RAC} = 80 ns		140		
Operating current (Fast page mode)		I_{CC4}	$\overline{RAS} \leqq V_{IL(MAX)}$ $\overline{CAS}$ Cycling, $t_{PC} = t_{PC(MIN)}$, I_O = 0 mA	t_{RAC} = 70 ns		130	mA	4, 5
				t_{RAC} = 80 ns		120		
$\overline{CAS}$ before $\overline{RAS}$ refresh current		I_{CC6}	$\overline{RAS}$ Cycling, $t_{RC} = t_{RC(MIN.}$ I_O = 0 mA	t_{RAC} = 70 ns		160	mA	4, 5
				t_{RAC} = 80 ns		140		
$\overline{CAS}$ before $\overline{RAS}$ long refresh current (1 024 cycles/128 ms, only for μPD42S4190)		I_{CC6}	Standby : $\overline{RAS}, \overline{CAS}$: V_{CC}–0.2 V $\leqq V_{IH} \leqq V_{IH(MAX.)}$ $\overline{CAS}$ before $\overline{RAS}$ refresh : 1 024 cycles/128 ms $\overline{RAS}, \overline{CAS}$: 0 V $\leqq V_{IL} \leqq$ 0.2 V V_{CC}–0.2 V $\leqq V_{IH} \leqq V_{IH(MAX.)}$ $\overline{WE}, \overline{OE}$: V_{IH} Address input : V_{IH} or V_{IL} Output : Hi-Z	$t_{RAS} \leqq$ 200 ns		200	μA	4, 5
				$t_{RAS} \leqq$ 1 μs		300		
Self refresh current ($\overline{CAS}$ before $\overline{RAS}$ self refresh, only for μPD42S4190)		I_{CC7}	I_O = 0 mA $\overline{RAS}, \overline{CAS}$: 0 V $\leqq V_{IL} \leqq$ 0.2 V V_{CC}–0.2 V $\leqq V_{IH} \leqq V_{IH(MAX.)}$			150	μA	
Input leakage current		$I_{I(L)}$	V_I = 0 to 5.5 V all other pins except for testing pin = 0 V		–10	+10	μA	
Output leakage current		$I_{O(L)}$	Output is disabled (Hi-Z) V_O = 0 to 5.5 V		–10	+10	μA	
High level output voltage		V_{OH}	I_O = –2.5 mA		2.4		V	
Low level output voltage		V_{OL}	I_O = 2.1 mA			0.4	V	

AC CHARACTERISTICS ★

(Recommended Operating Conditions unless otherwise noted) NOTE 6, 7

(1/2)

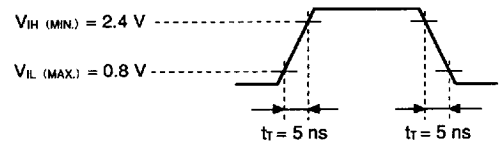
PARAMETER	SYMBOL	t_{RAC} = 70 ns		t_{RAC} = 80 ns		UNIT	NOTE
		MIN.	MAX.	MIN.	MAX.		
Random Read or Write Cycle Time	t_{RC}	130		150		ns	8
Read Modify Write Cycle Time	t_{RWC}	175		200		ns	8
Fast Page Mode Cycle Time	t_{PC}	45		50		ns	8
Read Modify Write Cycle Time (Fast Page Mode)	t_{PRWC}	90		105		ns	8
Access Time from $\overline{RAS}$	t_{RAC}		70		80	ns	9, 10
Access Time from $\overline{CAS}$	t_{CAC}		20		20	ns	9, 10
Access Time from Column Address	t_{AA}		35		40	ns	9, 10
Access Time from $\overline{CAS}$ Precharge	t_{ACP}		40		45	ns	10
$\overline{CAS}$ to Output Data Setup Time	t_{CLZ}	0		0		ns	10
Output Buffer Turn-off Delay Time ($\overline{CAS}$)	t_{OFF}	0	15	0	20	ns	11
Transition Time (rise and fall)	t_T	3	50	3	50	ns	
$\overline{RAS}$ Precharge Time	t_{RP}	50		60		ns	
$\overline{RAS}$ Pulse Width	t_{RAS}	70	10 000	80	10 000	ns	
$\overline{RAS}$ Pulse Width (Fast Page Mode)	t_{RASP}	70	125 000	80	125 000	ns	
$\overline{RAS}$ Hold Time	t_{RSH}	20		20		ns	
$\overline{CAS}$ Hold Time	t_{CSH}	70		80		ns	
$\overline{CAS}$ Pulse Width	t_{CAS}	20	10 000	20	10 000	ns	
$\overline{RAS}$ to $\overline{CAS}$ Delay Time	t_{RCD}	20	50	20	60	ns	9
$\overline{RAS}$ to Column Address Delay Time	t_{RAD}	15	35	15	40	ns	9
$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	t_{CRP}	10		10		ns	12
$\overline{CAS}$ Precharge Time (Fast Page Mode)	t_{CP}	10		10		ns	
Row Address Setup Time	t_{ASR}	0		0		ns	
Row Address Hold Time	t_{RAH}	10		10		ns	
Column Address Setup Time	t_{ASC}	0		0		ns	
Column Address Hold Time	t_{CAH}	15		15		ns	
$\overline{CAS}$ Precharge Time	t_{CPN}	10		10		ns	
Column Address Lead Time Referenced to $\overline{RAS}$	t_{RAL}	35		40		ns	
Read Command Setup Time	t_{RCS}	0		0		ns	
Read Command Hold Time Referenced to $\overline{CAS}$	t_{RCH}	0		0		ns	13
Read Command Hold Time Referenced to $\overline{RAS}$	t_{RRH}	0		0		ns	13
Write Command Hold Time Referenced to $\overline{CAS}$	t_{WCH}	15		15		ns	14
Write Command Pulse Width	t_{WP}	15		15		ns	14
Write Command Lead Time Referenced to $\overline{RAS}$	t_{RWL}	20		25		ns	
Write Command Lead Time Referenced to $\overline{CAS}$	t_{CWL}	15		20		ns	
Data-in Setup Time	t_{DS}	0		0		ns	15
Data-in Hold Time	t_{DH}	15		20		ns	15

(2/2)

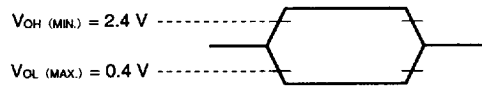
PARAMETER		SYMBOL	t_{RAC} = 70 ns		t_{RAC} = 80 ns		UNIT	NOTE
			MIN.	MAX.	MIN.	MAX.		
Refresh Time	μPD42S4190	t_{REF}		128		128	ms	17
	μPD424190			16		16	ms	
Write Command Setup Time		t_{WCS}	0		0		ns	16
$\overline{CAS}$ to $\overline{WE}$ Delay Time		t_{CWD}	40		45		ns	16
$\overline{RAS}$ to $\overline{WE}$ Delay Time		t_{RWD}	90		105		ns	16
$\overline{CAS}$ Precharge Delay Time Referenced to $\overline{WE}$ (Fast Page Mode)		t_{CPWD}	60		70		ns	16
Column Address Delay Time Referenced to $\overline{WE}$		t_{AWD}	55		65		ns	16
$\overline{CAS}$ Setup Time ($\overline{CAS}$ before $\overline{RAS}$ Refresh)		t_{CSR}	10		10		ns	
$\overline{CAS}$ Hold Time ($\overline{CAS}$ before $\overline{RAS}$ Refresh)		t_{CHR}	15		15		ns	
$\overline{RAS}$ Precharge $\overline{CAS}$ Hold Time		t_{RPC}	10		10		ns	
$\overline{OE}$ to $\overline{RAS}$ inactive Setup Time		t_{OES}	0		0		ns	
Access Time from $\overline{OE}$		t_{OEA}		20		20	ns	
$\overline{OE}$ Data Delay Time		t_{OED}	15		20		ns	
Output Buffer Turn-off Delay Time ($\overline{OE}$)		t_{OEZ}	0	15	0	20	ns	11
$\overline{OE}$ Output Data Setup Time		t_{OLZ}	0		0		ns	
$\overline{OE}$ Hold Time		t_{OEH}	0		0		ns	
Masked Byte Write Setup Time		t_{MCS}	0		0		ns	
Masked Byte Write Hold Time Referenced to $\overline{RAS}$		t_{MRH}	0		0		ns	
Masked Byte Write Hold Time Referenced to $\overline{CAS}$		t_{MCH}	0		0		ns	
$\overline{RAS}$ Hold Time Referenced to $\overline{CAS}$ Precharge		t_{RHCP}	40		45		ns	
$\overline{RAS}$ Pulse Width ($\overline{CAS}$ before $\overline{RAS}$ Self Refresh)		t_{RASS}	100		100		μs	17
$\overline{CAS}$ Pulse Width ($\overline{CAS}$ before $\overline{RAS}$ Self Refresh)		t_{CASS}	500		500		μs	17
$\overline{RAS}$ Precharge Time ($\overline{CAS}$ before $\overline{RAS}$ Self Refresh)		t_{RPS}	130		150		ns	17
$\overline{CAS}$ Hold Time ($\overline{CAS}$ before $\overline{RAS}$ Self Refresh)		t_{CHS}	−50		−50		ns	17

NOTES 1. $\overline{WE}$ means $\overline{UWE}$ and $\overline{LWE}$.

2. All voltages are referenced to GND.
3. 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 address refresh counter, a minimum of 8 $\overline{CAS}$ before $\overline{RAS}$ refresh cycles instead of 8 $\overline{RAS}$ only refresh cycles are required.
4. I_{CC1}, I_{CC3}, I_{CC4}, I_{CC5} and I_{CC6} depend on t_{RC} and t_{PC}. Specified values are obtained with outputs open.
5. Address can be changed once or less while $\overline{RAS}$ = V_{IL} and $\overline{CAS}$ = V_{IH}.
6. AC measurements assume t_T = 5 ns.
7. AC Characteristics test condition
   (1) Input timing specification



   (2) Output timing specification

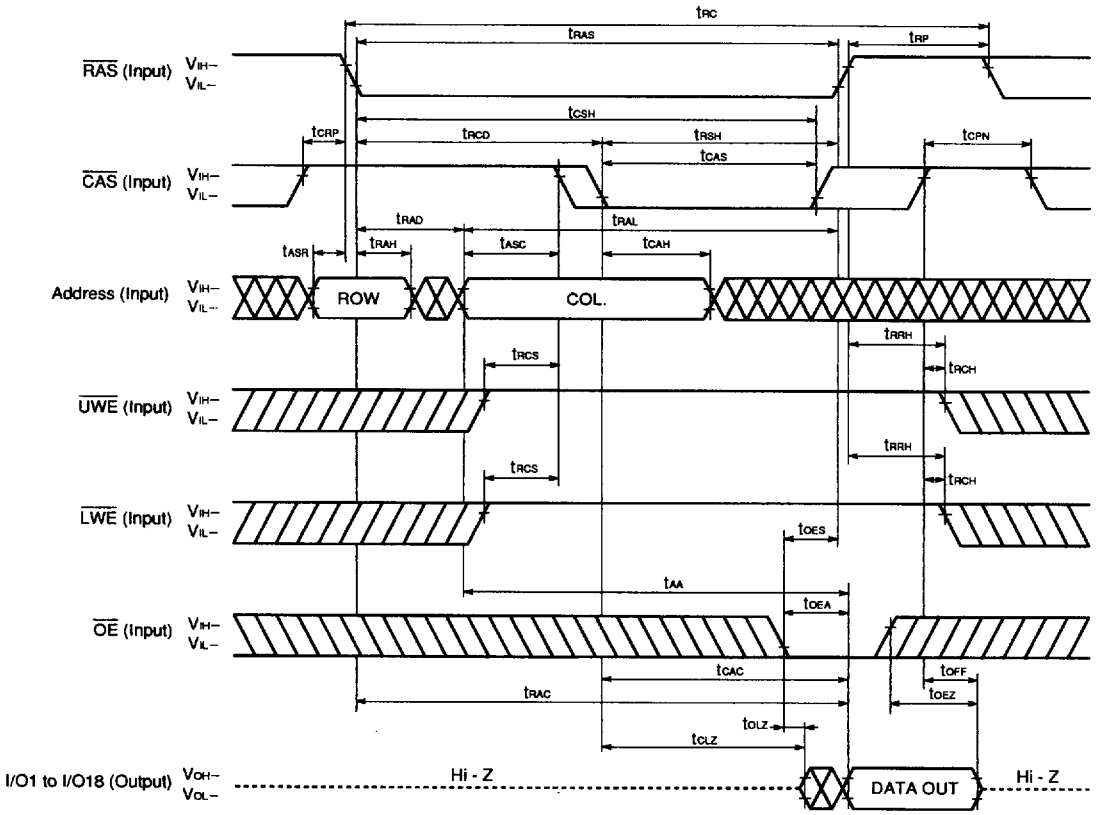


8. The minimum specifications are used only to indicate cycle time at which proper operation over the full temperature range (T_a = 0 to 70 °C) is assured.
9. In random read cycle, the access time is changed by the conditions of t_{RAD} and t_{RCD} as follows.

