NEC

MOS INTEGRATED CIRCUIT
μPD424400

4 M-BIT DYNAMIC RAM
1 M-WORD BY 4-BIT, FAST PAGE MODE

Description

The μPD424400 is a 1 048 576 words by 4 bits dynamic CMOS RAM. The fast page mode capability realize high speed access and low power consumption.

These are packed in 26-pin plastic TSOP(II), 26-pin plastic SOJ and 20-pin plastic ZIP.

Features

- 1 048 576 words by 4 bits organization
- Single +5.0 V±10 % power supply
- Fast access and cycle time

Part number	Power consumption		Access time (MAX.)	R/W cycle time (MIN.)	Fast page mode cycle time (MIN.)
	Active (MAX.)	Standby(MAX.)			
μPD424400-60	660 mW	5.5 mW (CMOS level input)	60 ns	120 ns	40 ns
μPD424400-70	550 mW		70 ns	140 ns	45 ns
μPD424400-80	495 mW		80 ns	160 ns	50 ns
μPD424400-10	440 mW		100 ns	190 ns	60 ns

- 1 024 refresh cycles/16 ms
- $\overline{CAS}$ before $\overline{RAS}$ refresh, $\overline{RAS}$ only refresh, Hidden refresh
- Multiplexed address inputs ····· Row address : A0 to A9, Column address : A0 to A9

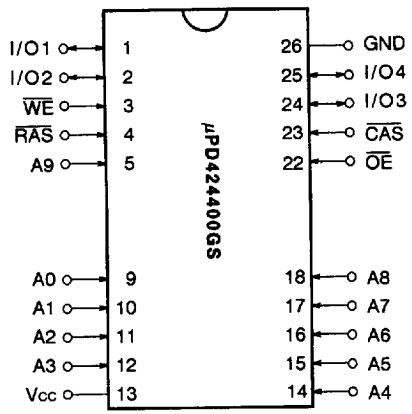
Ordering Information

Part number	Access time (MAX.)	Package	Quality grade
μPD424400GS-60	60 ns	26-pin Plastic TSOP (II) (300 mil)	Standard
μPD424400GS-70	70 ns		
μPD424400GS-80	80 ns		
μPD424400GS-10	100 ns		
μPD424400LA-60	60 ns	26-pin Plastic SOJ (300 mil)	
μPD424400LA-70	70 ns		
μPD424400LA-80	80 ns		
μPD424400LA-10	100 ns		
μPD424400V-60	60 ns	20-pin Plastic ZIP (400 mil)	
μPD424400V-70	70 ns		
μPD424400V-80	80 ns		
μPD424400V-10	100 ns		

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.

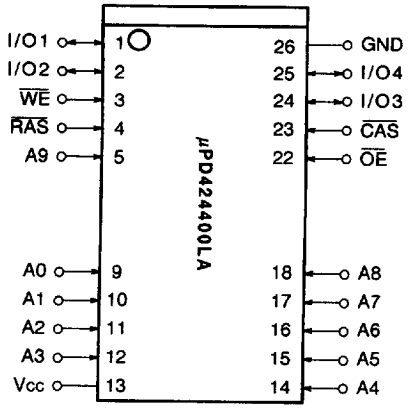
Pin Configurations (Marking Side)

26-pin Plastic TSOP(II) (300 mil)

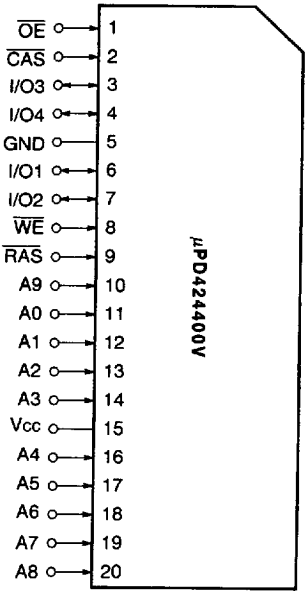


A0 to A9	: Address Inputs
I/O1 to I/O4	: Data Inputs/Outputs
$\overline{RAS}$	: Row Address Strobe
$\overline{CAS}$	: Column Address Strobe
$\overline{WE}$	: Write Enable
$\overline{OE}$	: Output Enable
Vcc	: Power Supply
GND	: Ground

26-pin Plastic SOJ (300 mil)

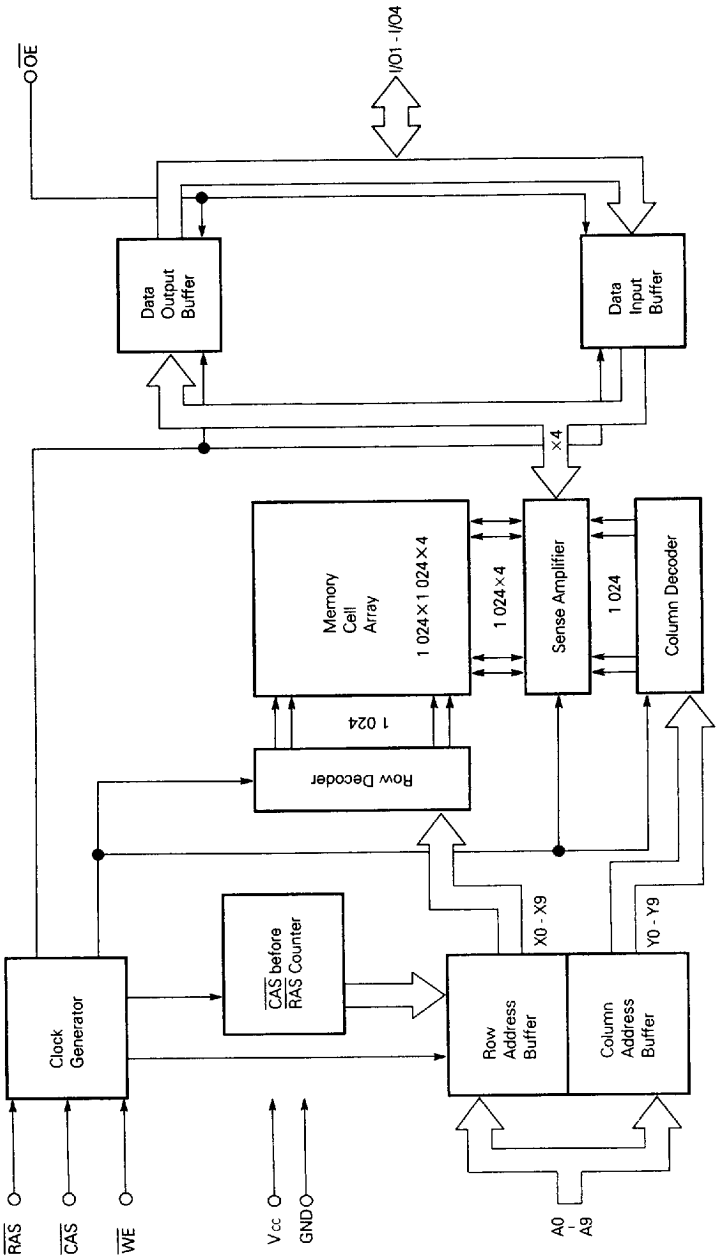


20-pin Plastic ZIP (400 mil)



A0 to A9	: Address Inputs
I/O1 to I/O4	: Data Inputs/Outputs
$\overline{RAS}$	: Row Address Strobe
$\overline{CAS}$	: Column Address Strobe
$\overline{WE}$	: Write Enable
$\overline{OE}$	: Output Enable
Vcc	: Power Supply
GND	: Ground

Block Diagram



Input/Output Pin Functions

The μPD424400 has input pins $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$, A0 to A9 and input/output pins I/O1 to I/O4.

