

**M53210400CW0/CB0
M53210410CW0/CB0**

DRAM MODULE

M53210400CW0/CB0 & M53210410CW0/CB0 Fast Page Mode

4M x 32 DRAM SIMM using 4Mx4, 4K/2K Refresh, 5V

GENERAL DESCRIPTION

The Samsung M5321040(1)0C is a 4Mx32bits Dynamic RAM high density memory module. The Samsung M5321040(1)0C consists of eight CMOS 4Mx4bits DRAMs in 24-pin SOJ package mounted on a 72-pin glass-epoxy substrate. A 0.1 or 0.22uF decoupling capacitor is mounted on the printed circuit board for each DRAM. The M5321040(1)0C is a Single In-line Memory Module with edge connections and is intended for mounting into 72 pin edge connector sockets.

PERFORMANCE RANGE

Speed	t _{RAC}	t _{CAC}	t _{RC}
-50	50ns	13ns	90ns
-60	60ns	15ns	130ns

FEATURES

- Part Identification
 - M53210400CW0-C(4096 cycles/64ms Ref, SOJ, Solder)
 - M53210400CB0-C(4096 cycles/64ms Ref, SOJ, Gold)
 - M53210410CW0-C(2048 cycles/32ms Ref, SOJ, Solder)
 - M53210410CB0-C(2048 cycles/32ms Ref, SOJ, Gold)
- Fast Page Mode Operation
- CAS-before-RAS refresh capability
- RAS-only and Hidden refresh capability
- TTL compatible inputs and outputs
- Single +5V±10% power supply
- JEDEC standard PDPin & pinout
- PCB : Height(1000mil), single sided component

PIN CONFIGURATIONS

Pin	Symbol	Pin	Symbol
1	V _{ss}	37	NC
2	DQ0	38	NC
3	DQ16	39	V _{ss}
4	DQ1	40	CAS0
5	DQ17	41	CAS2
6	DQ2	42	CAS3
7	DQ18	43	CAS1
8	DQ3	44	RAS0
9	DQ19	45	Res(RAS1)
10	V _{cc}	46	NC
11	NC	47	W
12	A0	48	NC
13	A1	49	DQ8
14	A2	50	DQ24
15	A3	51	DQ9
16	A4	52	DQ25
17	A5	53	DQ10
18	A6	54	DQ26
19	A10	55	DQ11
20	DQ4	56	DQ27
21	DQ20	57	DQ12
22	DQ5	58	DQ28
23	DQ21	59	V _{cc}
24	DQ6	60	DQ29
25	DQ22	61	DQ13
26	DQ7	62	DQ30
27	DQ23	63	DQ14
28	A7	64	DQ31
29	A11	65	DQ15
30	V _{cc}	66	NC
31	A8	67	PD1
32	A9	68	PD2
33	Res(RAS1)	69	PD3
34	RAS0	70	PD4
35	NC	71	NC
36	NC	72	V _{ss}

PIN NAMES

Pin Name	Function
A0 - A11	Address Inputs(4K Ref)
A0 - A10	Address Inputs(2K Ref)
DQ0 - DQ31	Data In/Out
W	Read/Write Enable
RAS0	Row Address Strobe
CAS0 - CAS3	Column Address Strobe
PD1 -PD4	Presence Detect
V _{cc}	Power(+5V)
V _{ss}	Ground
NC	No Connection

PRESENCE DETECT PINS (Optional)