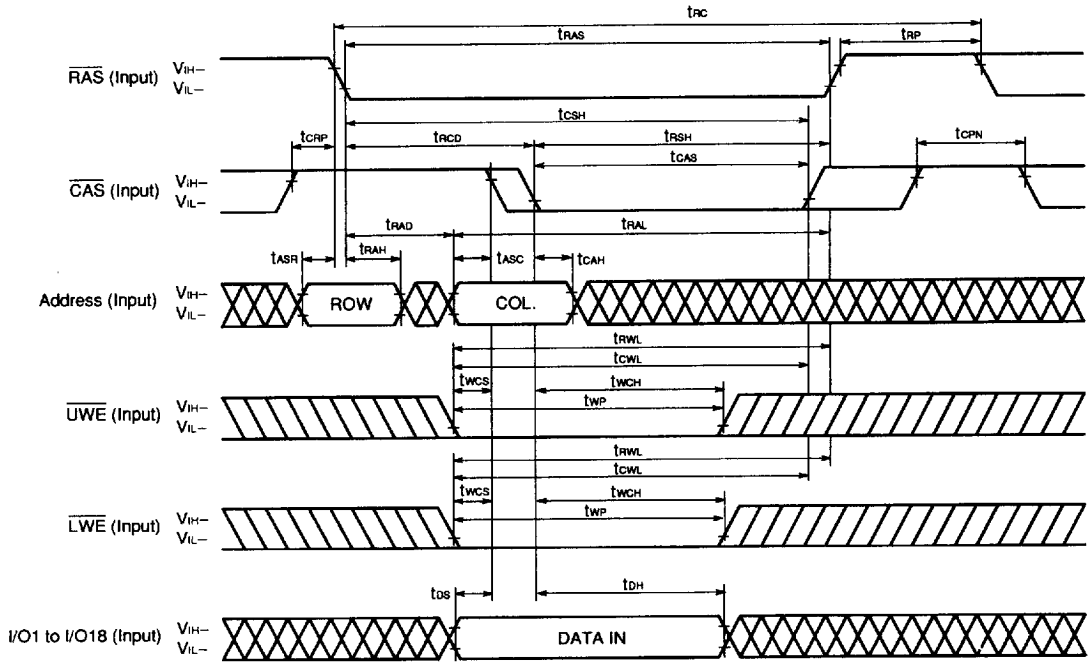
CONDITION	ACCESS TIME
$t_{RAD} \leqq t_{RAD\,(MAX.)}$ and $t_{RCD} \leqq t_{RCD\,(MAX.)}$	$t_{RAC\,(MAX.)}$
$t_{RAD\,(MAX.)} \leqq t_{RAD}$ and $t_{RCD} \leqq t_{RCD\,(MAX.)}$	$t_{AA\,(MAX.)}$
$t_{RCD\,(MAX.)} \leqq t_{RCD}$	$t_{CAC\,(MAX.)}$

   $t_{RAD\,(MAX.)}$ and $t_{RCD\,(MAX.)}$ indicate the points which the access time changes and are not the limits of operation.
10. Loading conditions are 1TTL and 100 pF.
11. $t_{OFF\,(MAX.)}$ and $t_{OEZ\,(MAX.)}$ define the time at which the output achieves the open circuit condition and are not referenced to V_{OH} or V_{OL}.
12. $t_{CRP(MIN.)}$ requirement should be applicable for $\overline{RAS}$/$\overline{CAS}$ cycles preceded by any cycles.
13. Either $t_{RCH\,(MIN.)}$ or $t_{RRH\,(MIN.)}$ must be satisfied for a read cycle.
14. $t_{WP\,(MIN.)}$ is applicable for late write cycle or read modify write cycle. In early write cycles, $t_{WCH\,(MIN.)}$ should be satisfied.
15. This specification is referenced to $\overline{CAS}$ falling edge in early write cycles and to $\overline{WE}$ falling edge in late write or read modify write cycles.
16. 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 $t_{WCS\,(MIN.)} \leqq t_{WCS}$, the cycle is an early write cycle and the data out pins will remain Hi-Z through the entire cycle. If $t_{RWD\,(MIN.)} \leqq t_{RWD}$, $t_{CWD\,(MIN.)} \leqq t_{CWD}$, $t_{AWD\,(MIN.)} \leqq t_{AWD}$, and $t_{CPWD\,(MIN.)} \leqq t_{CPWD}$, the cycle is a read modify write cycle and condition of the data out (at access time) is indeterminate.
17. This specification is applicable only for μPD42S4190.

READ CYCLE

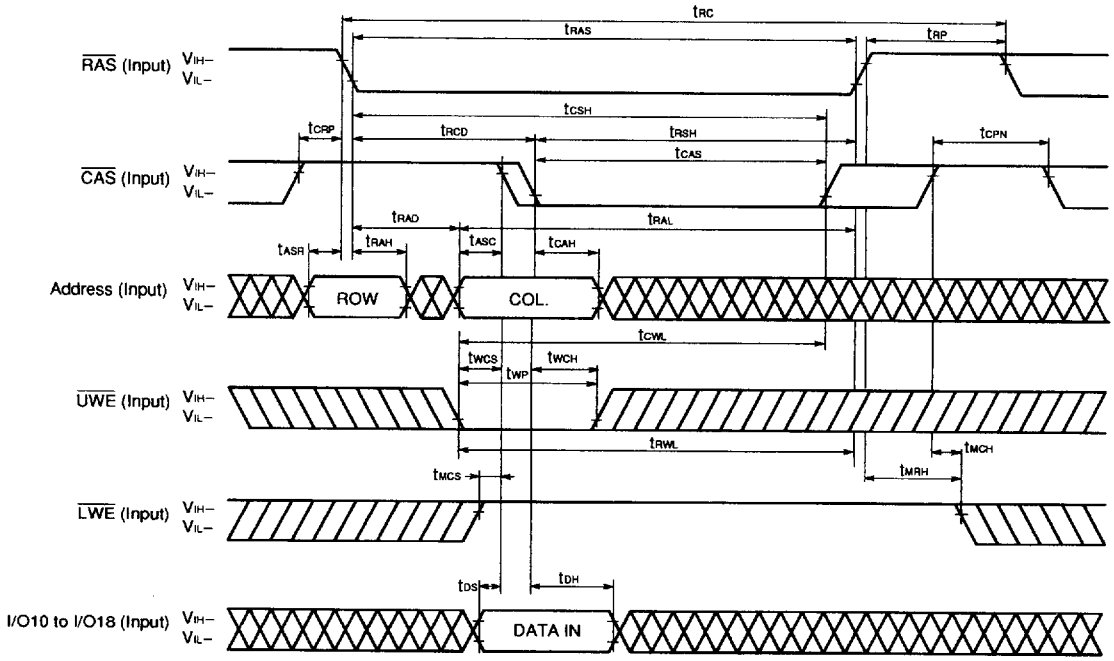


EARLY WRITE CYCLE



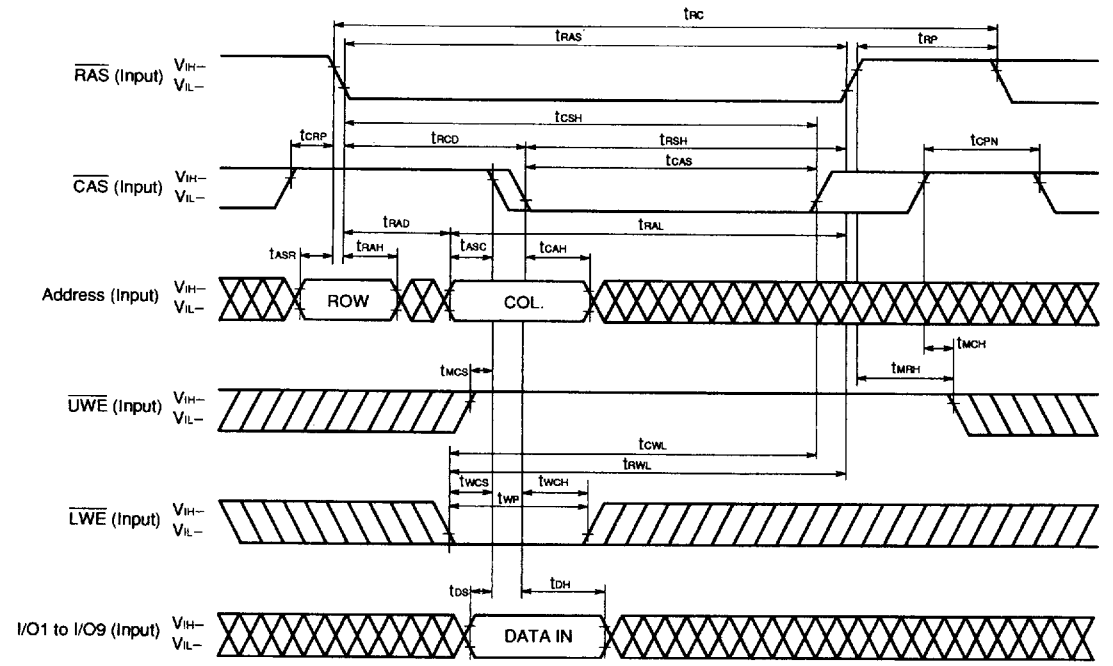
Remark $\overline{OE}$ = Don't care

UPPER BYTE EARLY WRITE CYCLE



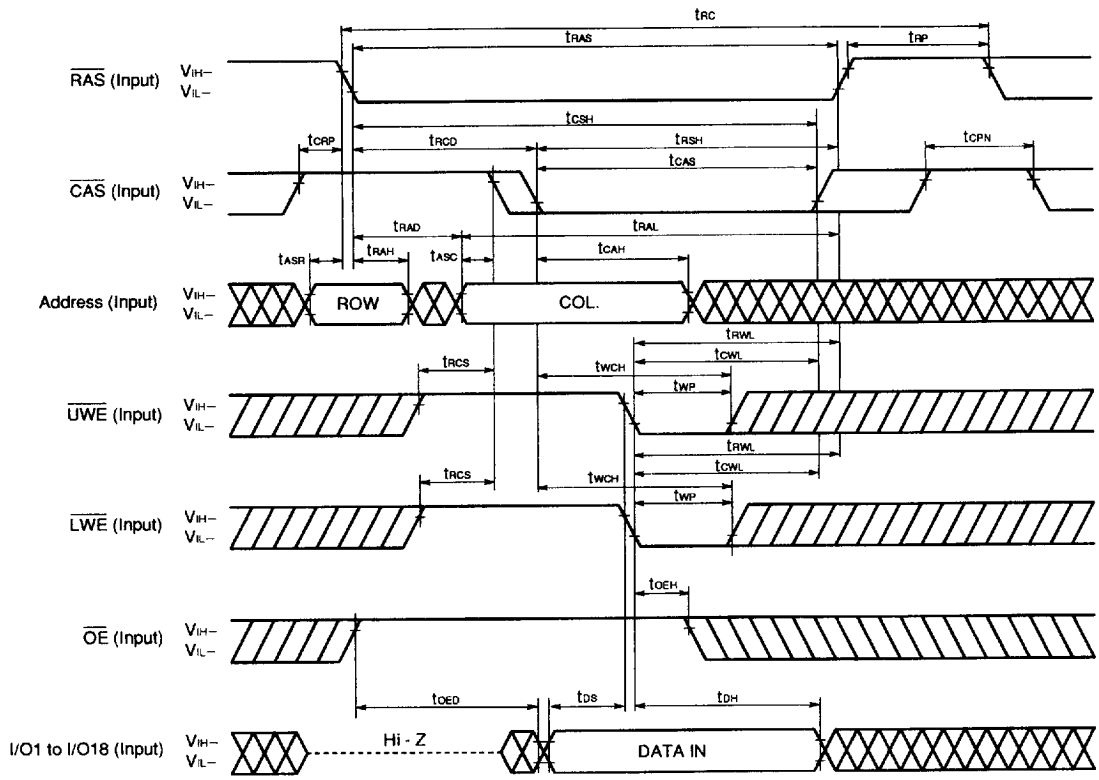
Remark $\overline{OE}$, I/O1 to I/O9 = Don't care