Pin Name	Input/ Output	Function
$\overline{RAS}$ (Row address strobe)	Input	$\overline{RAS}$ activates the sense amplifier by latching a row address and selecting a corresponding word line. It refreshes memory cell array of one line selected by the row address. It also selects the following function. • $\overline{CAS}$ before $\overline{RAS}$ refresh
$\overline{CAS}$ (Column address strobe)		$\overline{CAS}$ activates data input/output circuit by latching column address and selecting a digit line connected with the sense amplifier.
A0 to A9 (Address input)		Address bus. Input total 20-bit of address signal, upper 10-bit and lower 10-bit in sequence (address multiplex method). Therefore, one word is selected from 1 048 576-word by 4-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)		Write control signal. Write operation is executed by activating $\overline{RAS}$, $\overline{CAS}$ and $\overline{WE}$.
$\overline{OE}$ (Output enable)		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/O4 (Data input/output)	Input/ Output	4-bit data bus. I/O1 to I/O4 are used to input/output data.

Electrical Specifications

- All voltages are referenced to GND.
- After power up, wait more than 100 μs and then, execute eight $\overline{CAS}$ before $\overline{RAS}$ or $\overline{RAS}$ only refresh cycles as dummy cycles to initialize internal circuit.

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

Caution 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

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	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	$C_{I/O}$	I/O			7	pF

DC Characteristics (Recommended operating conditions unless otherwise noted)

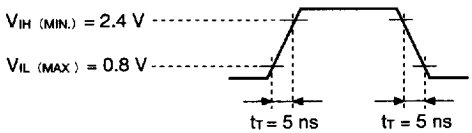
Parameter	Symbol	Test Condition		MIN.	TYP.	MAX.	Unit	Notes
Operating current	I_{CC1}	$\overline{RAS}$, $\overline{CAS}$ Cycling $t_{RC} = t_{RC(MIN)}$ I_O = 0 mA	t_{RAC} = 60 ns			120	mA	1, 2, 3
			t_{RAC} = 70 ns			100		
			t_{RAC} = 80 ns			90		
			t_{RAC} = 100 ns			80		
Standby current	I_{CC2}	$\overline{RAS}$, $\overline{CAS} \geq V_{IH(MIN.)}$, I_O = 0 mA				2	mA	
		$\overline{RAS}$, $\overline{CAS} \geq V_{CC}$ – 0.2 V, I_O = 0 mA				1		
$\overline{RAS}$ only refresh current	I_{CC3}	$\overline{RAS}$ Cycling, $\overline{CAS} \geq V_{IH(MIN)}$ $t_{RC} = t_{RC(MIN)}$, I_O = 0 mA	t_{RAC} = 60 ns			120	mA	1,2,3,4
			t_{RAC} = 70 ns			100		
			t_{RAC} = 80 ns			90		
			t_{RAC} = 100 ns			80		
Operating current (Fast page mode)	I_{CC4}	$\overline{RAS} \leq V_{IL(MAX.)}$, $\overline{CAS}$ Cycling $t_{PC} = t_{PC(MIN)}$, I_O = 0 mA	t_{RAC} = 60 ns			90	mA	1, 2, 5
			t_{RAC} = 70 ns			80		
			t_{RAC} = 80 ns			70		
			t_{RAC} = 100 ns			60		
$\overline{CAS}$ before $\overline{RAS}$ refresh current	I_{CC5}	$\overline{RAS}$ Cycling $t_{RC} = t_{RC(MIN)}$ I_O = 0 mA	t_{RAC} = 60 ns			120	mA	1, 2
			t_{RAC} = 70 ns			100		
			t_{RAC} = 80 ns			90		
			t_{RAC} = 100 ns			80		
Input leakage current	$I_{I(L)}$	V_I = 0 to 5.5 V All other pins not under test = 0 V		–10		+10	μA	
Output leakage current	$I_{O(L)}$	V_O = 0 to 5.5 V Output is disabled (Hi-Z)		–10		+10	μA	
High level output voltage	V_{OH}	I_O = –5.0 mA		2.4			V	
Low level output voltage	V_{OL}	I_O = +4.2 mA				0.4	V	

Notes
1. I_{CC1}, I_{CC3}, I_{CC4} and I_{CC5} depend on cycle rates (t_{RC} and t_{PC}).
2. Specified values are obtained with outputs unloaded.
3. I_{CC1} and I_{CC3} are measured assuming that address can be changed once or less during $\overline{RAS} \leq V_{IL(MAX.)}$ and $\overline{CAS} \geq V_{IH(MIN.)}$.
4. I_{CC3} is measured assuming that all column address inputs are held at either high or low.
5. I_{CC4} is measured assuming that all column address inputs are switched only once during each fast page cycle.

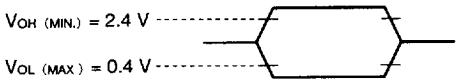
AC Characteristics (Recommended Operating Conditions unless otherwise noted)

AC Characteristics Test Conditions

(1) Input timing specification



(2) Output timing specification



(3) Loading conditions are 100 pF + 2 TTLs.

Common to Read, Write, Read Modify Write Cycle

Parameter	Symbol	tRAC = 60 ns		tRAC = 70 ns		tRAC = 80 ns		tRAC = 100 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read / Write Cycle Time	tRC	120	–	140	–	160	–	190	–	ns	
$\overline{RAS}$ Precharge Time	tRP	50	–	60	–	70	–	80	–	ns	
$\overline{CAS}$ Precharge Time	tCPN	10	–	10	–	10	–	10	–	ns	
$\overline{RAS}$ Pulse Width	tRAS	60	10 000	70	10 000	80	10 000	100	10 000	ns	
$\overline{CAS}$ Pulse Width	tCAS	15	10 000	20	10 000	20	10 000	25	10 000	ns	
$\overline{RAS}$ Hold Time	tRSH	20	–	20	–	20	–	25	–	ns	
$\overline{CAS}$ Hold Time	tCSH	60	–	70	–	80	–	100	–	ns	
$\overline{RAS}$ to $\overline{CAS}$ Delay Time	tRCD	20	40	20	50	25	60	25	75	ns	1
$\overline{RAS}$ to Column Address Delay Time	tRAD	15	30	15	35	17	40	17	50	ns	1
$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	tCRP	10	–	10	–	10	–	10	–	ns	2
Row Address Setup Time	tASR	0	–	0	–	0	–	0	–	ns	
Row Address Hold Time	tRAH	10	–	10	–	12	–	12	–	ns	
Column Address Setup Time	tASC	0	–	0	–	0	–	0	–	ns	
Column Address Hold Time	tCAH	15	–	15	–	15	–	20	–	ns	
$\overline{OE}$ Lead Time Referenced to $\overline{RAS}$	tOES	0	–	0	–	0	–	0	–	ns	
$\overline{CAS}$ to Data Setup Time	tCLZ	0	–	0	–	0	–	0	–	ns	
$\overline{OE}$ to Data Setup Time	tOLZ	0	–	0	–	0	–	0	–	ns	
$\overline{OE}$ to Data Delay Time	tOED	15	–	15	–	20	–	25	–	ns	
Transition Time (Rise and Fall)	tT	3	50	3	50	3	50	3	50	ns	
Refresh Time	tREF	–	16	–	16	–	16	–	16	ms	

Notes 1. For read cycles, access time is defined as follows:

Input Conditions	Access Time	Access Time from $\overline{RAS}$
$t_{RAD} \leqq t_{RAD(MAX)}$ and $t_{RCD} \leqq t_{RCD(MAX)}$	$t_{RAC(MAX)}$	$t_{RAC(MAX)}$
$t_{RAD} > t_{RAD(MAX)}$ and $t_{RCD} \leqq t_{RCD(MAX)}$	$t_{AA(MAX)}$	$t_{RAD} + t_{AA(MAX)}$
$t_{RCD} > t_{RCD(MAX)}$	$t_{CAC(MAX)}$	$t_{RCD} + t_{CAC(MAX)}$

$t_{RAD(MAX.)}$ and $t_{RCD(MAX.)}$ are specified as reference points only ; they are not restrictive operating parameters. They are used to determine which access time(t_{RAC}, t_{AA} or t_{CAC}) is to be used for finding out when output data will be available. Therefore, the input conditions $t_{RAD} \geqq t_{RAD(MAX)}$ and $t_{RCD} \geqq t_{RCD(MAX)}$ will not cause any operation problems.