Pin	50NS	60NS
PD1	V _{ss}	V _{ss}
PD2	NC	NC
PD3	V _{ss}	NC
PD4	V _{ss}	NC

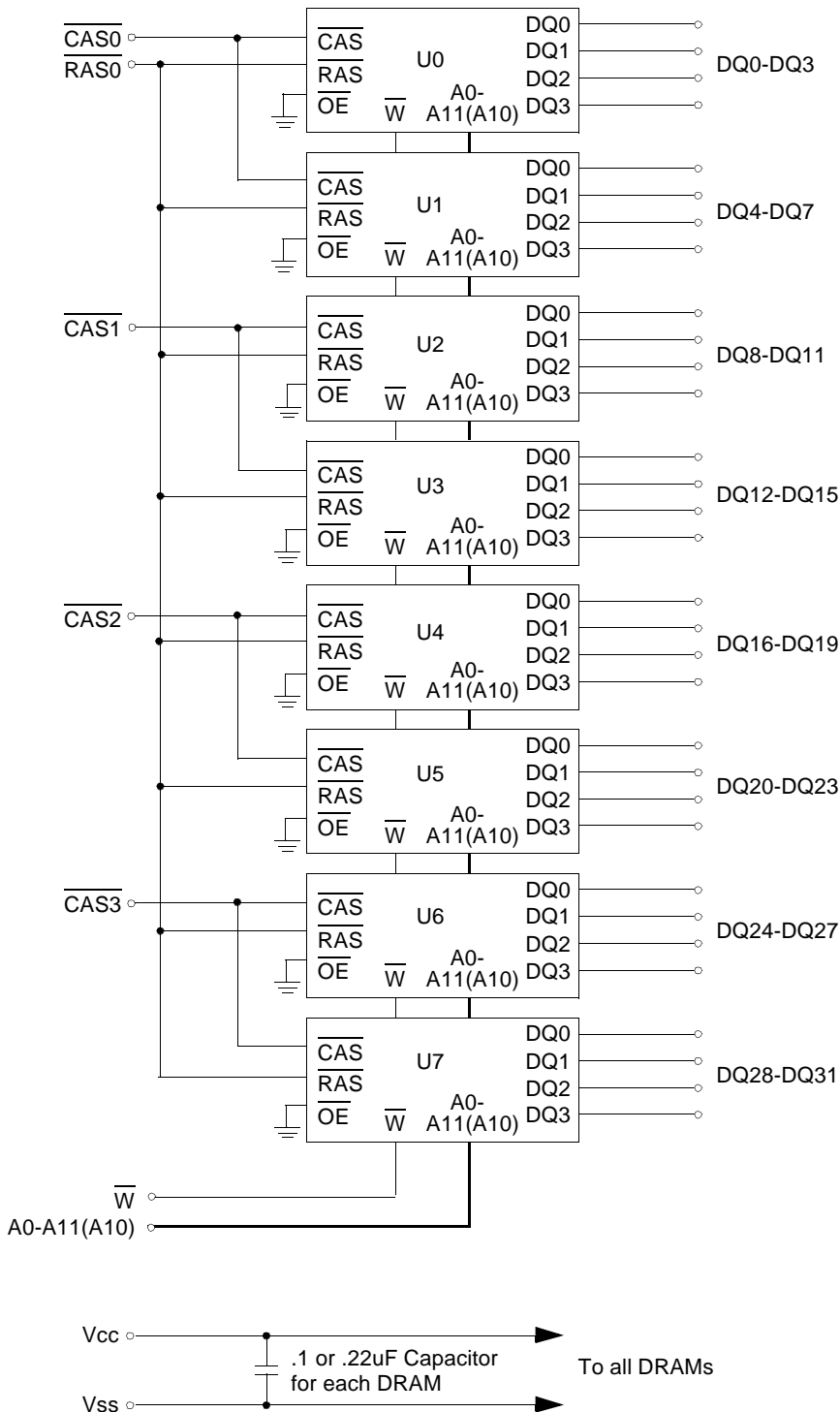
* Pin connection changing available

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* NOTE : A11 is used for only M53210400CW0/CB0 (4K ref.)

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FUNCTIONAL BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS *

Item	Symbol	Rating	Unit
Voltage on any pin relative to Vss	V _{IN} , V _{OUT}	-1 to +7.0	V
Voltage on Vcc supply relative to Vss	V _{CC}	-1 to +7.0	V
Storage Temperature	T _{stg}	-55 to +150	°C
Power Dissipation	P _d	8	W
Short Circuit Output Current	I _{OS}	50	mA

* Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for intended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS (Voltage referenced to V_{SS}, T_A = 0 to 70°C)

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{CC}	4.5	5.0	5.5	V
Ground	V _{SS}	0	0	0	V
Input High Voltage	V _{IH}	2.4	-	V _{CC} +1 ^{*2}	V
Input Low Voltage	V _{IL}	-1.0 ^{*2}	-	0.8	V

*1 : V_{CC}+2.0V/20ns, Pulse width is measured at V_{CC}.

*2 : -2.0V/20ns, Pulse width is measured at V_{SS}.

DC AND OPERATING CHARACTERISTICS (Recommended operating conditions unless otherwise noted)

Symbol	Speed	M53210400CW0/CB0		M53210410CW0/CB0		Unit
		Min	Max	Min	Max	
I _{CC1}	-50	-	720	-	880	mA
	-60	-	640	-	800	mA
I _{CC2}	Don't care	-	16	-	16	mA
I _{CC3}	-50	-	720	-	880	mA
	-60	-	640	-	800	mA
I _{CC4}	-50	-	640	-	720	mA
	-60	-	560	-	640	mA
I _{CC5}	Don't care	-	8	-	8	mA
I _{CC6}	-50	-	720	-	880	mA
	-60	-	640	-	800	mA
I _{I(L)}	Don't care	-40	40	-40	40	uA
I _{O(L)}	Don't care	-5	5	-5	5	uA
V _{OH}	Don't care	2.4	-	2.4	-	V
V _{OL}	Don't care	-	0.4	-	0.4	V

I_{CC1} : Operating Current * ($\overline{\text{RAS}}$, $\overline{\text{CAS}}$, Address cycling @trc=min)