LOWER BYTE EARLY WRITE CYCLE

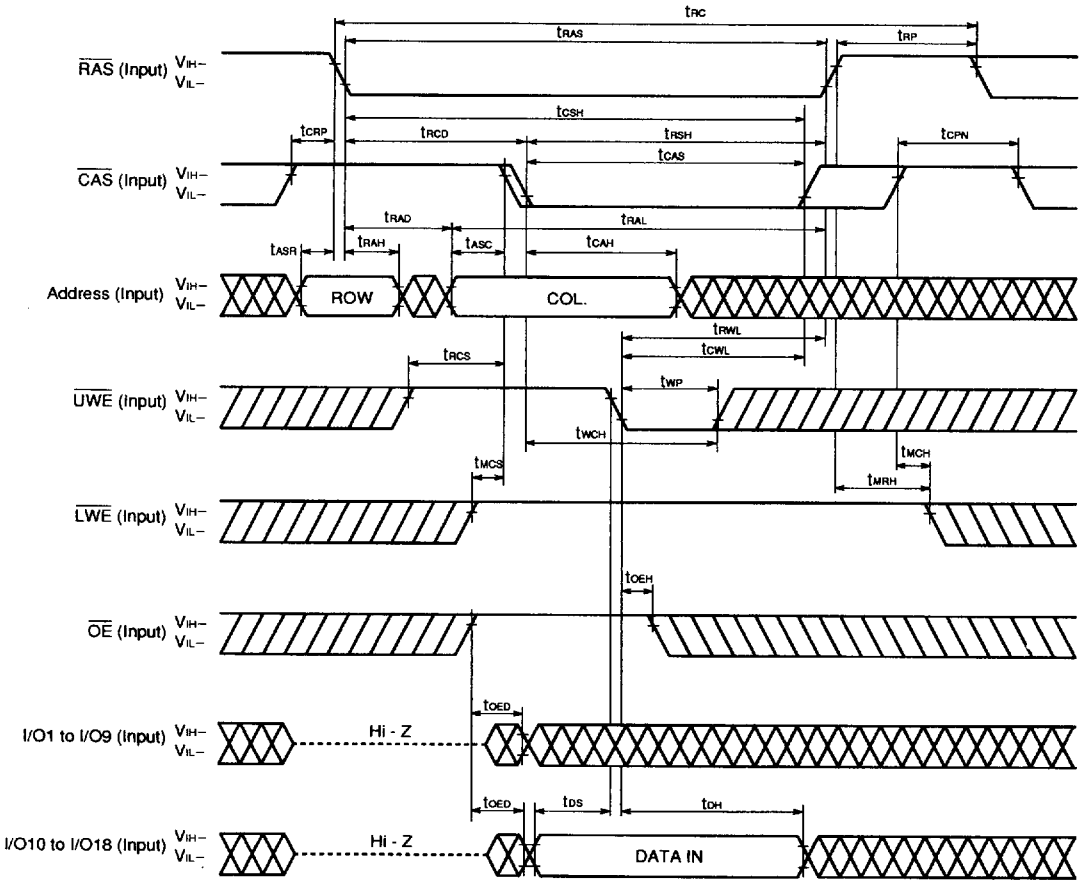


Remark $\overline{OE}$, I/O10 to I/O18 = Don't care

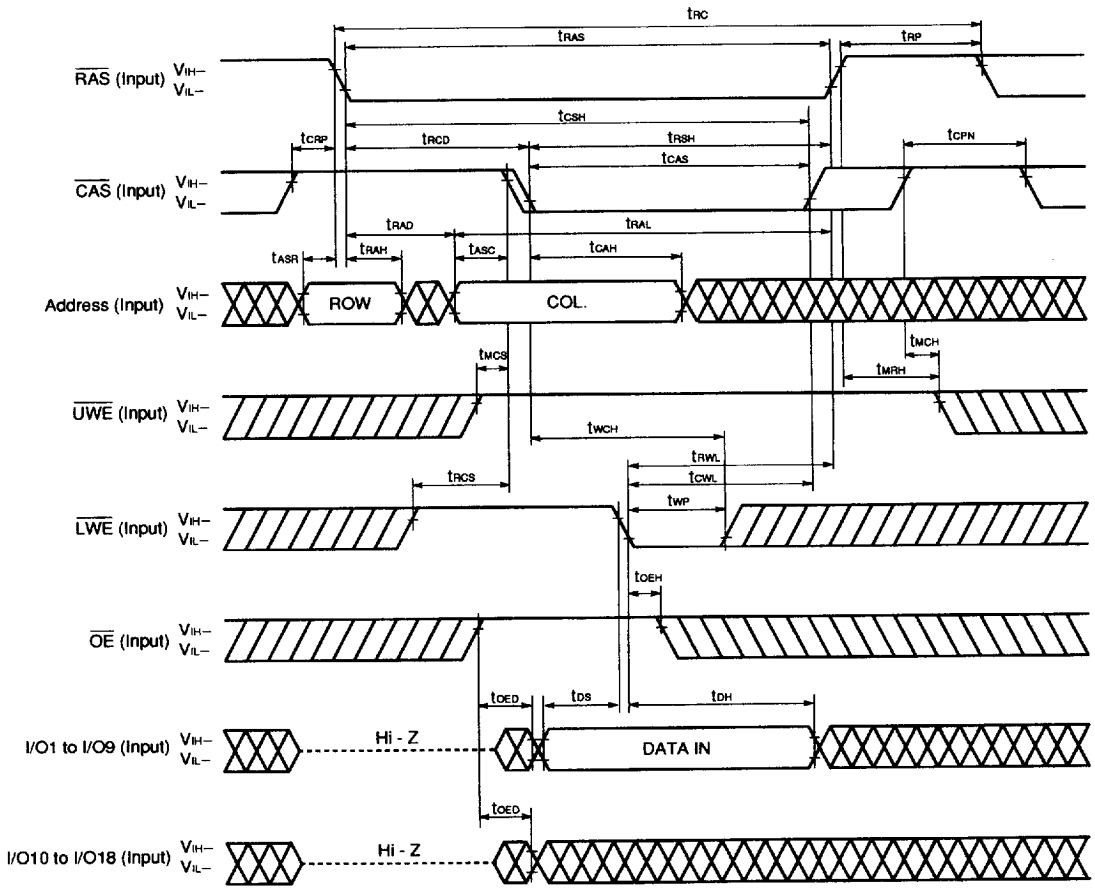
LATE WRITE CYCLE



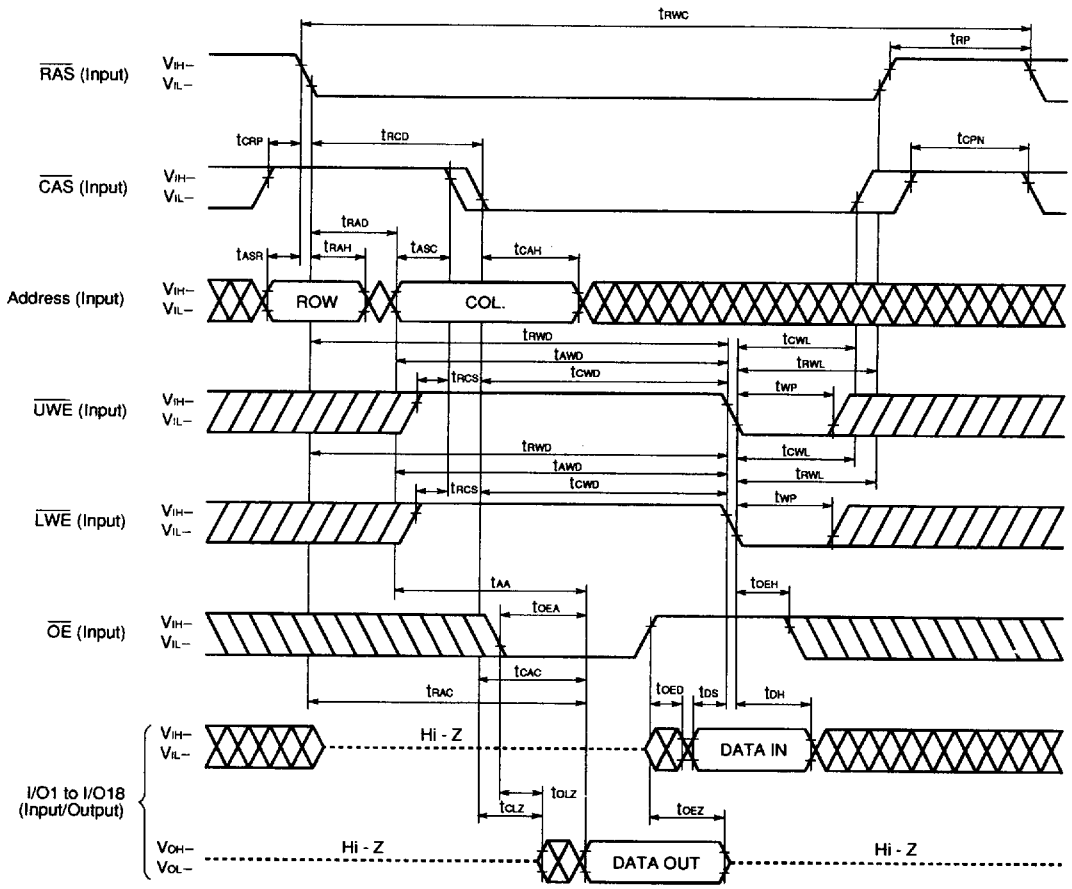
UPPER BYTE LATE WRITE CYCLE



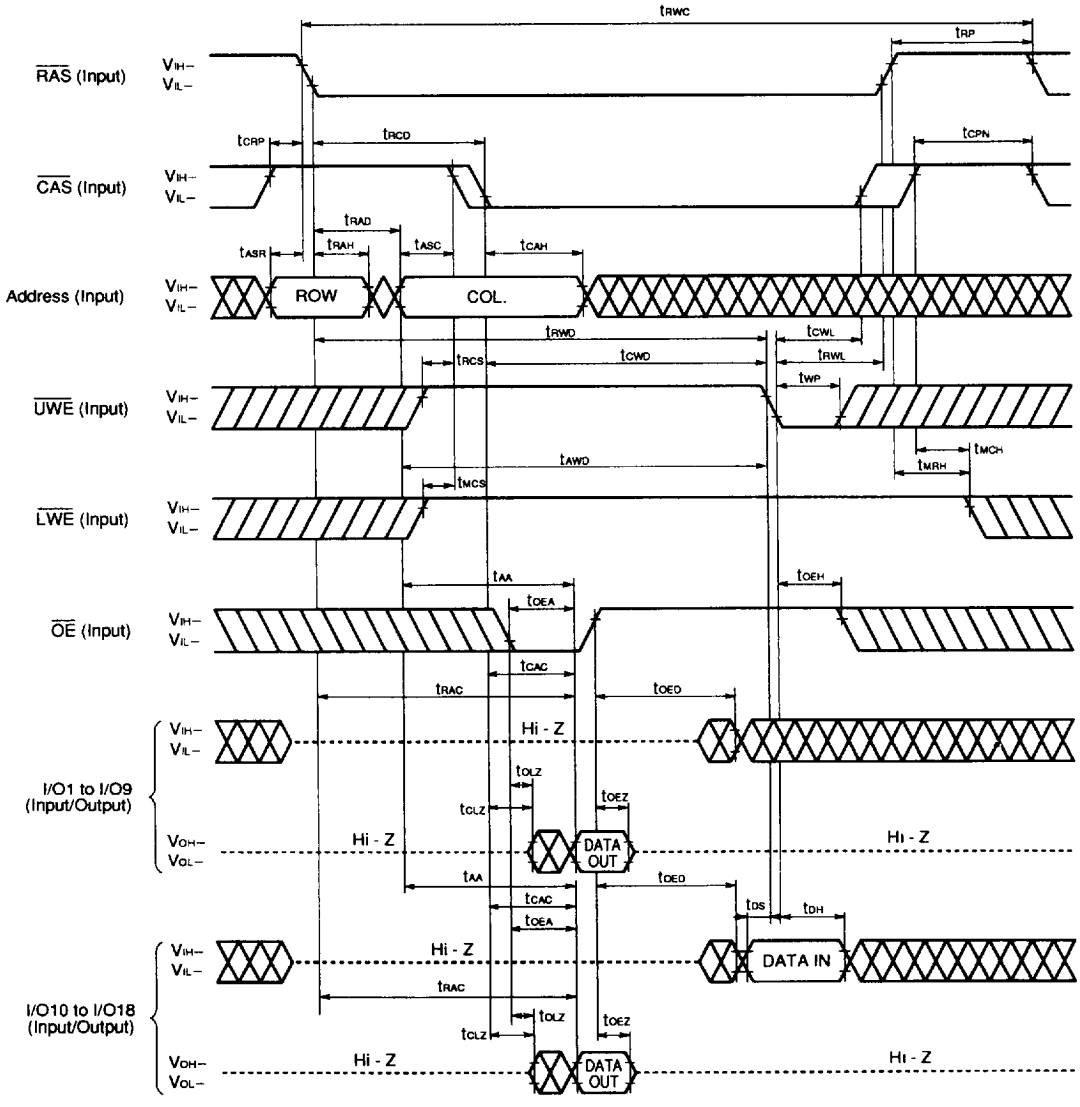
LOWER BYTE LATE WRITE CYCLE