2. $t_{CRP(MIN.)}$ requirement is applied for $\overline{RAS}$, $\overline{CAS}$ cycles preceded by any cycle.

Read Cycle

Parameter	Symbol	t_{RAC} = 60 ns		t_{RAC} = 70 ns		t_{RAC} = 80 ns		t_{RAC} = 100 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Access Time from $\overline{RAS}$	t_{RAC}	–	60	–	70	–	80	–	100	ns	1
Access Time from $\overline{CAS}$	t_{CAC}	–	15	–	20	–	20	–	25	ns	1
Access Time from Column Address	t_{AA}	–	30	–	35	–	40	–	50	ns	1
Access Time from $\overline{OE}$	t_{OEA}	–	20	–	20	–	20	–	25	ns	
Column Address Lead Time Referenced to $\overline{RAS}$	t_{RAL}	30	–	35	–	40	–	50	–	ns	
Read Command Setup Time	t_{RCS}	0	–	0	–	0	–	0	–	ns	
Read Command Hold Time Referenced to $\overline{RAS}$	t_{RRH}	10	–	10	–	10	–	10	–	ns	2
Read Command Hold Time Referenced to $\overline{CAS}$	t_{RCH}	0	–	0	–	0	–	0	–	ns	2
Output Buffer Turn-off Delay Time from $\overline{OE}$	t_{OEZ}	0	15	0	15	0	20	0	25	ns	3
Output Buffer Turn-off Delay Time from $\overline{CAS}$	t_{OFF}	0	15	0	15	0	20	0	25	ns	3

Notes 1. For read cycles, access time is defined as follows:

Input Conditions	Access Time	Access Time from $\overline{RAS}$
$t_{RAD} \leqq t_{RAD(MAX)}$ and $t_{RCD} \leqq t_{RCD(MAX.)}$	$t_{RAC(MAX)}$	$t_{RAC(MAX)}$
$t_{RAD} > t_{RAD(MAX)}$ and $t_{RCD} \leqq t_{RCD(MAX.)}$	$t_{AA(MAX)}$	$t_{RAD} + t_{AA(MAX.)}$
$t_{RCD} > t_{RCD(MAX)}$	$t_{CAC(MAX)}$	$t_{RCD} + t_{CAC(MAX.)}$

$t_{RAD(MAX)}$ and $t_{RCD(MAX)}$ are specified as reference points only ; they are not restrictive operating parameters. They are used to determine which access time(t_{RAC}, t_{AA} or t_{CAC}) is to be used for finding out when output data will be available. Therefore, the input conditions $t_{RAD} \geqq t_{RAD(MAX)}$ and $t_{RCD} \geqq t_{RCD(MAX)}$ will not cause any operation problems.

2. Either $t_{RCH(MIN)}$ or $t_{RRH(MIN)}$ should be met in read cycles.
3. $t_{OFF(MAX)}$ and $t_{OEZ(MAX)}$ define the time when the output achieves the condition of Hi - Z and is not referenced to V_{OH} or V_{OL}.

Write Cycle

Parameter	Symbol	t_{RAC} = 60 ns		t_{RAC} = 70 ns		t_{RAC} = 80 ns		t_{RAC} = 100 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
$\overline{WE}$ Hold Time Referenced to $\overline{CAS}$	t_{WCH}	15	–	15	–	15	–	20	–	ns	1
$\overline{WE}$ Pulse Width	t_{WP}	15	–	15	–	15	–	20	–	ns	1
$\overline{WE}$ Lead Time Referenced to $\overline{RAS}$	t_{RWL}	20	–	20	–	20	–	25	–	ns	
$\overline{WE}$ Lead Time Referenced to $\overline{CAS}$	t_{CWL}	15	–	15	–	15	–	20	–	ns	
$\overline{WE}$ Setup Time	t_{WCS}	0	–	0	–	0	–	0	–	ns	2
$\overline{OE}$ Hold Time	t_{OEH}	0	–	0	–	0	–	0	–	ns	
Data-in Setup Time	t_{DS}	0	–	0	–	0	–	0	–	ns	3
Data-in Hold Time	t_{DH}	15	–	15	–	15	–	20	–	ns	3

Notes 1. $t_{WP(MIN.)}$ is applied for late write cycles or read modify write cycles. In early write cycles, $t_{WCH(MIN.)}$ should be met.

2. If $t_{WCS} \geqq t_{WCS(MIN.)}$, the cycle is an early write cycle and the data out will remain Hi - Z through the entire cycle.

3. $t_{DS(MIN.)}$ and $t_{DH(MIN.)}$ are referenced to the $\overline{CAS}$ falling edge in early write cycles. In late write cycles and read modify write cycles, they are referenced to the $\overline{WE}$ falling edge.

Read Modify Write Cycle

Parameter	Symbol	t_{RAC} = 60 ns		t_{RAC} = 70 ns		t_{RAC} = 80 ns		t_{RAC} = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read Modify Write Cycle Time	t_{RWC}	165	–	185	–	210	–	250	–	ns	
$\overline{RAS}$ to $\overline{WE}$ Delay Time	t_{RWD}	80	–	90	–	105	–	130	–	ns	1
$\overline{CAS}$ to $\overline{WE}$ Delay Time	t_{CWD}	40	–	40	–	45	–	55	–	ns	1
Column Address to $\overline{WE}$ Delay Time	t_{AWD}	50	–	55	–	65	–	80	–	ns	1

Note 1. If $t_{WCS} \geqq t_{WCS(MIN.)}$, the cycle is an early write cycle and the data out will remain Hi - Z through the entire cycle. If $t_{RWD} \geqq t_{RWD(MIN.)}$, $t_{CWD} \geqq t_{CWD(MIN.)}$, $t_{AWD} \geqq t_{AWD(MIN.)}$, and $t_{CPWD} \geqq t_{CPWD(MIN.)}$, 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 met, the state of the data out is indeterminate.