I_{CC2} : Standby Current ($\overline{\text{RAS}}=\overline{\text{CAS}}=\overline{\text{W}}=\text{V}_{\text{IH}}$)

I_{CC3} : $\overline{\text{RAS}}$ Only Refresh Current * ($\overline{\text{CAS}}=\text{V}_{\text{IH}}$, $\overline{\text{RAS}}$ cycling @trc=min)

I_{CC4} : Fast Page Mode Current * ($\overline{\text{RAS}}=\text{V}_{\text{IL}}$, $\overline{\text{CAS}}$ Address cycling : tPC=min)

I_{CC5} : Standby Current ($\overline{\text{RAS}}=\overline{\text{CAS}}=\overline{\text{W}}=\text{V}_{\text{CC}}-0.2\text{V}$)

I_{CC6} : $\overline{\text{CAS}}$ -Before- $\overline{\text{RAS}}$ Refresh Current * ($\overline{\text{RAS}}$ and $\overline{\text{CAS}}$ cycling @trc=min)

I_{I(L)} : Input Leakage Current (Any input $0\leq\text{V}_{\text{IN}}\leq\text{V}_{\text{CC}}+0.5\text{V}$, all other pins not under test=0 V)

I_{O(L)} : Output Leakage Current(Data Out is disabled, $0\text{V}\leq\text{V}_{\text{OUT}}\leq\text{V}_{\text{CC}}$)

V_{OH} : Output High Voltage Level (I_{OH} = -5mA)

V_{OL} : Output Low Voltage Level (I_{OL} = 4.2mA)

* **NOTE** : I_{CC1}, I_{CC3}, I_{CC4} and I_{CC6} are dependent on output loading and cycle rates. Specified values are obtained with the output open. I_{CC} is specified as an average current. In I_{CC1} and I_{CC3}, address can be changed maximum once while $\overline{\text{RAS}}=\text{V}_{\text{IL}}$. In I_{CC4}, address can be changed maximum once within one page mode cycle, tPC.



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CAPACITANCE (TA = 25°C, VCC=5V, f = 1MHz)

Item	Symbol	Min	Max	Unit
Input capacitance[A0-A11(A10)]	CIN1	-	55	pF
Input capacitance[V]	CIN2	-	70	pF
Input capacitance[RAS0]	CIN3	-	70	pF
Input capacitance[CAS0 - CAS3]	CIN4	-	30	pF
Input/Output capacitance[DQ0-31]	CDQ1	-	20	pF

AC CHARACTERISTICS (0°C≤TA≤70°C, VCC=5.0V±10%. See notes 1,2.)

Test condition : VIH/VIIL=2.4/0.8V, VOH/VOIL=2.4/0.4V, Output loading CL=100pF

Parameter	Symbol	-50		-60		Unit	Note
		Min	Max	Min	Max		
Random read or write cycle time	tRC	90		110		ns	
Access time from RAS	tRAC		50		60	ns	3,4
Access time from CAS	tCAC		13		15	ns	3,4,5
Access time from column address	tAA		25		30	ns	3,10
CAS to output in Low-Z	tCLZ	0		0		ns	3
Output buffer turn-off delay	tOFF	0	13	0	15	ns	6
Transition time(rise and fall)	tT	3	50	3	50	ns	2
RAS precharge time	tRP	30		40		ns	
RAS pulse width	tRAS	50	10K	60	10K	ns	
RAS hold time	tRSH	13		15		ns	
CAS hold time	tCSH	50		60		ns	
CAS pulse width	tCAS	13	10K	15	10K	ns	
RAS to CAS delay time	tRCD	20	37	20	45	ns	4
RAS to column address delay time	tRAD	15	25	15	30	ns	10
CAS to RAS precharge time	tCRP	5		5		ns	
Row address set-up time	tASR	0		0		ns	
Row address hold time	tRAH	10		10		ns	
Column address set-up time	tASC	0		0		ns	
Column address hold time	tCAH	10		10		ns	
Column address to RAS lead time	tRAL	25		30		ns	
Read command set-up time	tRCS	0		0		ns	
Read command hold time referenced to CAS	tRCH	0		0		ns	8
Read command hold time referenced to RAS	tRRH	0		0		ns	8
Write command hold time	tWCH	10		10		ns	
Write command pulse width	tWP	10		10		ns	
Write command to RAS lead time	tRWL	13		15		ns	
Write command to CAS lead time	tCWL	13		15		ns	
Data-in set-up time	tDS	0		0		ns	9
Data-in hold time	tDH	10		15		ns	9
Refresh period (4K Ref)	tREF		64		64	ms	
Refresh period (2K Ref)	tREF		32		32	ms	
Write command set-up time	tWCS	0		0		ns	7
CAS setup time(CAS-before-RAS refresh)	tCSR	5		5		ns	
CAS hold time(CAS-before-RAS refresh)	tCHR	10		10		ns	
RAS precharge to CAS hold time	tRPC	5		5		ns	

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AC CHARACTERISTICS (0°C≤T_A≤70°C, V_{CC}=5.0V±10%. See notes 1,2.)