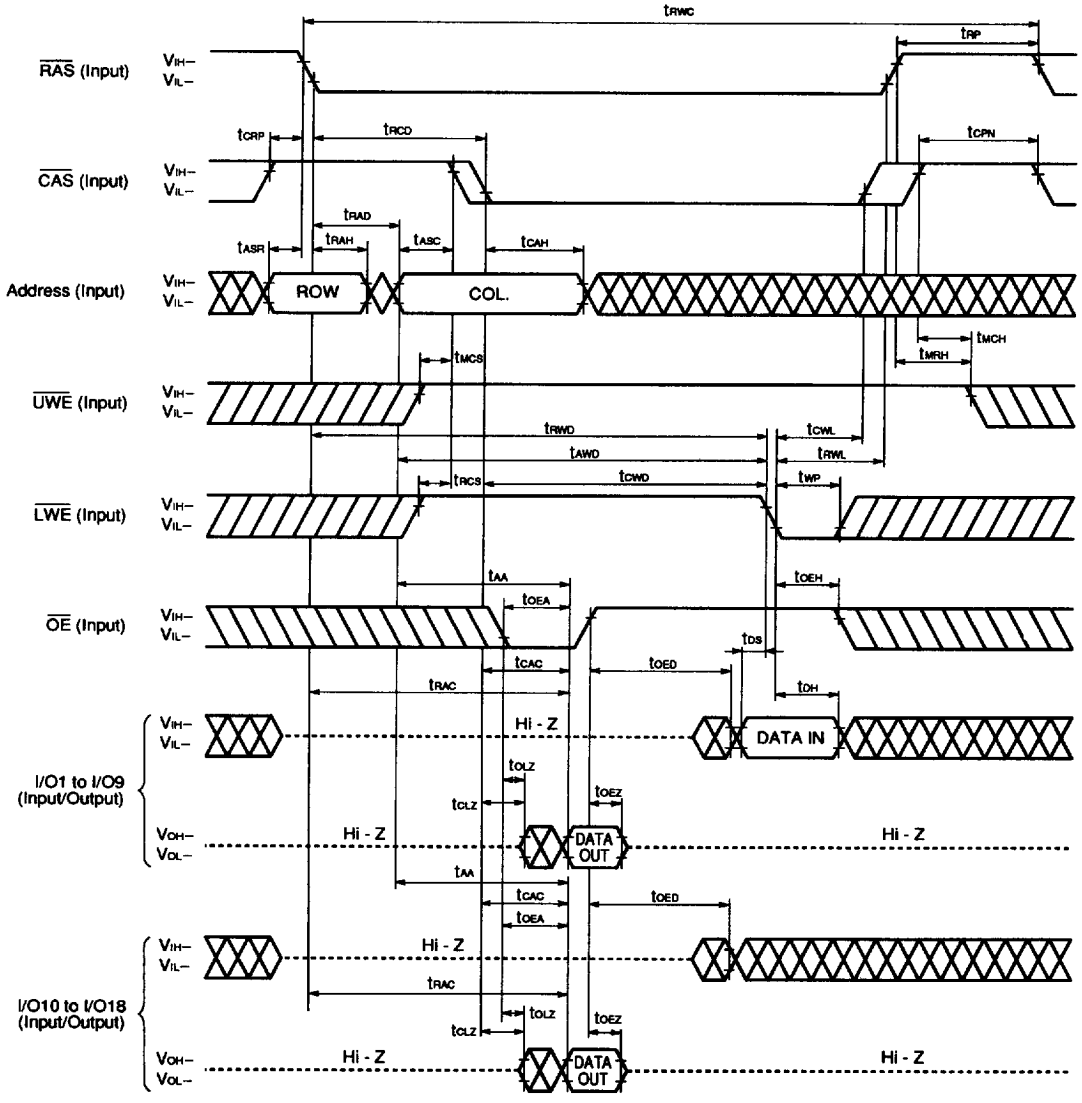
READ MODIFY WRITE CYCLE



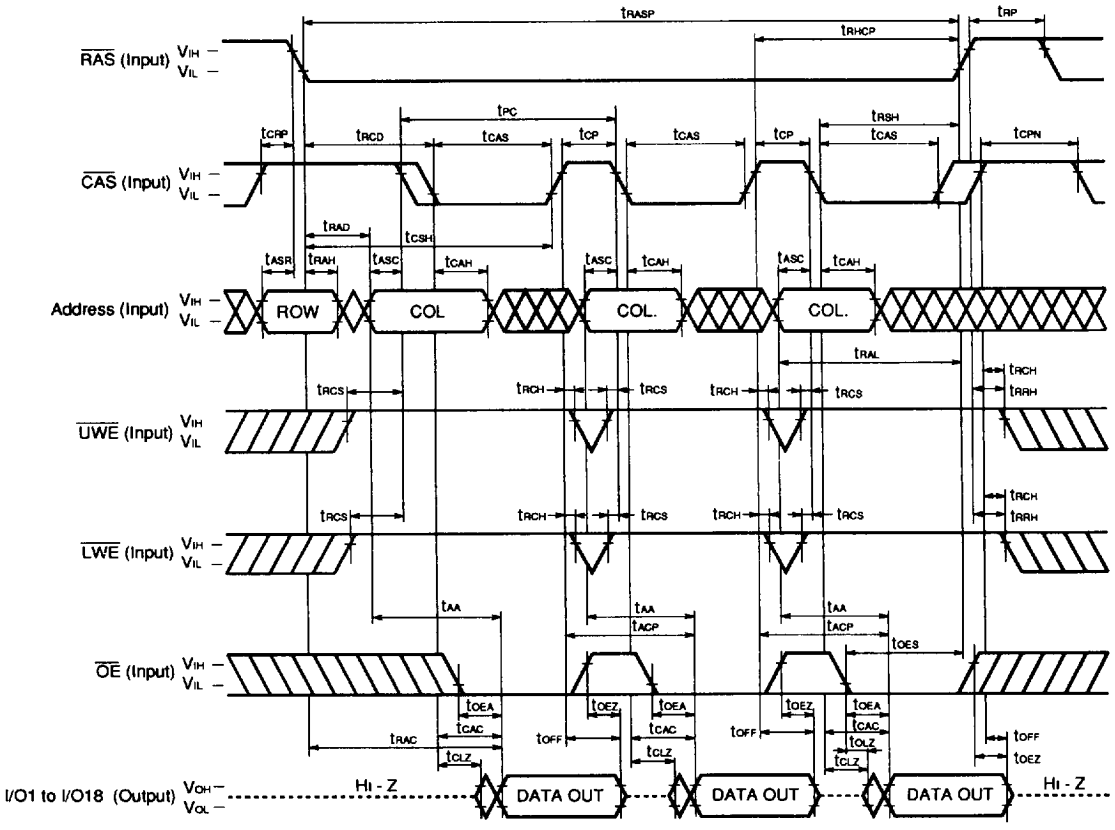
UPPER BYTE READ MODIFY WRITE CYCLE



LOWER BYTE READ MODIFY WRITE CYCLE

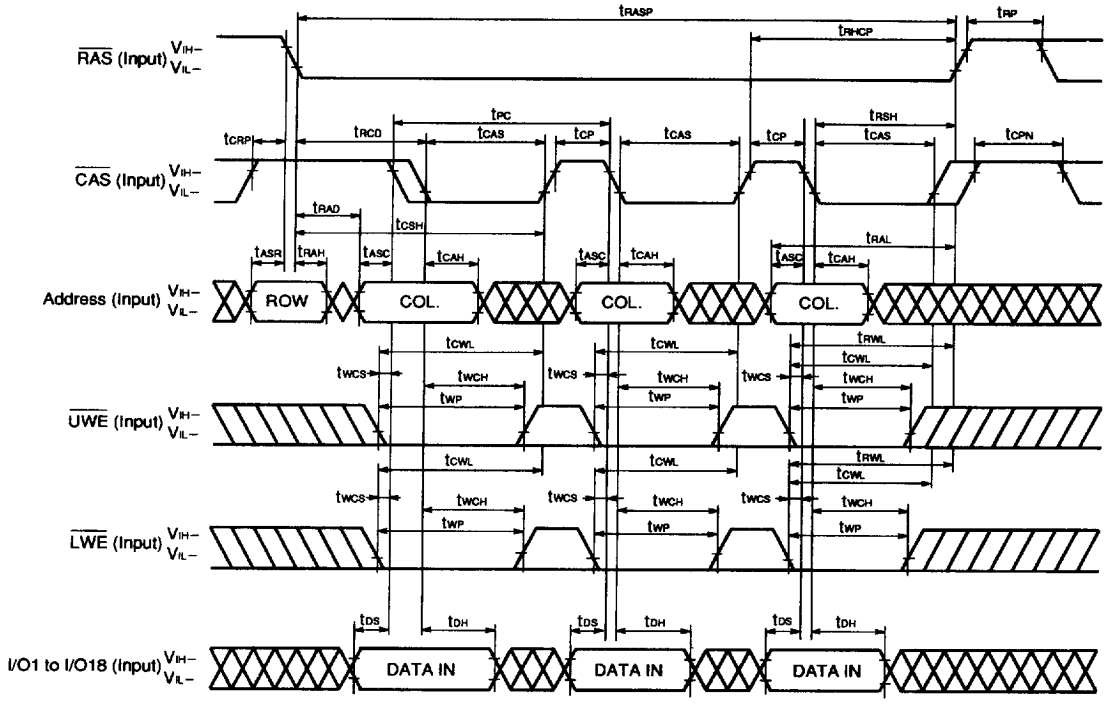


FAST PAGE MODE READ CYCLE



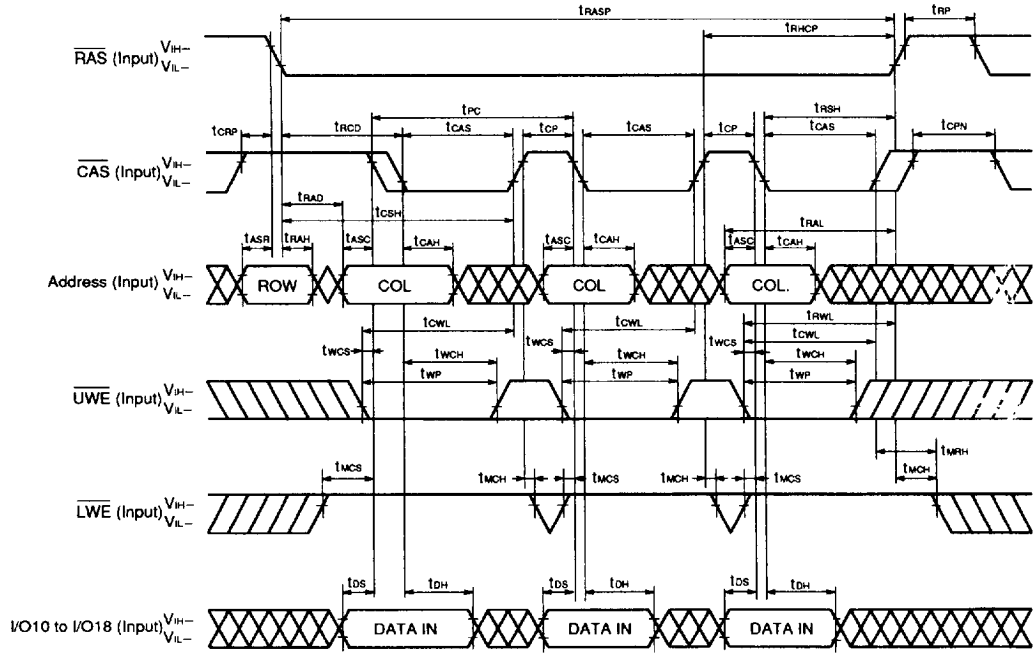
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE EARLY WRITE CYCLE