Fast Page Mode

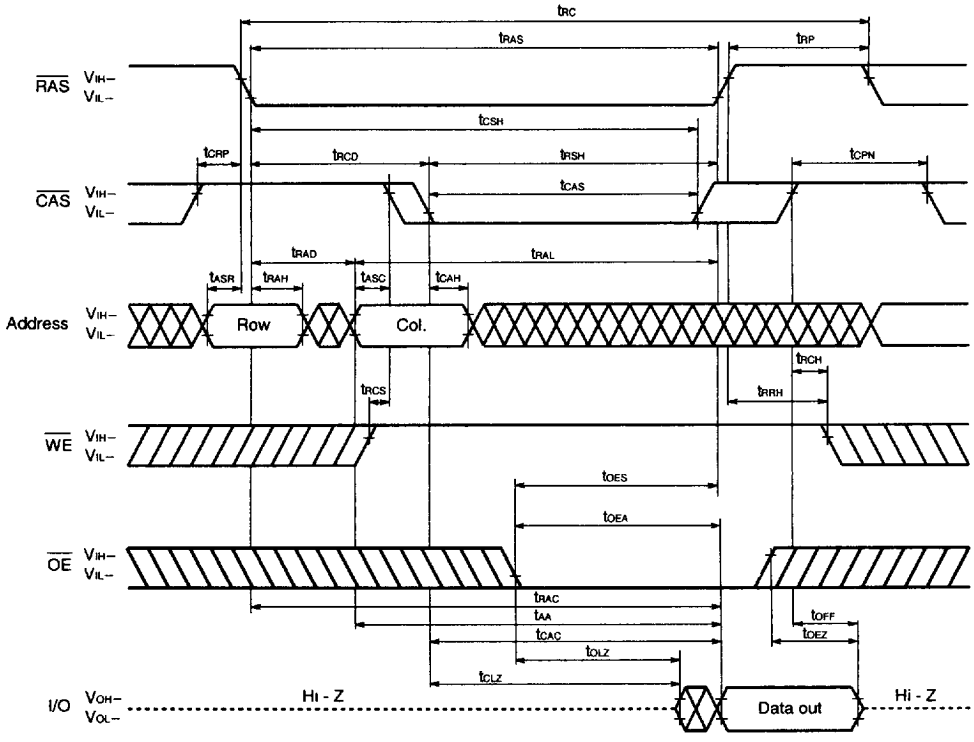
Parameter	Symbol	t_{RAC} = 60 ns		t_{RAC} = 70 ns		t_{RAC} = 80 ns		t_{RAC} = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Fast Page Mode Cycle Time	t_{PC}	40	–	45	–	50	–	60	–	ns	
Access Time from $\overline{CAS}$ Precharge	t_{ACP}	–	35	–	40	–	45	–	55	ns	
$\overline{RAS}$ Pulse Width	t_{RASP}	60	125 000	70	125 000	80	125 000	100	125 000	ns	
$\overline{CAS}$ Precharge Time	t_{CP}	10	–	10	–	10	–	10	–	ns	
$\overline{RAS}$ Hold Time from $\overline{CAS}$ Precharge	t_{RHCP}	35	–	40	–	45	–	55	–	ns	
Read Modify Write Cycle Time	t_{PRWC}	85	–	90	–	100	–	120	–	ns	
$\overline{CAS}$ Precharge to $\overline{WE}$ Delay Time	t_{CPWD}	55	–	60	–	70	–	85	–	ns	1

Note 1. If $t_{WCS} \geqq t_{WCS(MIN)}$, the cycle is an early write cycle and the data out will remain Hi - Z through the entire cycle. If $t_{RWD} \geqq t_{RWD(MIN)}$, $t_{CWD} \geqq t_{CWD(MIN)}$, $t_{AWD} \geqq t_{AWD(MIN)}$, and $t_{CPWD} \geqq t_{CPWD(MIN)}$, 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 met, the state of the data out is indeterminate.

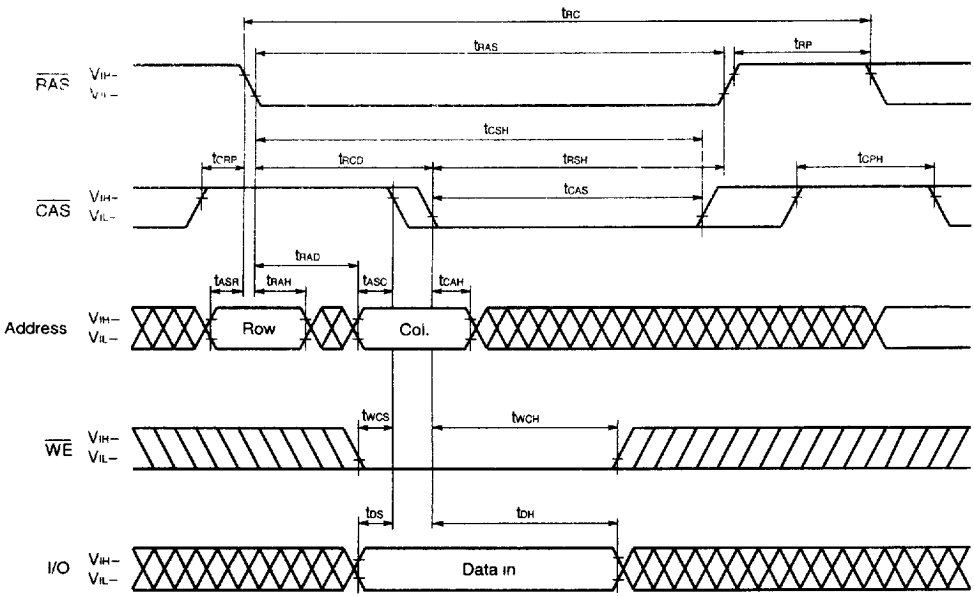
Refresh Cycle

Parameter	Symbol	t_{RAC} = 60 ns		t_{RAC} = 70 ns		t_{RAC} = 80 ns		t_{RAC} = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
$\overline{CAS}$ Setup Time	t_{CSR}	10	–	10	–	10	–	10	–	ns	
$\overline{CAS}$ Hold Time ($\overline{CAS}$ before $\overline{RAS}$ Refresh)	t_{CHR}	15	–	15	–	15	–	20	–	ns	
$\overline{RAS}$ Precharge $\overline{CAS}$ Hold Time	t_{RPC}	10	–	10	–	10	–	10	–	ns	
$\overline{WE}$ Setup Time	t_{WSR}	10	–	10	–	10	–	10	–	ns	
$\overline{WE}$ Hold Time	t_{WHR}	15	–	15	–	15	–	20	–	ns	