Test condition : V_{IH}/V_{IL}=2.4/0.8V, V_{OH}/V_{OL}=2.4/0.4V, Output loading C_L=100pF

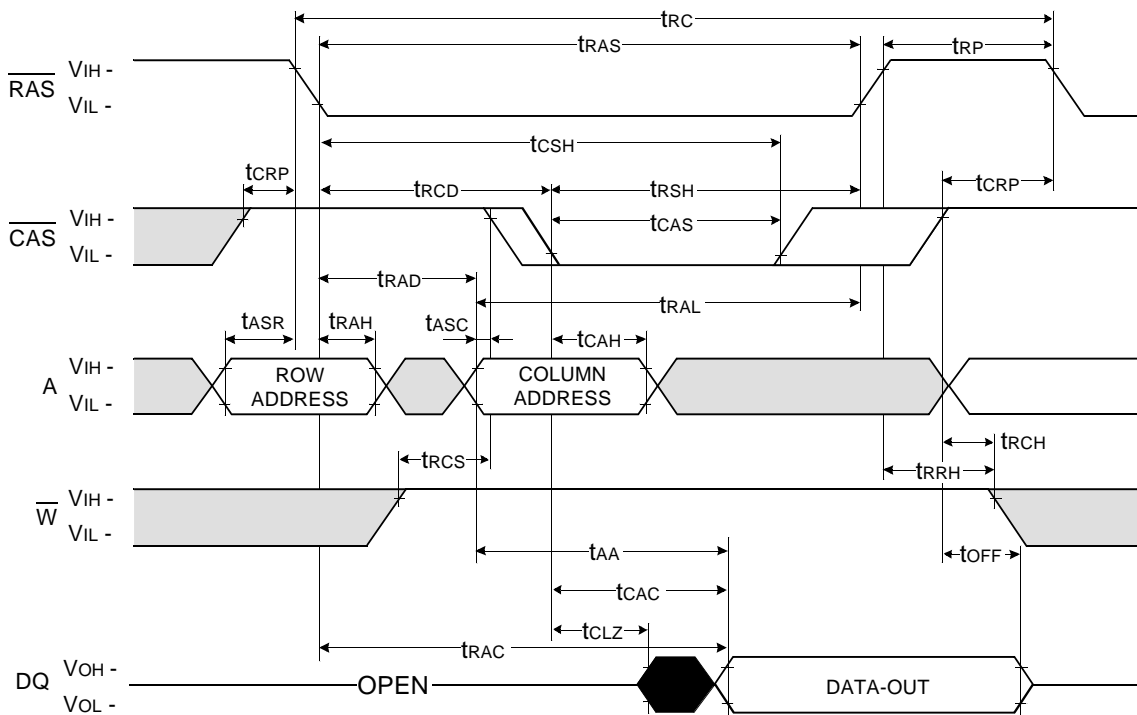
Parameter	Symbol	-50		-60		Unit	Note
		Min	Max	Min	Max		
Access time from $\overline{\text{CAS}}$ precharge	tCPA		30		35	ns	3
Fast page mode cycle time	tPC	35		40		ns	
$\overline{\text{CAS}}$ precharge time(Fast page cycle)	tCP	10		10		ns	
$\overline{\text{RAS}}$ pulse width(Fast page cycle)	tRASP	50	200K	60	200K	ns	
$\overline{\text{W}}$ to $\overline{\text{RAS}}$ precharge time(C-B-R refresh)	tWRP	10		10		ns	
$\overline{\text{W}}$ to $\overline{\text{RAS}}$ hold time(C-B-R refresh)	tWRH	10		10		ns	
$\overline{\text{CAS}}$ precharge(C-B-R counter test)	tCPT	20		20		ns	