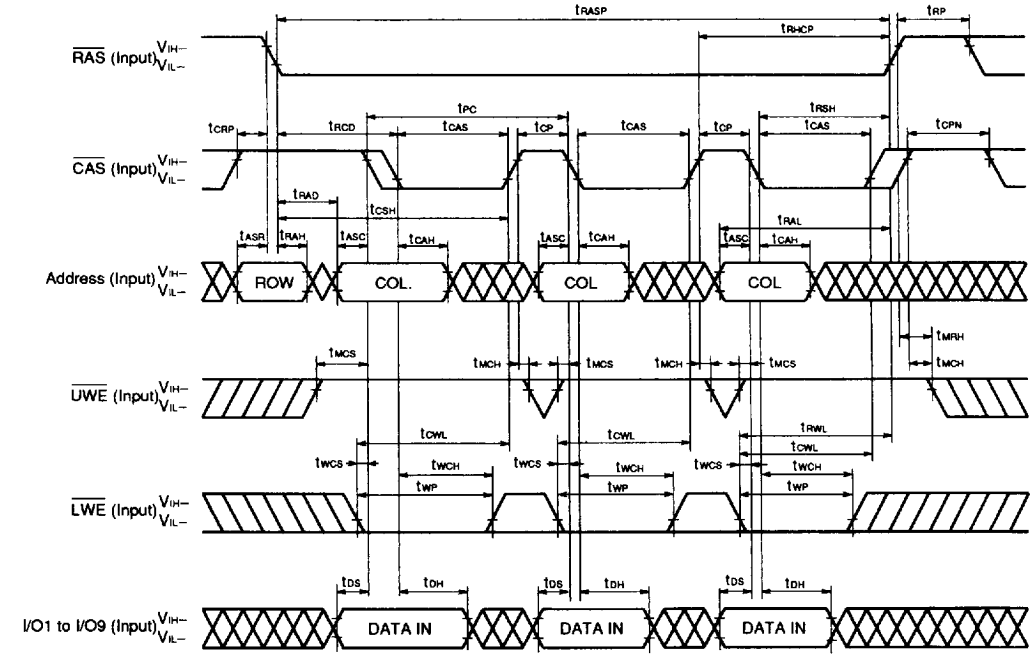
Remark $\overline{OE}$ = Don't care
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE UPPER BYTE EARLY WRITE CYCLE



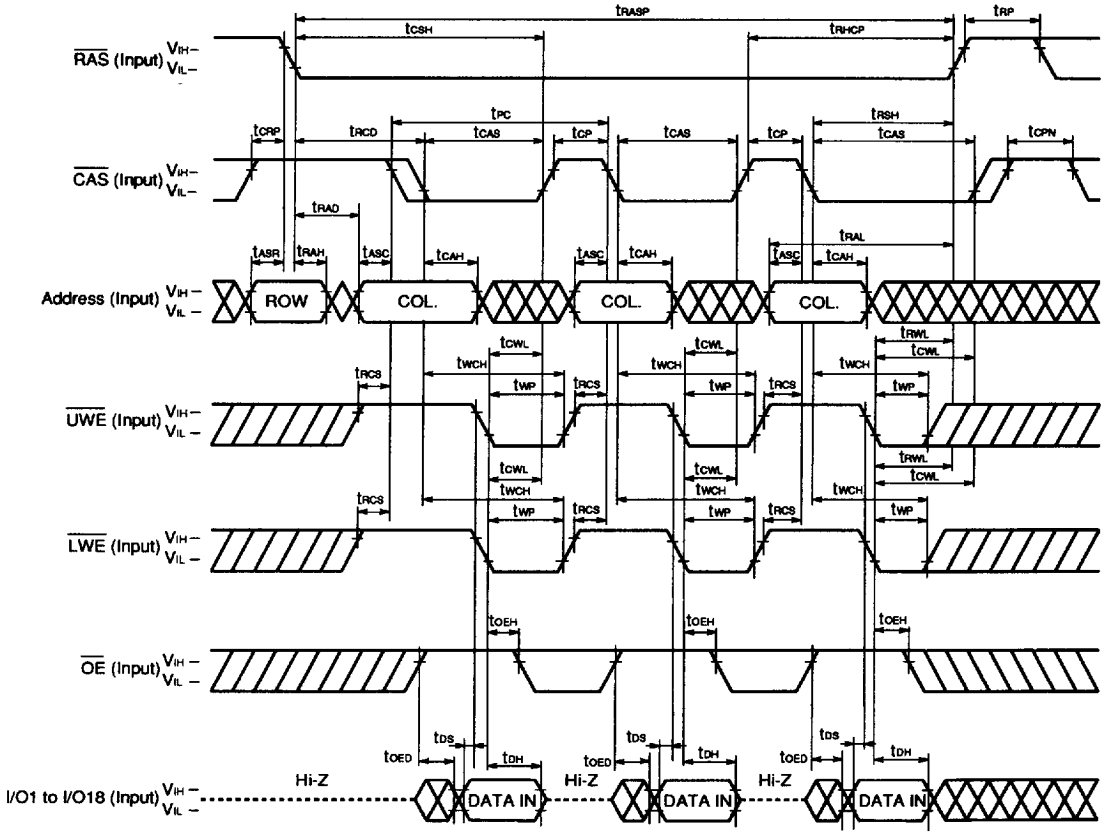
Remark $\overline{OE}$, I/O1 to I/O9 = Don't care
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle

FAST PAGE MODE LOWER BYTE EARLY WRITE CYCLE



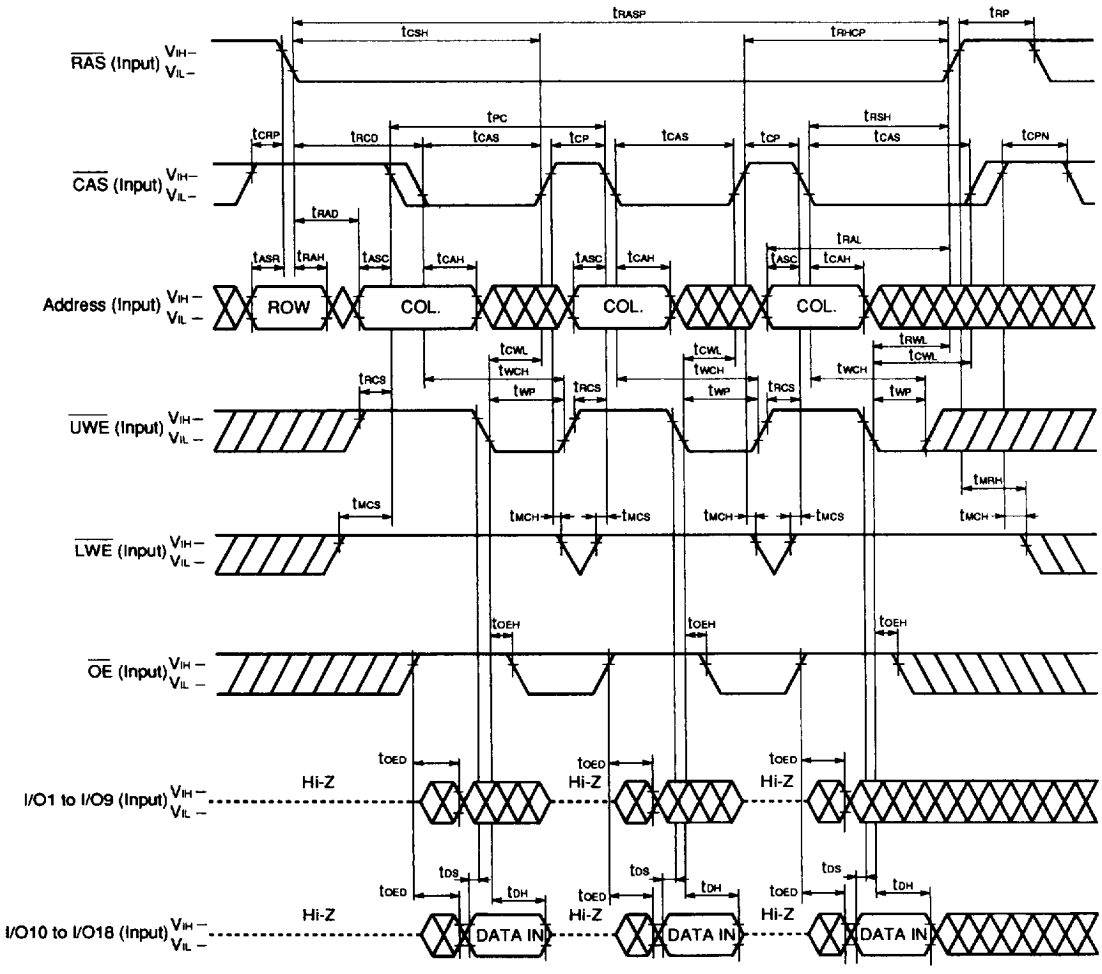
Remark $\overline{OE}$, I/O10 to I/O18 = Don't care
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle

FAST PAGE MODE LATE WRITE CYCLE



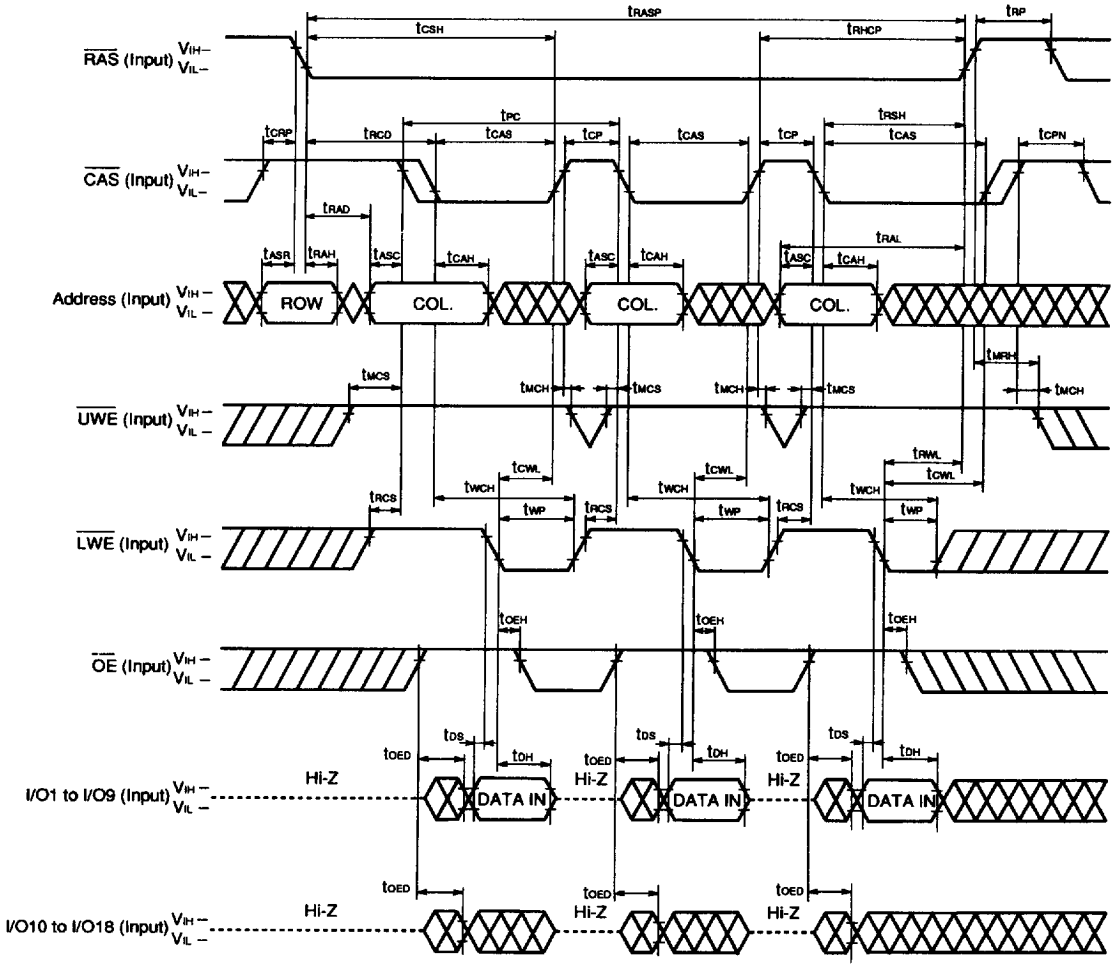
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE UPPER BYTE LATE WRITE CYCLE