Read Cycle

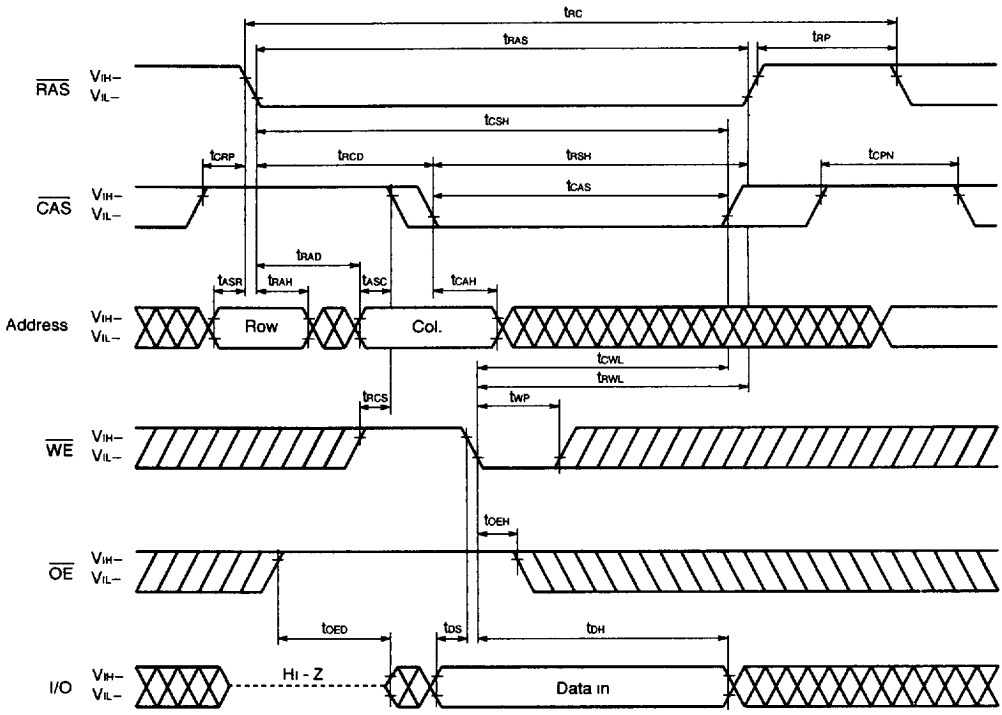


Early Write Cycle

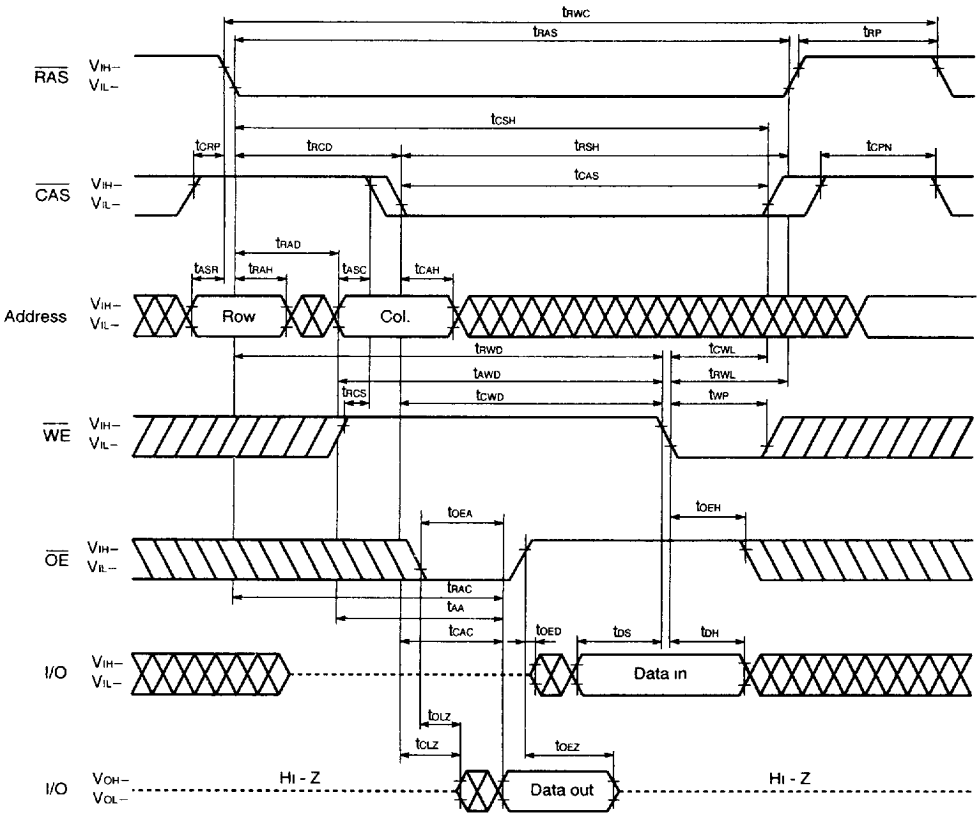


Remark $\overline{OE}$: Don't care

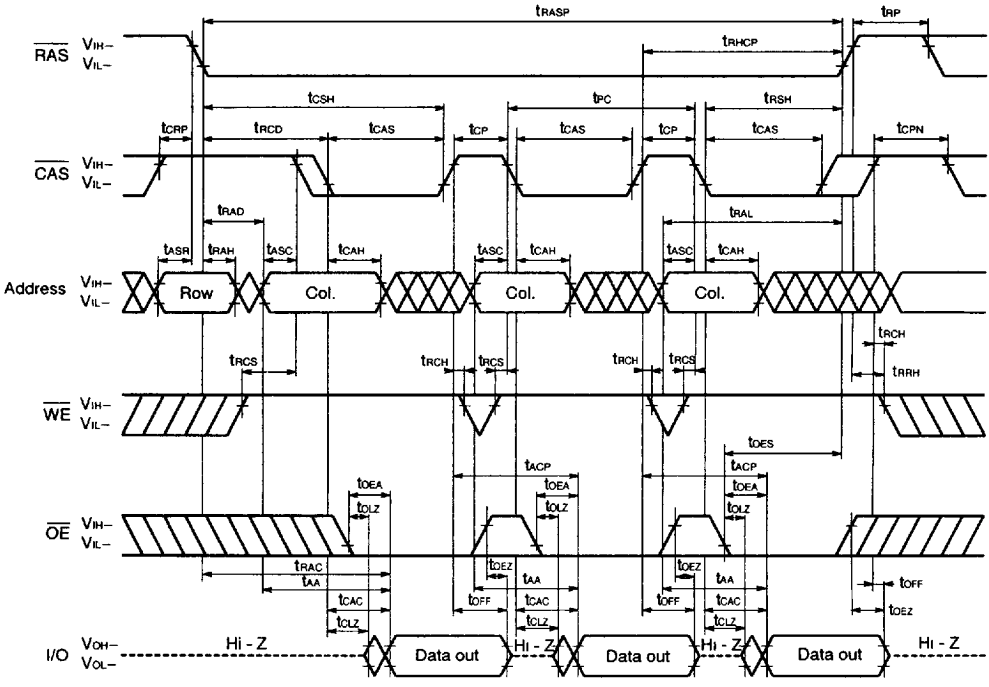
Late Write Cycle



Read Modify Write Cycle

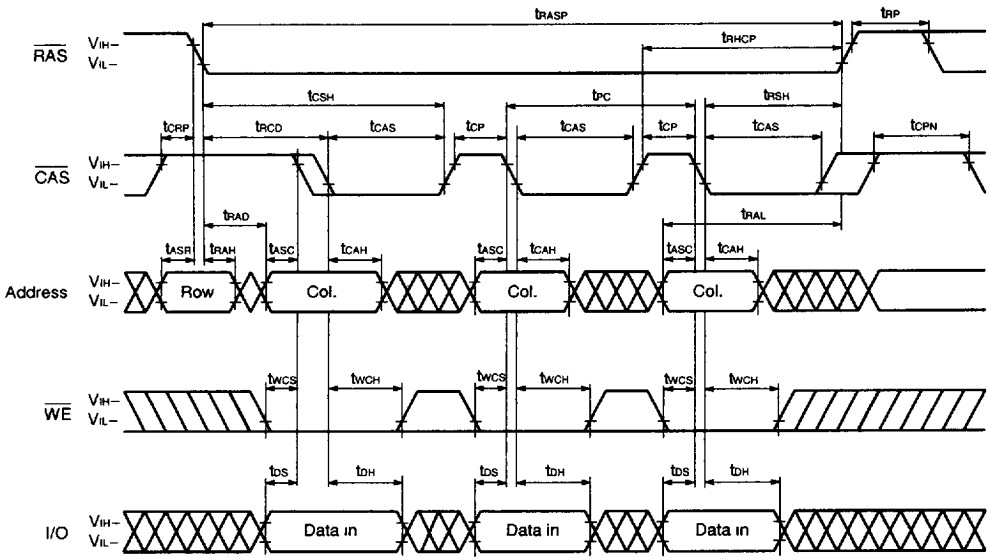


Fast Page Mode Read Cycle



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.