NOTES

1. An initial pause of 200us is required after power-up followed by any 8 RAS-only or CAS-before-RAS refresh cycles before proper device operation is achieved.
2. V_{IH}(min) and V_{IL}(max) are reference levels for measuring timing of input signals. Transition times are measured between V_{IH}(min) and V_{IL}(max) and are assumed to be 5ns for all inputs.
3. Measured with a load equivalent to 2 TTL loads and 100pF.
4. Operation within the t_{RCD}(max) limit insures that t_{RAC}(max) can be met. t_{RCD}(max) is specified as a reference point only. If t_{RCD} is greater than the specified t_{RCD}(max) limit, then access time is controlled exclusively by t_{CAC}.
5. Assumes that t_{RCD}≥t_{RCD}(max).
6. This parameter defines the time at which the output achieves the open circuit condition and is not referenced to V_{OH} or V_{OL}.
7. twcs is non-restrictive operating parameter. It is included in the data sheet as electrical characteristics only. If twcs≥twcs(min), the cycle is an early write cycle and the data out pin will remain high impedance for the duration of the cycle.
8. Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.
9. These parameter are referenced to the $\overline{\text{CAS}}$ leading edge in early write cycles.
10. Operation within the t_{RAD}(max) limit insures that t_{RAC}(max) can be met. t_{RAD}(max) is specified as reference point only. If t_{RAD} is greater than the specified t_{RAD}(max) limit, then access time is controlled by t_{AA}.

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READ CYCLE

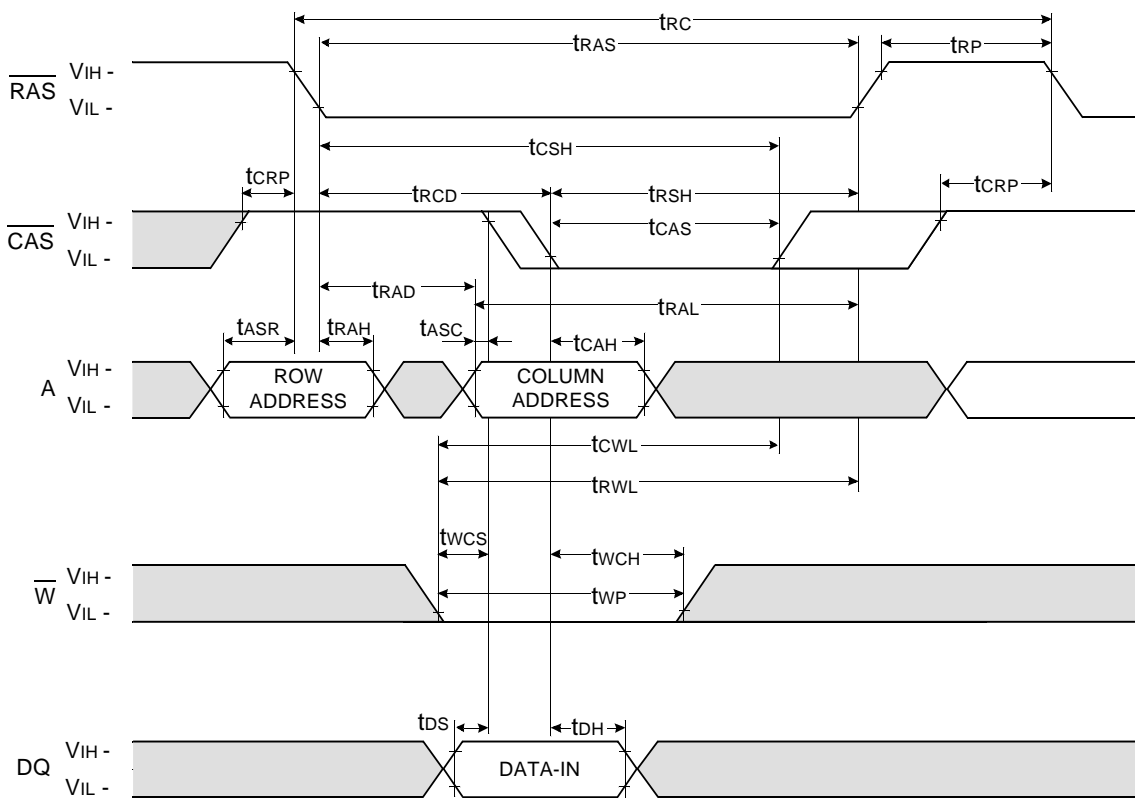


Don't care
Undefined

DRAM MODULE

WRITE CYCLE (EARLY WRITE)