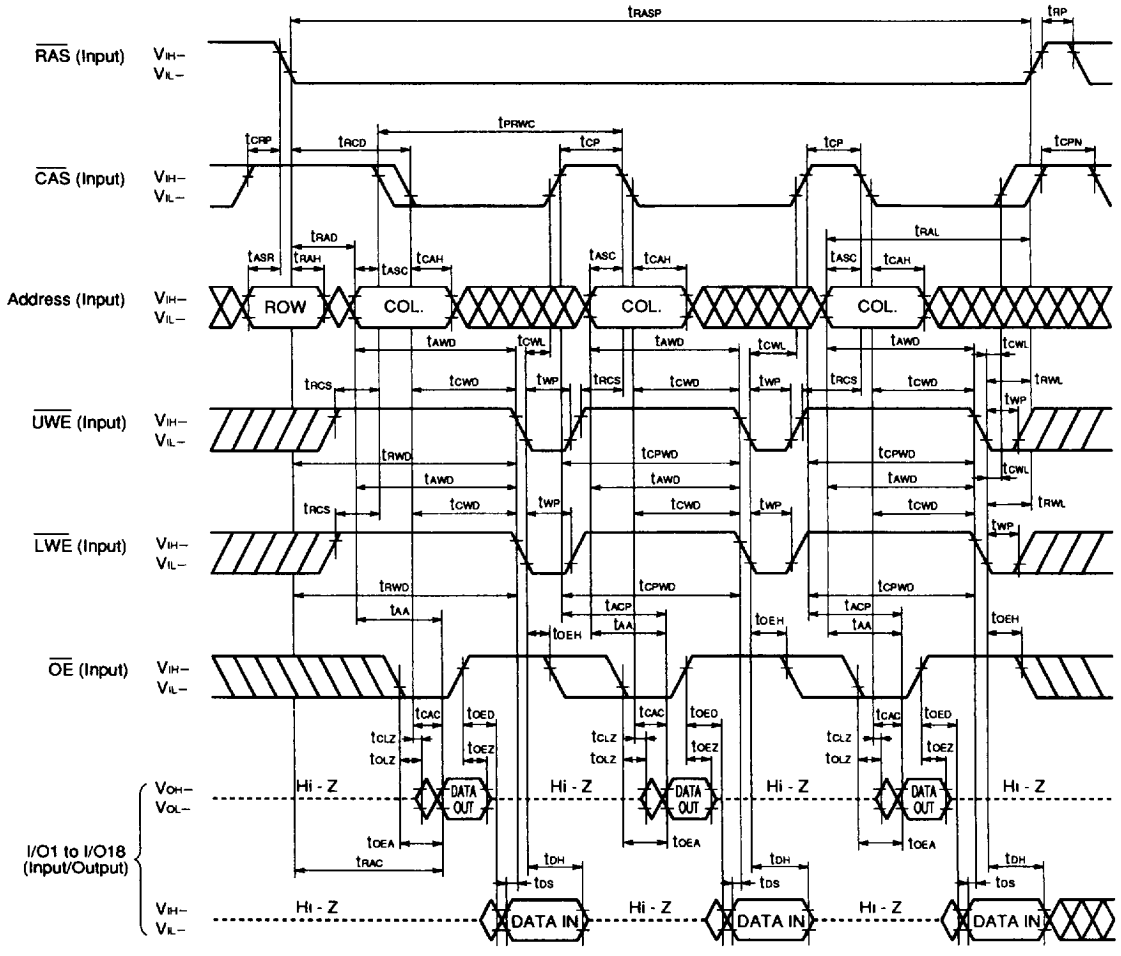
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE LOWER BYTE LATE WRITE CYCLE



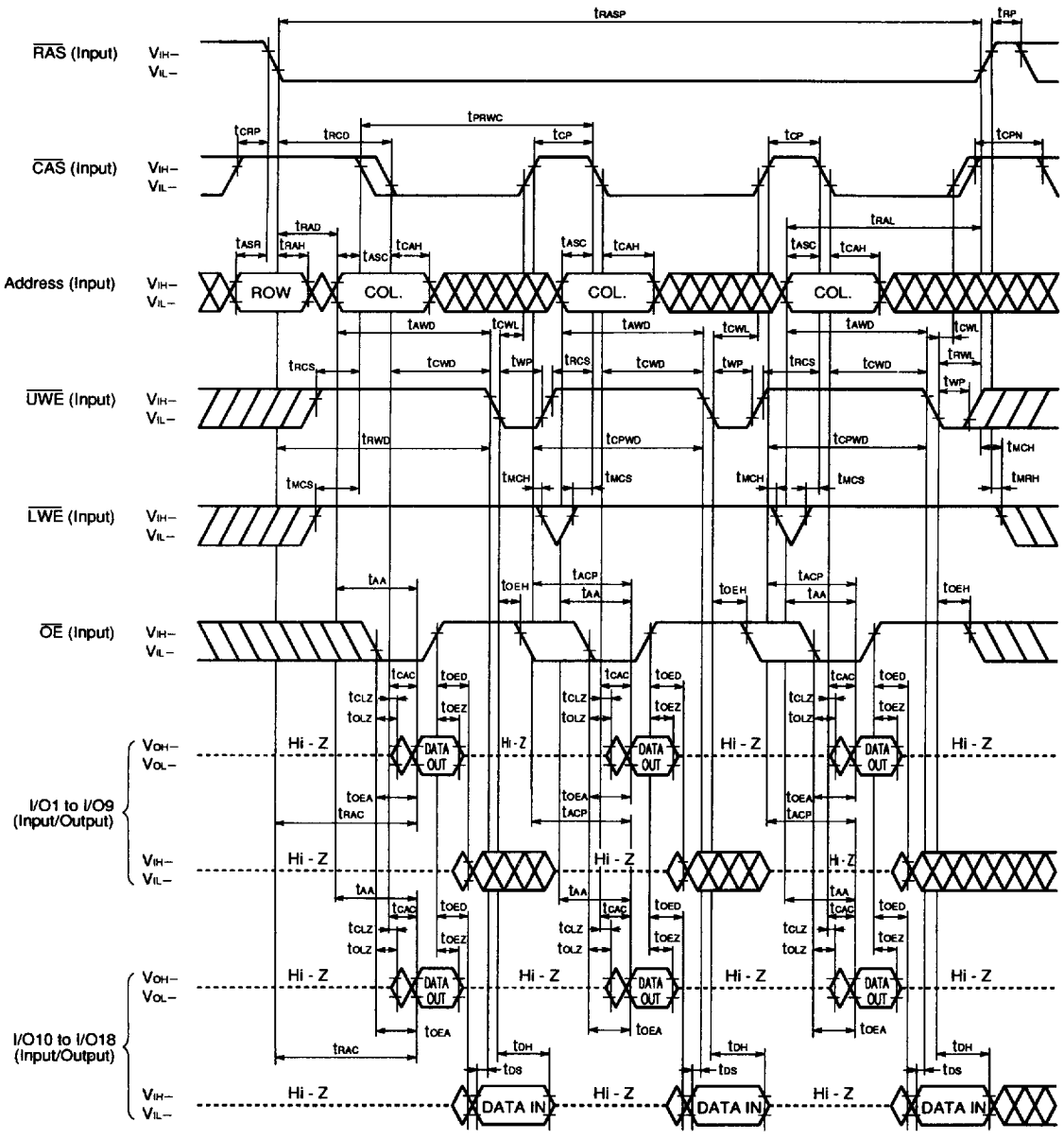
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE READ MODIFY WRITE CYCLE



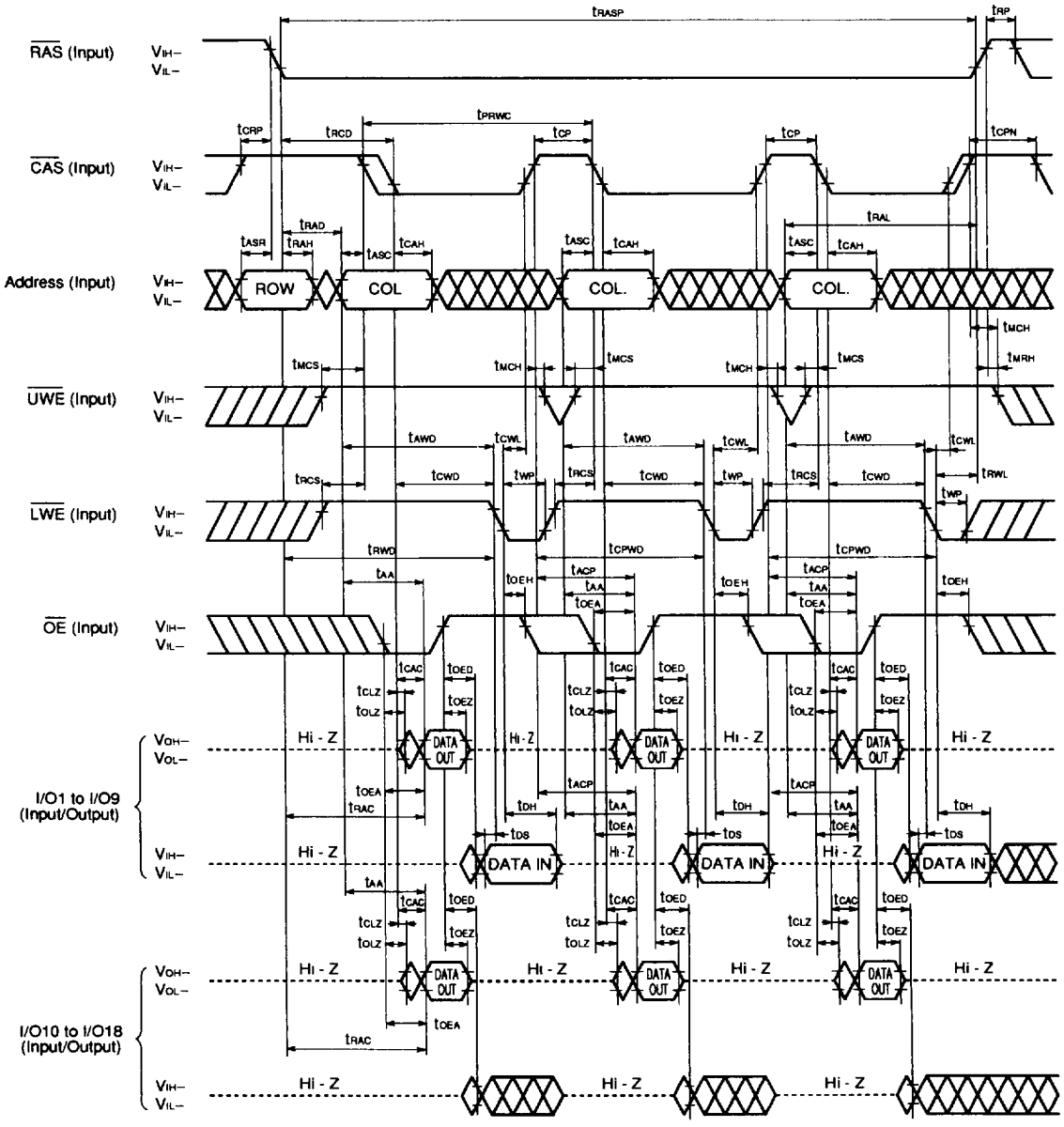
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle

FAST PAGE MODE UPPER BYTE READ MODIFY WRITE CYCLE



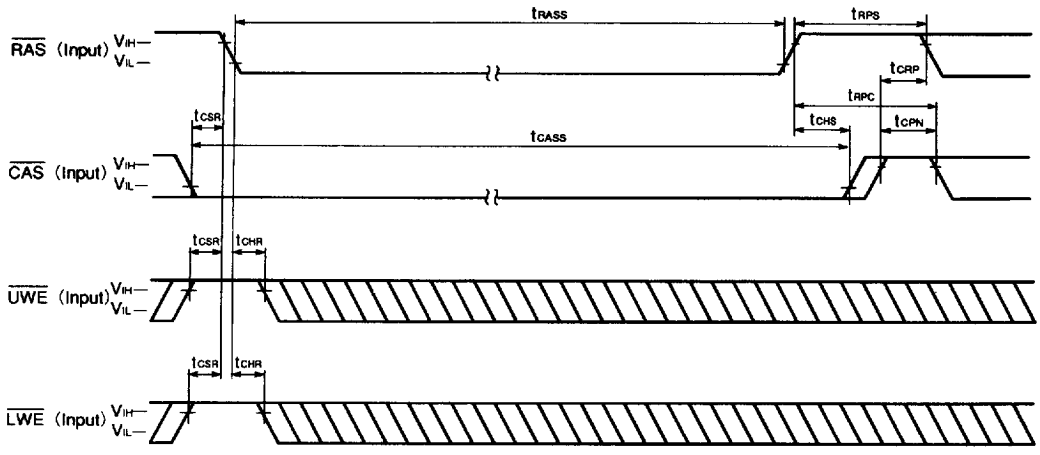
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

FAST PAGE MODE LOWER BYTE READ MODIFY WRITE CYCLE



Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

★ $\overline{CAS}$ BEFORE $\overline{RAS}$ SELF REFRESH CYCLE (Only for the μPD42S4190)



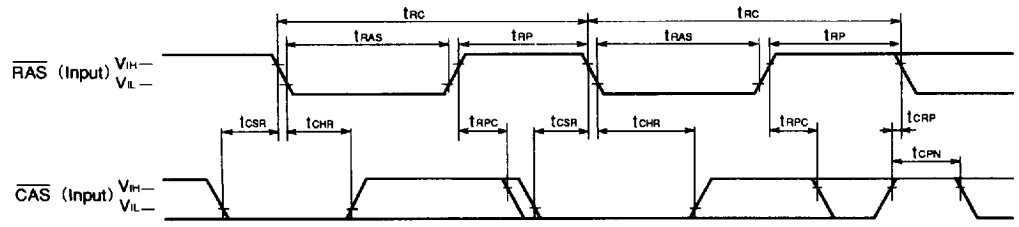
Remark Address, $\overline{OE}$ = Don't care I/O1 to I/O18 = Hi-Z

How to use the $\overline{CAS}$ before $\overline{RAS}$ self refresh mode.

$\overline{CAS}$ before $\overline{RAS}$ self refresh mode can't be used by itself. It must be used with performing one of 3 refreshes below.

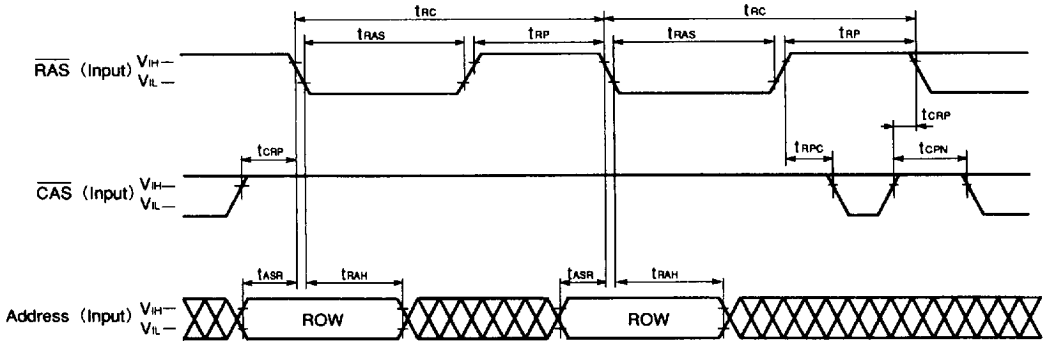
- **When using distributed $\overline{CAS}$ before $\overline{RAS}$ refresh**
  Refresh 1 024 times during 128 ms before set into the $\overline{CAS}$ before $\overline{RAS}$ self refresh mode and after reset.
- **When using burst $\overline{CAS}$ before $\overline{RAS}$ refresh**
  Refresh 1 024 times during 16 ms before set into the $\overline{CAS}$ before $\overline{RAS}$ self refresh mode and after reset.
- **When using $\overline{RAS}$ only refresh**
  Refresh all refresh addresses during 16 ms before set into the $\overline{CAS}$ before $\overline{RAS}$ self refresh mode and after reset.

$\overline{CAS}$ BEFORE $\overline{RAS}$ REFRESH CYCLE



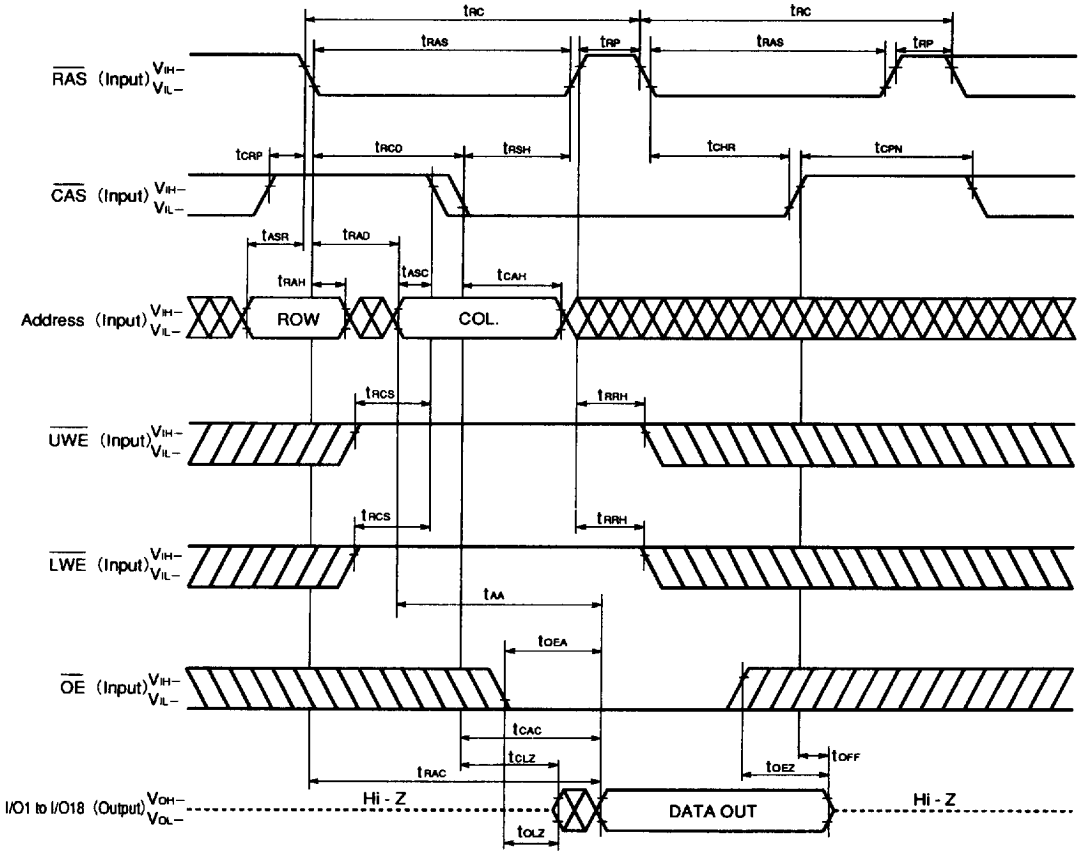
Remark Address, $\overline{UWE}$, $\overline{LWE}$, $\overline{OE}$ = Don't care I/O1 to I/O18 = Hi-Z

$\overline{RAS}$ ONLY REFRESH CYCLE

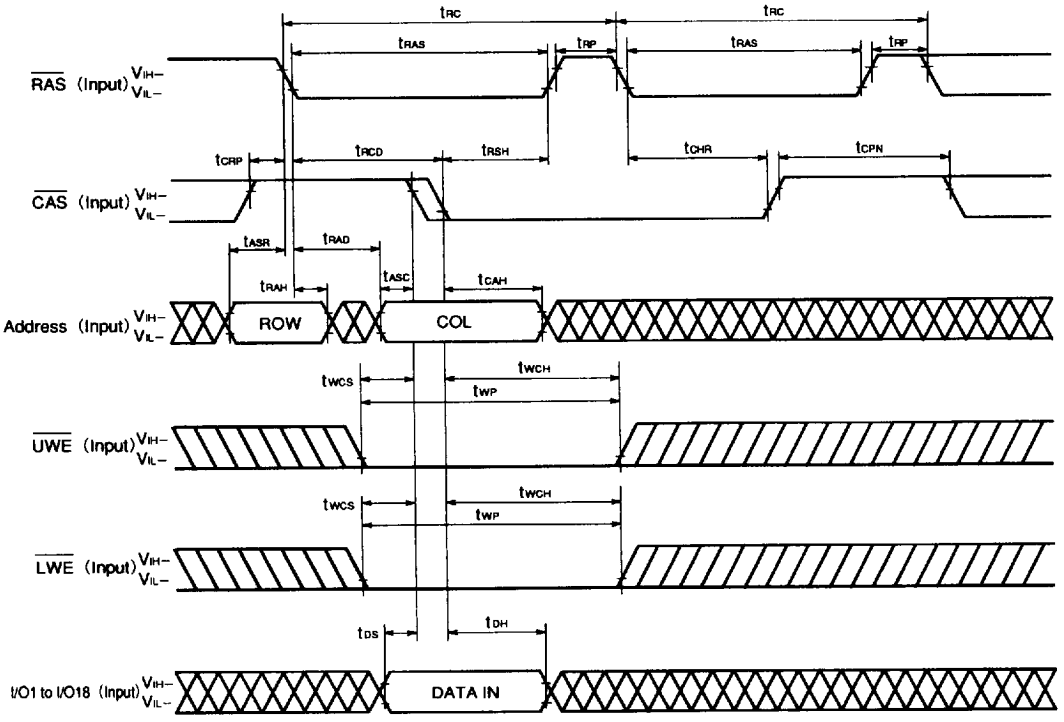


Remark $\overline{UWE}$, $\overline{LWE}$, $\overline{OE}$ = Don't care I/O1 to I/O18 = Hi-Z

HIDDEN REFRESH CYCLE (READ)

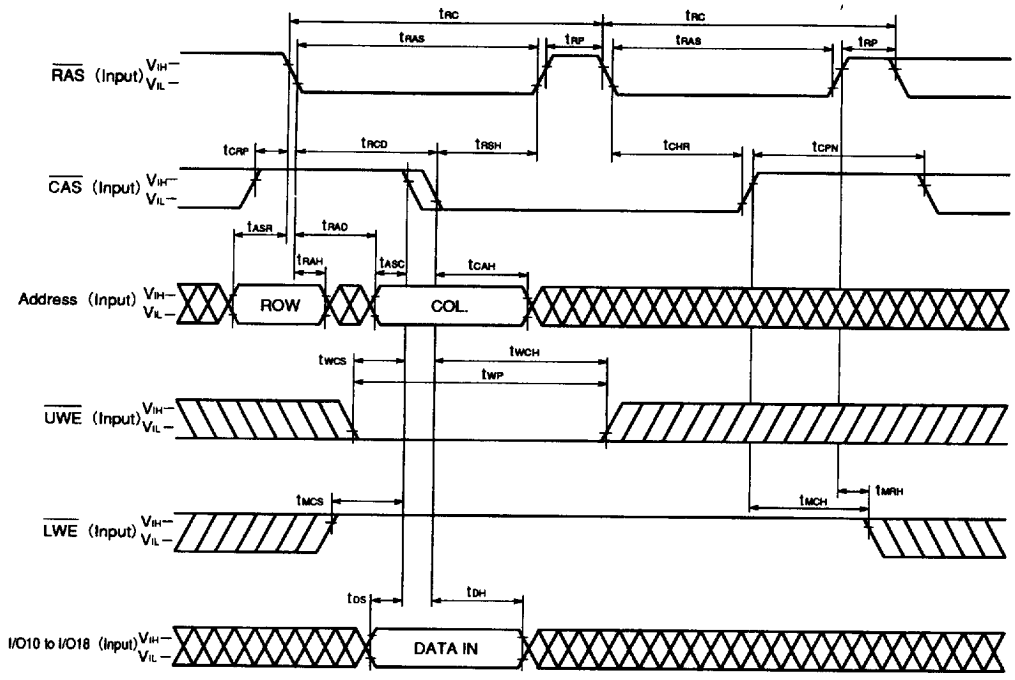


HIDDEN REFRESH CYCLE (WRITE)