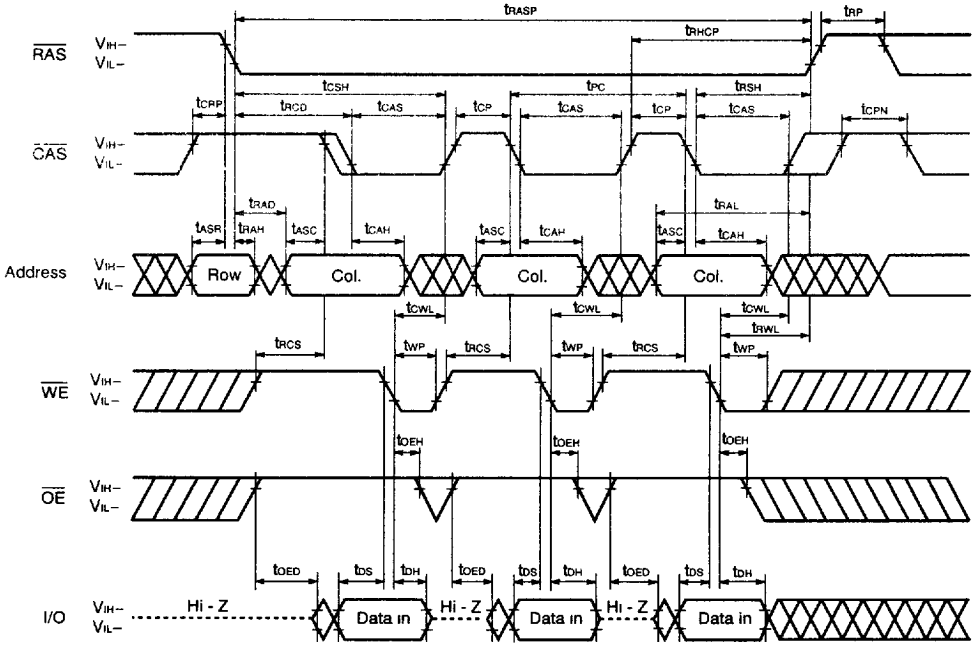
Fast Page Mode Early Write Cycle



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

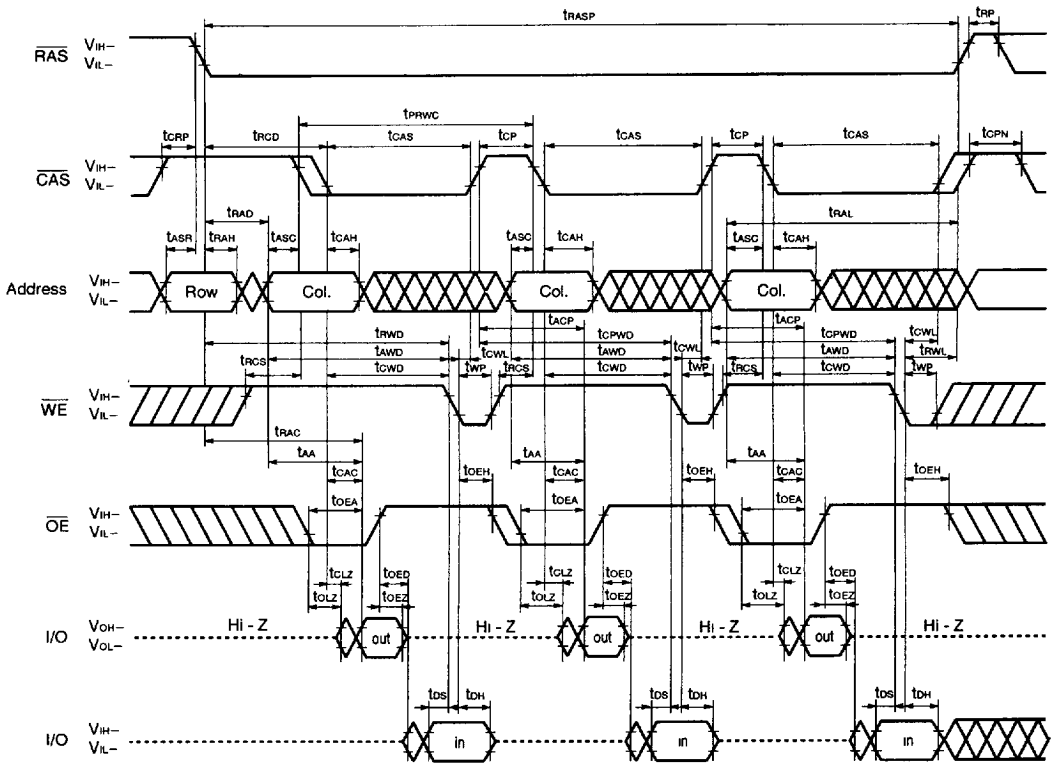
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

Fast Page Mode Late Write Cycle



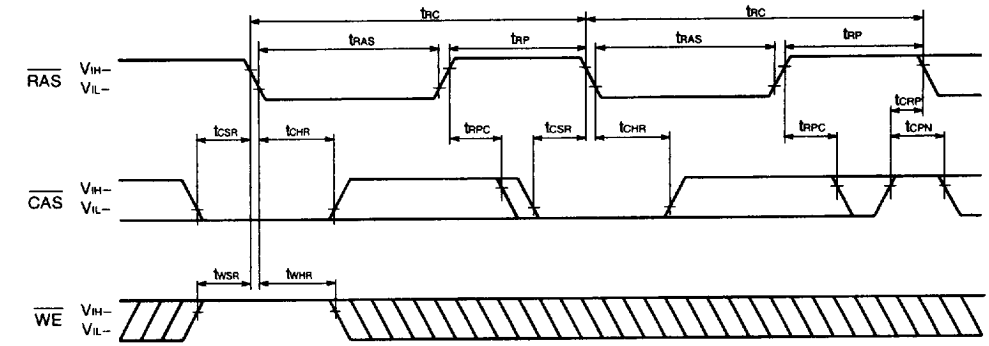
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

Fast Page Mode Read Modify Write Cycle



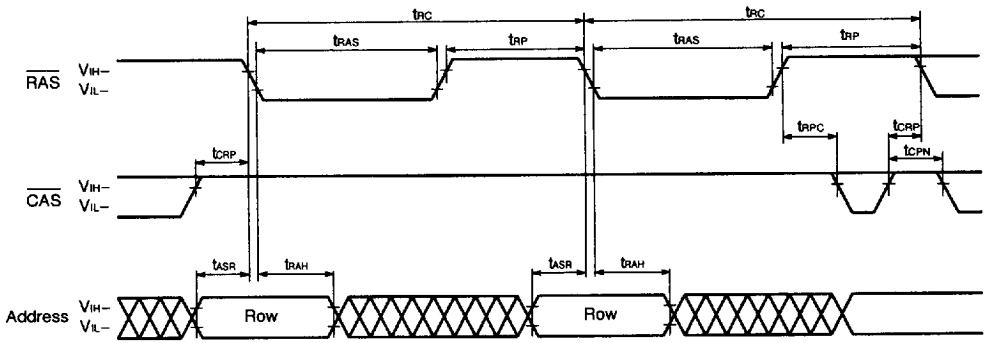
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive $\overline{CAS}$ cycles within the same $\overline{RAS}$ cycle.