NOTE : DOUT = OPEN

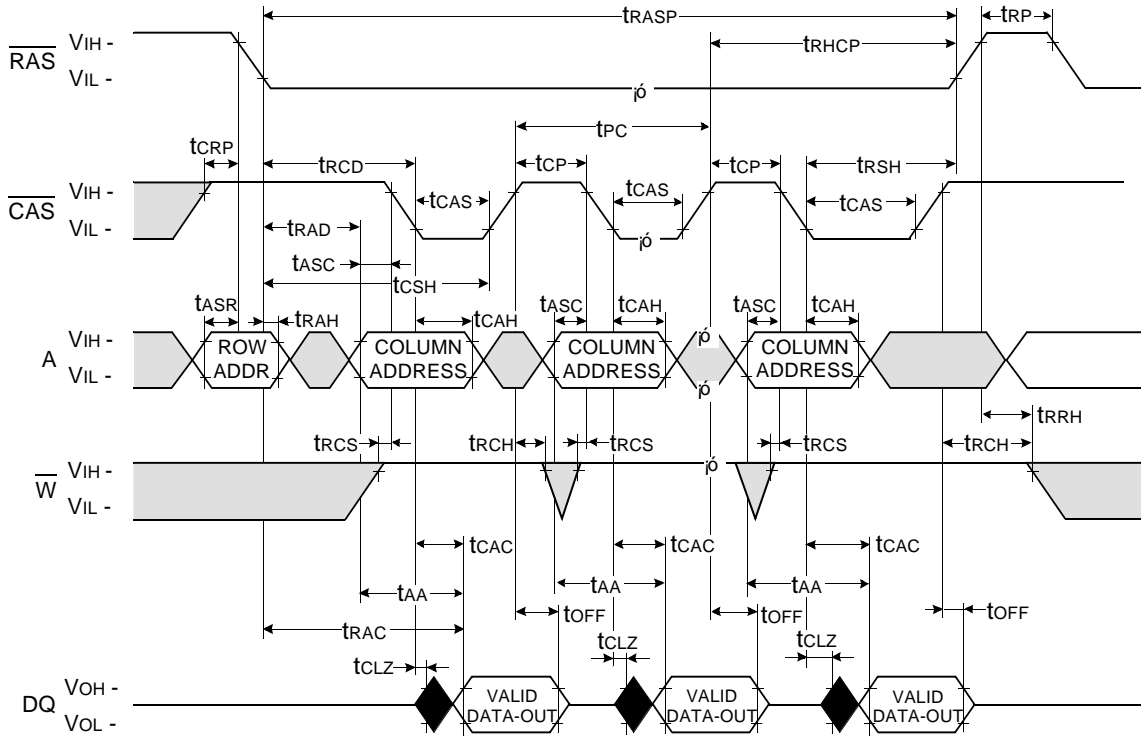


□ Don't care
■ Undefined

DRAM MODULE

FAST PAGE READ CYCLE

NOTE : DOUT = OPEN

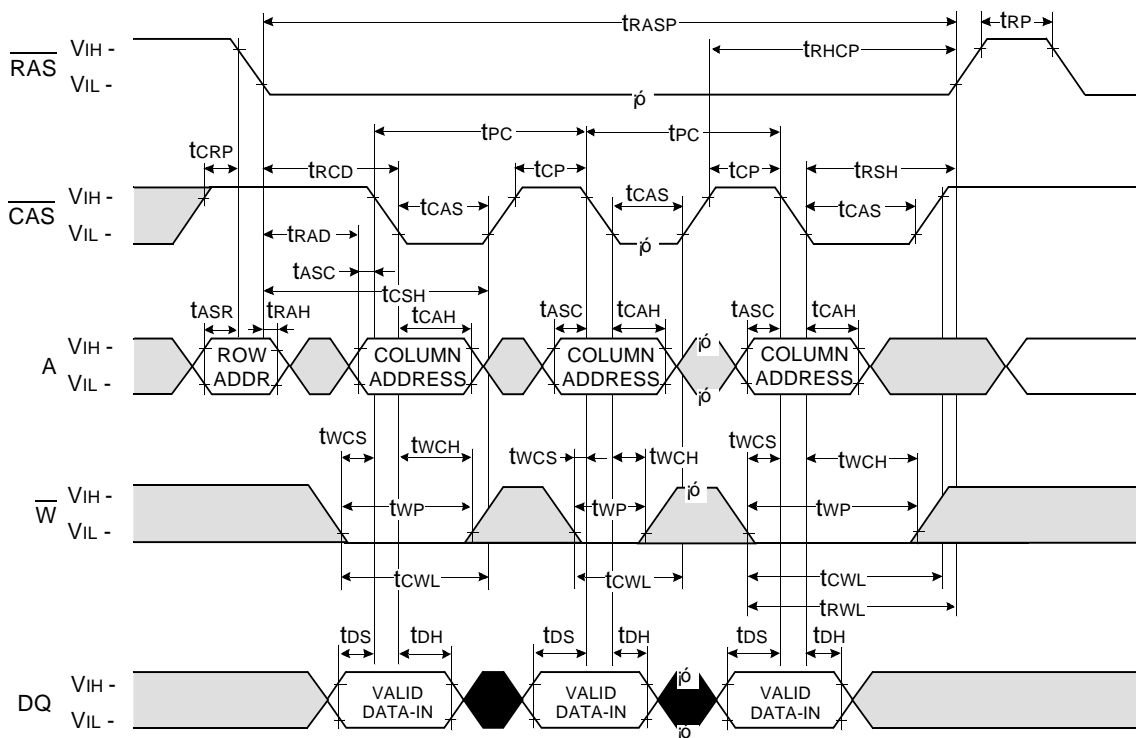


Don't care
Undefined

DRAM MODULE

FAST PAGE WRITE CYCLE (EARLY WRITE)