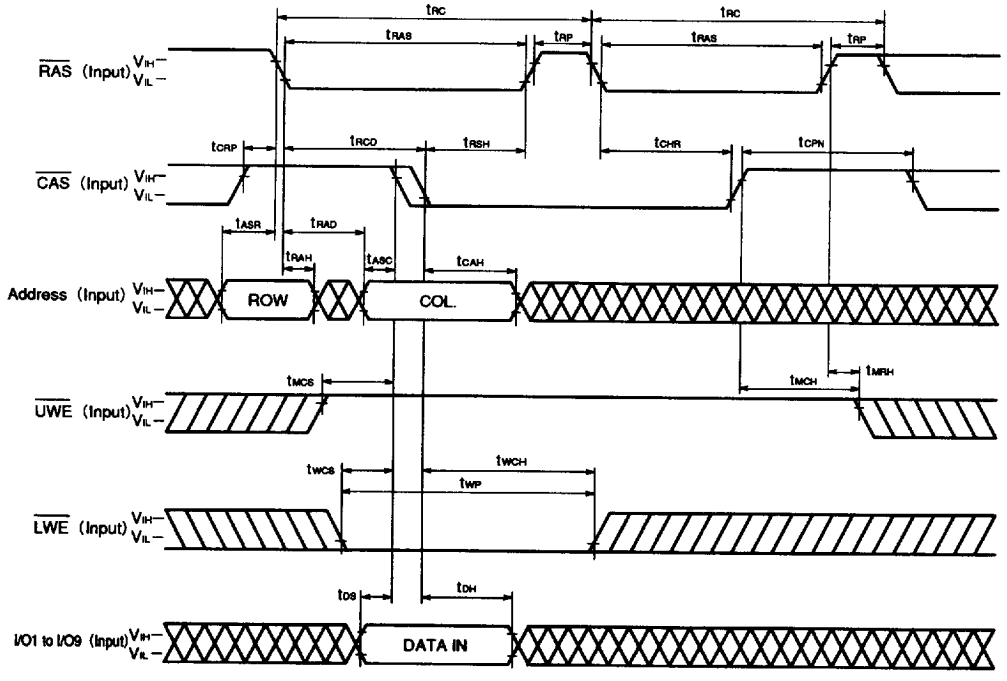
Remark $\overline{OE}$ = Don't care

HIDDEN REFRESH CYCLE (UPPER BYTE WRITE)



Remark $\overline{OE}$, I/O1 to I/O9 = Don't care

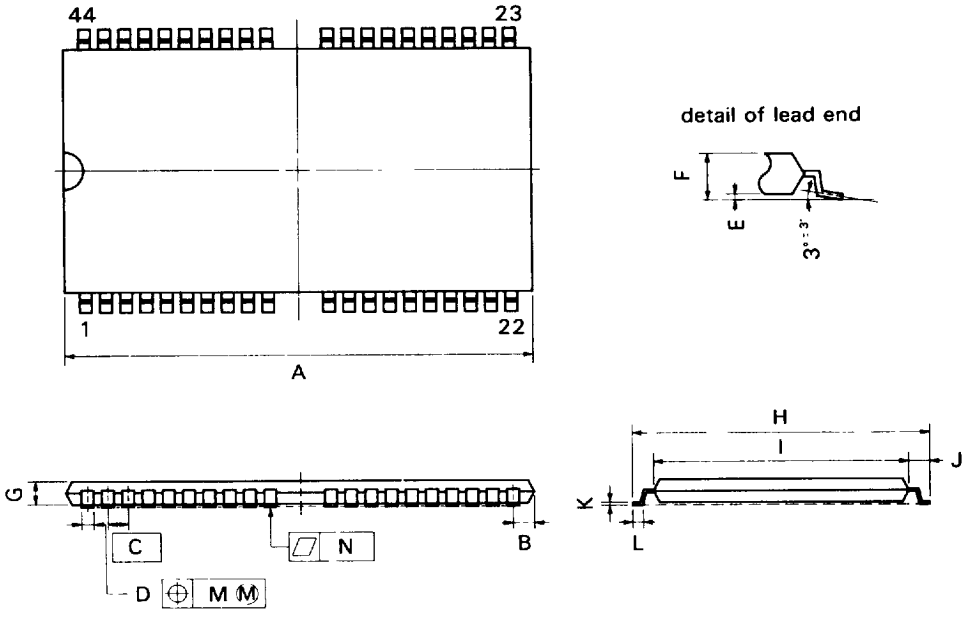
HIDDEN REFRESH CYCLE (LOWER BYTE WRITE)



Remark $\overline{OE}$, I/O10 to I/O18 = Don't care

PACKAGE DRAWINGS

44 PIN PLASTIC TSOP (400mil)



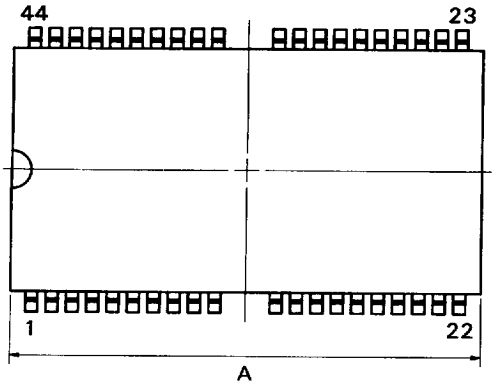
S44G5 80 7JF

NOTE

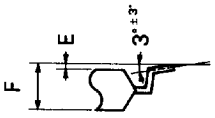
Each lead centerline is located within 0 13 mm (0.005 inch) of its true position (T.P.) at maximum material condition

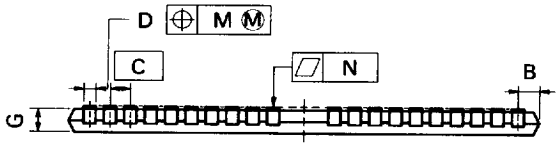
ITEM	MILLIMETERS	INCHES
A	18 81 MAX	0 741 MAX
B	1 0 MAX	0 040 MAX
C	0 8 (T P)	0 031 (T P)
D	$0\ 30^{+0\ 10}$	$0\ 012^{+0\ 004}_{-0\ 005}$
E	$0\ 05^{+0\ 05}$	$0.002^{+0\ 002}$
F	1 1 MAX	0 044 MAX.
G	0 97	0 038
H	$11\ 76^{+0\ 2}$	$0\ 463^{+0\ 008}$
I	$10\ 16^{+0\ 1}$	$0.400^{+0\ 004}$
J	$0.8^{+0\ 2}$	$0.031^{+0\ 009}_{-0\ 008}$
K	$0\ 125^{+0\ 10}_{-0\ 05}$	$0\ 005^{+0\ 004}_{-0\ 002}$
L	$0\ 5^{+0\ 1}$	$0\ 020^{+0\ 004}_{-0\ 005}$
M	0 13	0 005
N	0 10	0 004

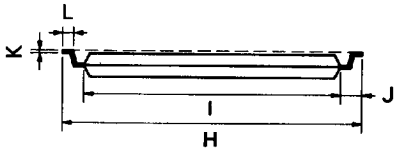
44 PIN PLASTIC TSOP (400mil)



detail of lead end







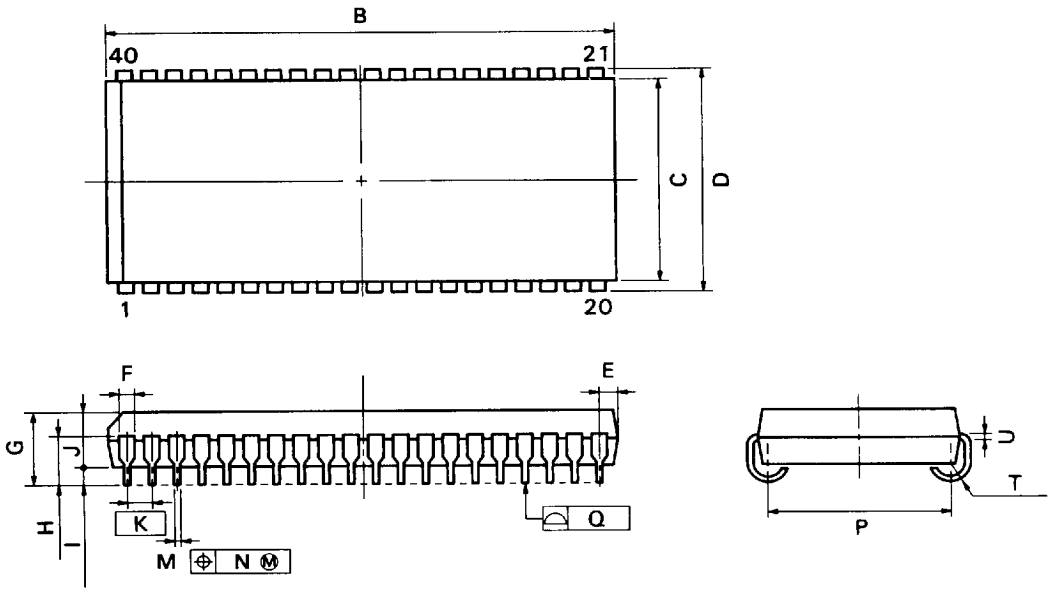
S44G5-80-7KF

NOTE

Each lead centerline is located within 0.13 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	18.81 MAX.	0.741 MAX.
B	1.0 MAX.	0.040 MAX.
C	0.8 (T.P.)	0.031 (T.P.)
D	$0.30^{+0.10}$	$0.012^{+0.004}_{-0.005}$
E	$0.05^{\pm 0.05}$	$0.002^{\pm 0.002}$
F	1.1 MAX.	0.044 MAX.
G	0.97	0.038
H	$11.76^{\pm 0.2}$	$0.463^{\pm 0.008}$
I	$10.16^{\pm 0.1}$	$0.400^{\pm 0.004}$
J	$0.8^{\pm 0.2}$	$0.031^{+0.008}_{-0.009}$
K	$0.125^{+0.10}_{-0.05}$	$0.005^{+0.004}_{-0.002}$
L	$0.5^{\pm 0.1}$	$0.020^{+0.004}_{-0.006}$
M	0.13	0.005
N	0.10	0.004

40PIN PLASTIC SOJ (400 mil)



P40LE-400A-1

NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
B	$26.29^{+0.2}_{-0.36}$	$1.035^{+0.008}_{-0.014}$
C	10.16	0.400
D	$11.18^{\pm 0.2}$	$0.440^{\pm 0.008}$
E	$1.08^{\pm 0.15}$	$0.043^{+0.008}_{-0.007}$
F	0.7	0.028
G	$3.5^{\pm 0.2}$	$0.138^{\pm 0.008}$
H	$2.4^{\pm 0.2}$	$0.094^{+0.009}_{-0.008}$
I	0.8 MIN.	0.031 MIN.
J	2.6	0.102
K	1.27(T.P.)	0.050(T.P.)
M	$0.40^{\pm 0.10}$	$0.016^{+0.004}_{-0.005}$
N	0.12	0.005
P	$9.4^{\pm 0.20}$	$0.370^{\pm 0.008}$
Q	0.15	0.006
T	R 0.85	R 0.033
U	$0.20^{+0.10}_{-0.05}$	$0.008^{+0.004}_{-0.002}$

★ RECOMMENDED SOLDERING CONDITIONS

Please consult with our sales offices for soldering conditions of the μPD42S4190, 424190.

TYPE OF SURFACE MOUNT DEVICE

μPD42S4190G5, 424190G5 (44-pin Plastic TSOP) (400 mil)
μPD42S4190LE, 424190LE (40-pin Plastic SOJ) (400 mil)