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



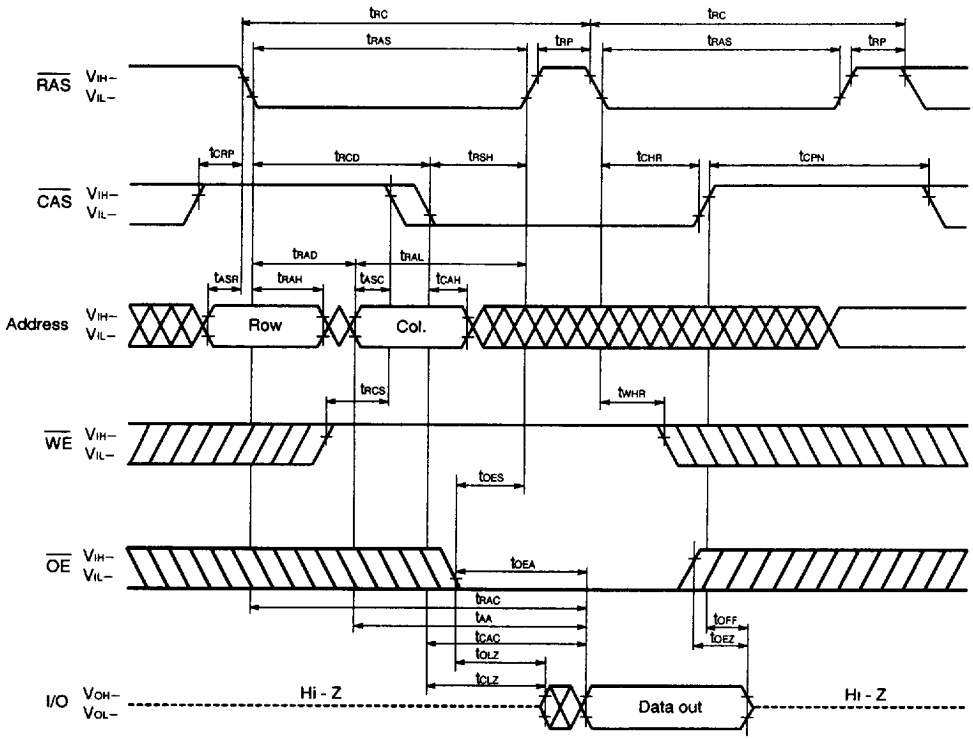
Remark Address, $\overline{OE}$: Don't care I/O : Hi - Z

$\overline{RAS}$ Only Refresh Cycle

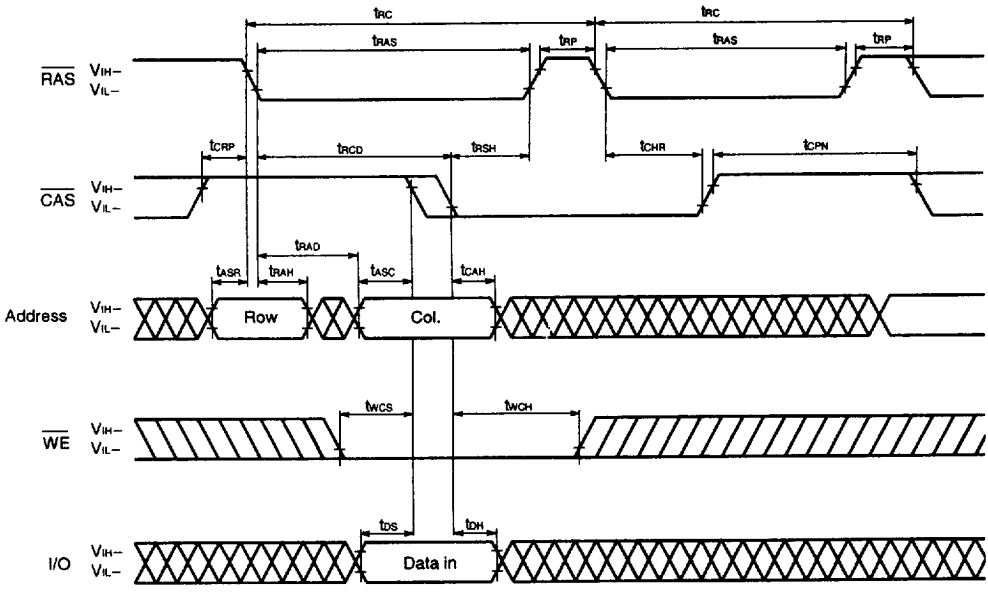


Remark $\overline{WE}$, $\overline{OE}$: Don't care I/O : Hi - Z

Hidden Refresh Cycle (Read)

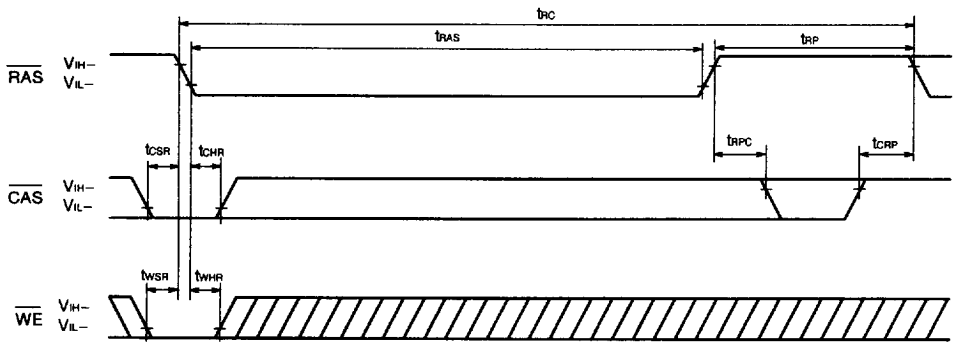


Hidden Refresh Cycle (Write)



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

Test Mode Set Cycle ($\overline{WE}$, $\overline{CAS}$ Before $\overline{RAS}$ Refresh Cycle)



Remark Address, $\overline{OE}$: Don't care I/O : Hi - Z

Test Mode

By using the test mode, the test time can be reduced. The reason for this is that, the memory emulates the × 8-bit structure during test mode.

(1) Setting the mode

Executing the test mode cycle ($\overline{WE}$, $\overline{CAS}$ before $\overline{RAS}$ refresh cycle) sets the test mode.

(2) Write/read operation

When either a "0" or a "1" is written to the input pin in test mode, this data is written to 8 bits of memory cell.

Next, when the data is read from the output pin at the same address, the cell can be checked.

Output="1": Normal write (all memory cells)
Output="0": Abnormal write

(3) Refresh

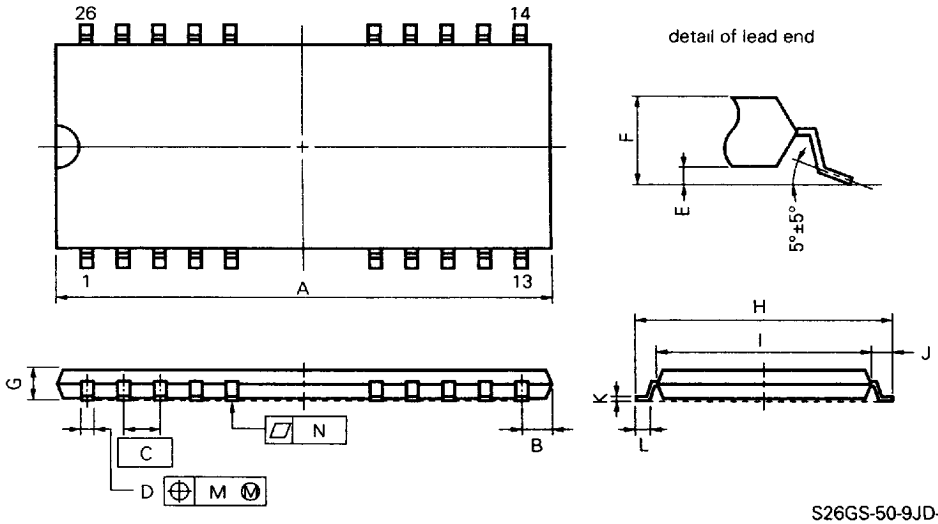
Refresh in the test mode must be performed with the $\overline{RAS}$ / $\overline{CAS}$ cycle or with the $\overline{WE}$, $\overline{CAS}$ before $\overline{RAS}$ refresh cycle. The $\overline{WE}$, $\overline{CAS}$ before $\overline{RAS}$ refresh cycle use the same counter as the $\overline{CAS}$ before $\overline{RAS}$ refresh's internal counter.