NOTE : DOUT = OPEN

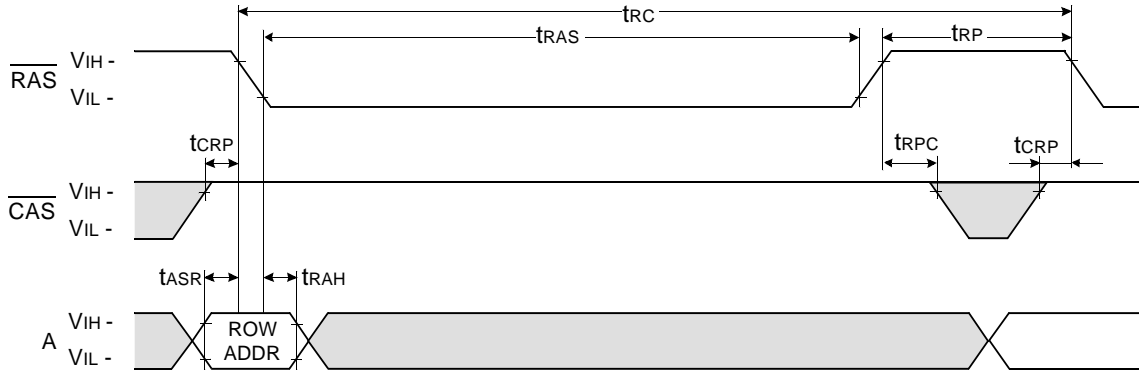


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$\overline{\text{RAS}}$ - ONLY REFRESH CYCLE

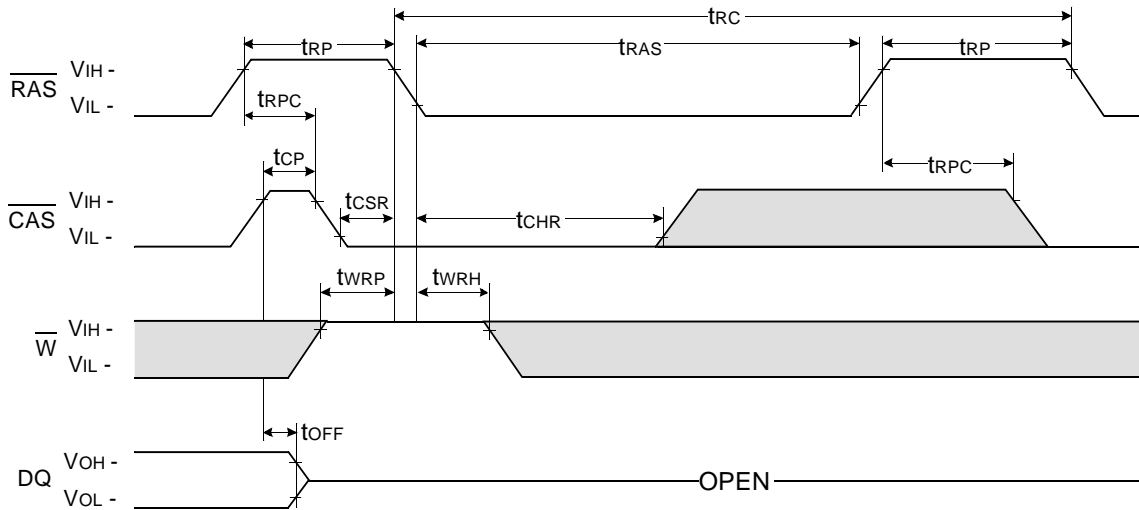
NOTE : $\overline{\text{W}}$, $\overline{\text{OE}}$, DIN = Don't care