(4) Mode Cancellation

The test mode is cancelled by executing one cycle of $\overline{RAS}$ only refresh cycle or $\overline{CAS}$ before $\overline{RAS}$ refresh cycle.

Package Drawings

26 PIN PLASTIC TSOP(III) (300 mil)



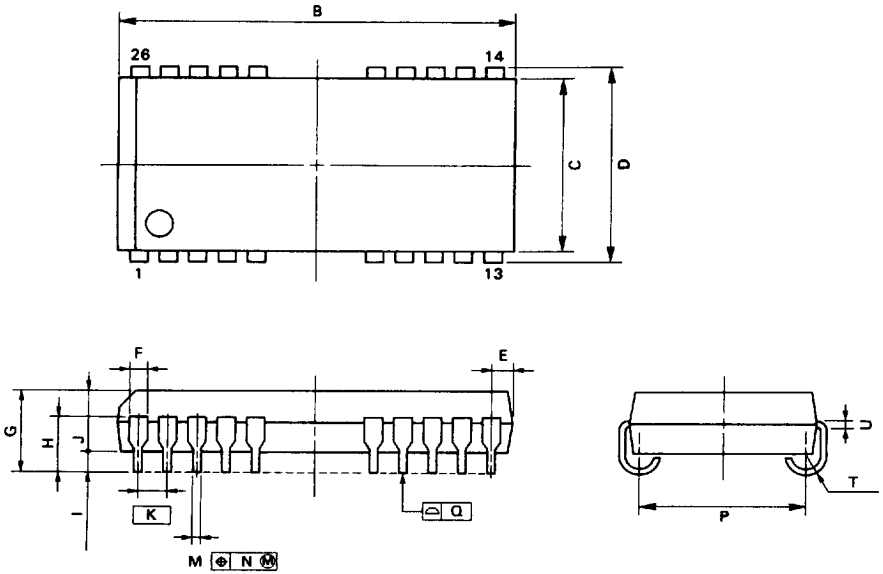
S26GS-50-9JD-2

NOTE

Each lead centerline is located within 0.21 mm (0.009 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	17.54 MAX.	0.691 MAX.
B	1.18 MAX.	0.047 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.005}$
E	0.05±0.05	0.002±0.002
F	1.13 MAX.	0.045 MAX.
G	1.0	0.039
H	9.22±0.2	0.363±0.008
I	7.62±0.1	0.300±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	0.21	0.009
N	0.10	0.004

26PIN PLASTIC SOJ (300 mil)



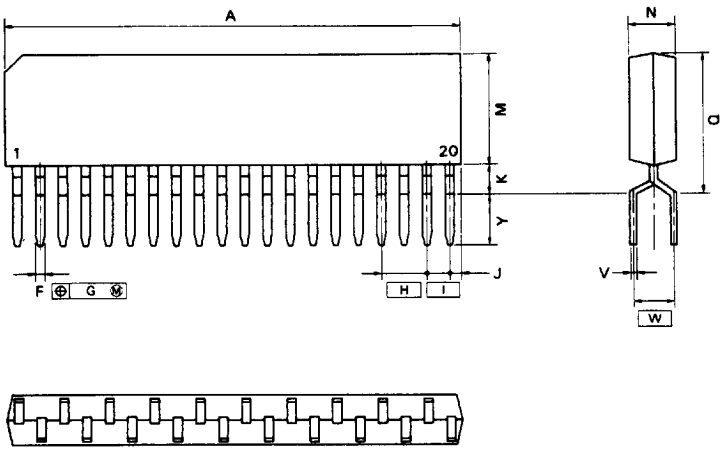
P26LA-50A-1

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	$17.4^{+0.2}_{-0.35}$	$0.685^{+0.008}_{-0.013}$
C	7.57	0.298
D	$8.47^{\pm 0.2}$	$0.333^{+0.009}_{-0.008}$
E	$1.08^{\pm 0.15}$	$0.043^{+0.008}_{-0.007}$
F	0.6	0.024
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	$6.73^{\pm 0.20}$	$0.265^{\pm 0.008}$
Q	0.15	0.006
T	R 0.85	R 0.033
U	$0.20^{+0.10}_{-0.05}$	$0.008^{+0.004}_{-0.002}$

20PIN PLASTIC ZIP (400 mil)



P20V-254-400A-1

NOTE
Each lead centerline is located within 0.25 mm (0.010 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	26.67 MAX.	1.050 MAX.
F	$0.5^{\pm 0.1}$	$0.020^{+0.004}_{-0.005}$
G	ϕ0.25	ϕ0.010
H	2.54	0.100
I	1.27	0.050
J	1.27 MAX	0.050 MAX
K	1.0 MIN.	0.039 MIN
M	8.9 MAX	0.350 MAX.
N	$2.8^{\pm 0.2}$	$0.110^{+0.008}_{-0.009}$
Q	10.16 MAX.	0.400 MAX
V	$0.25^{+0.10}_{-0.08}$	$0.010^{+0.004}_{-0.003}$
W	2.54	0.100
Y	$3.3^{\pm 0.5}$	$0.130^{\pm 0.02}$

Recommended Soldering Conditions

The following conditions (see tables below and next page) must be met for soldering conditions of the μPD424400.

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI–1207).

Please consult with our sales offices in case other soldering process is used, or in case the soldering is done under different conditions.

Types of Surface Mount Device

μPD424400GS : 26-pin plastic TSOP(II) (300 mil)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak temperature of package surface : 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow processes: MAX. 2 Exposure limit[Note]: 7 days (10 hours pre-baking is required at 125 °C afterwards) **[Remark]** (1) Please start the second reflow process after the temperature, raised by the first reflow process, returns to normal. (2) Please avoid removing the residual flux with water after the first reflow process .	IR35-107-2
VPS	Peak temperature of package : 215 °C or below, Reflow time : 40 seconds or below (200 °C or higher), Number of reflow processes: MAX. 2 Exposure limit[Note]: 7 days (10 hours pre-baking is required at 125 °C afterwards) **[Remark]** (1) Please start the second reflow process after the temperature, raised by the first reflow process, returns to normal. (2) Please avoid removing the residual flux with water after the first reflow process .	VP15-107-2
Partial heating method	Terminal temperature: 300 °C or below, Time : 3 seconds or below (Per one side of the device).	———

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than one soldering method at any one time, except for "Partial heating method".

μPD424400LA : 26-pin plastic SOJ (300 mil)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak temperature of package surface : 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow processes: MAX. 2 Exposure limit[Note]: 7 days (20 hours pre-baking is required at 125 °C afterwards) **[Remark]** (1) Please start the second reflow process after the temperature, raised by the first reflow process, returns to normal. (2) Please avoid removing the residual flux with water after the first reflow process.	IR35-207-2
VPS	Peak temperature of package : 215 °C or below, Reflow time : 40 seconds or below (200 °C or higher), Number of reflow processes: MAX. 2 Exposure limit[Note]: 7 days (20 hours pre-baking is required at 125 °C afterwards) **[Remark]** (1) Please start the second reflow process after the temperature, raised by the first reflow process, returns to normal. (2) Please avoid removing the residual flux with water after the first reflow process.	VP15-207-2
Partial heating method	Terminal temperature: 300 °C or below, Time : 3 seconds or below (Per one side of the device).	———

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than one soldering method at any one time, except for "Partial heating method".

Type of Through Hole Mount Device

μPD424400V : 26-pin plastic ZIP (400 mil)

Soldering process	Soldering conditions
Wave soldering	Solder temperature : 260 °C or below, Flow time : 10 seconds or below
Partial heating method	Terminal temperature : 260 °C below, Time : 10 seconds or below

Caution Do not jet molten solder on the surface of package.