DOUT = OPEN



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

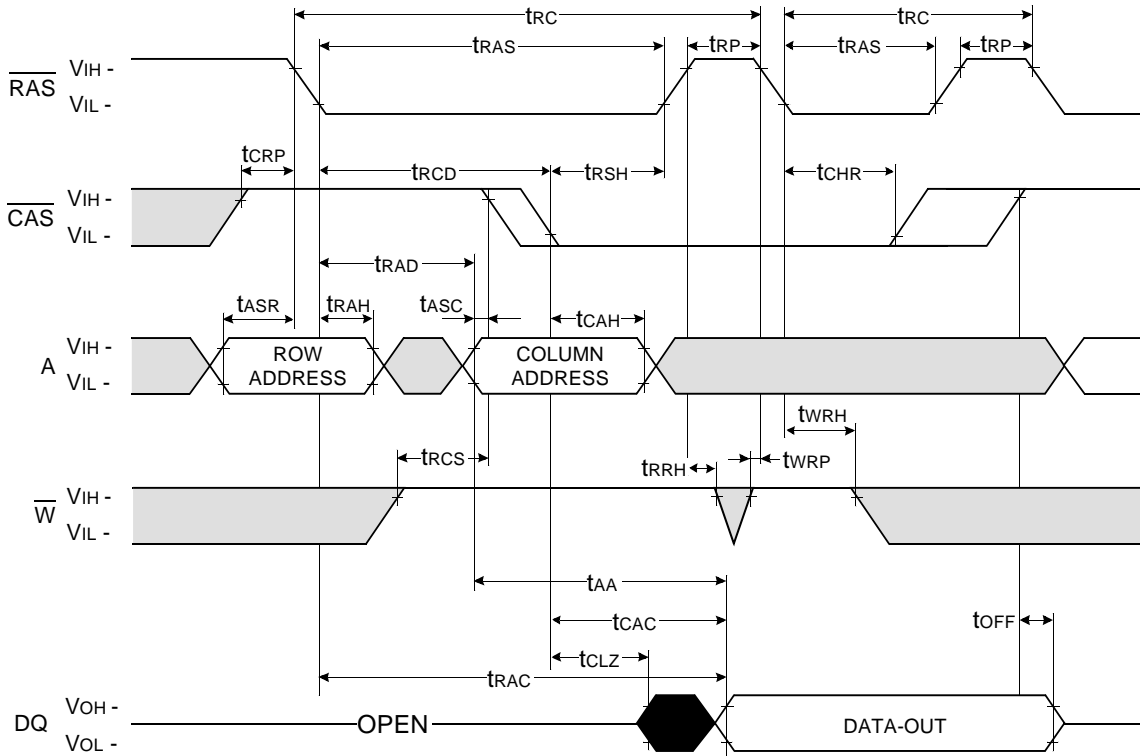
NOTE : $\overline{\text{OE}}$, A = Don't care



□ Don't care
 ■ Undefined

DRAM MODULE

HIDDEN REFRESH CYCLE (READ)

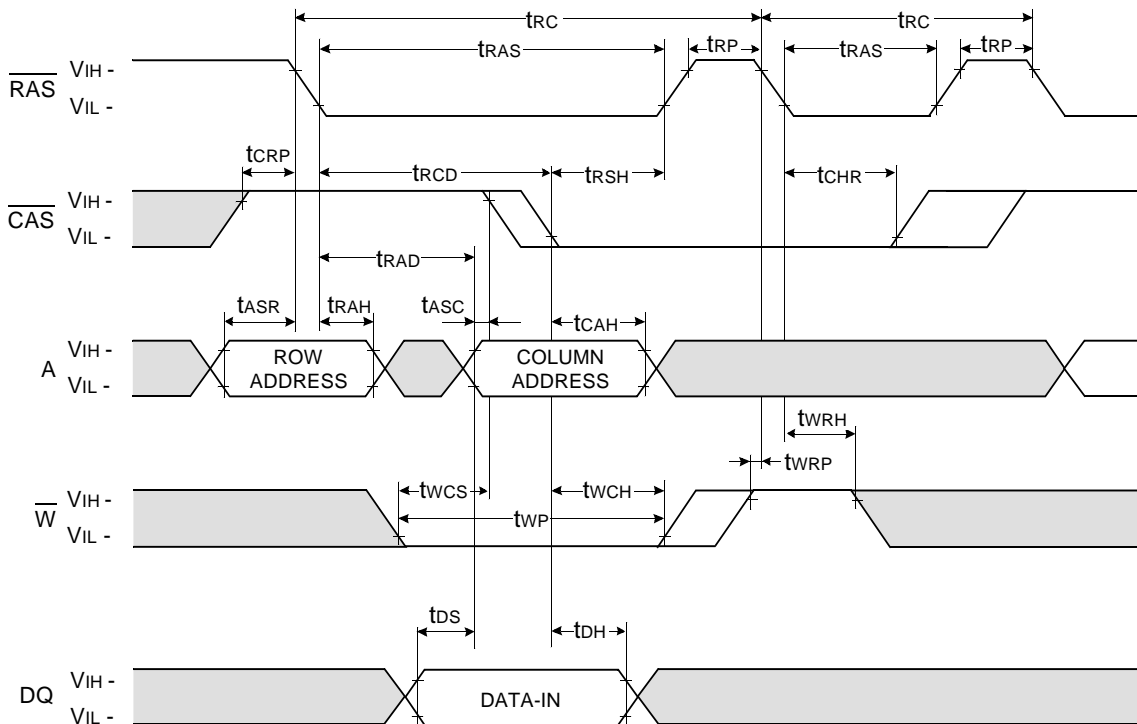


Don't care
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DRAM MODULE

HIDDEN REFRESH CYCLE (WRITE)

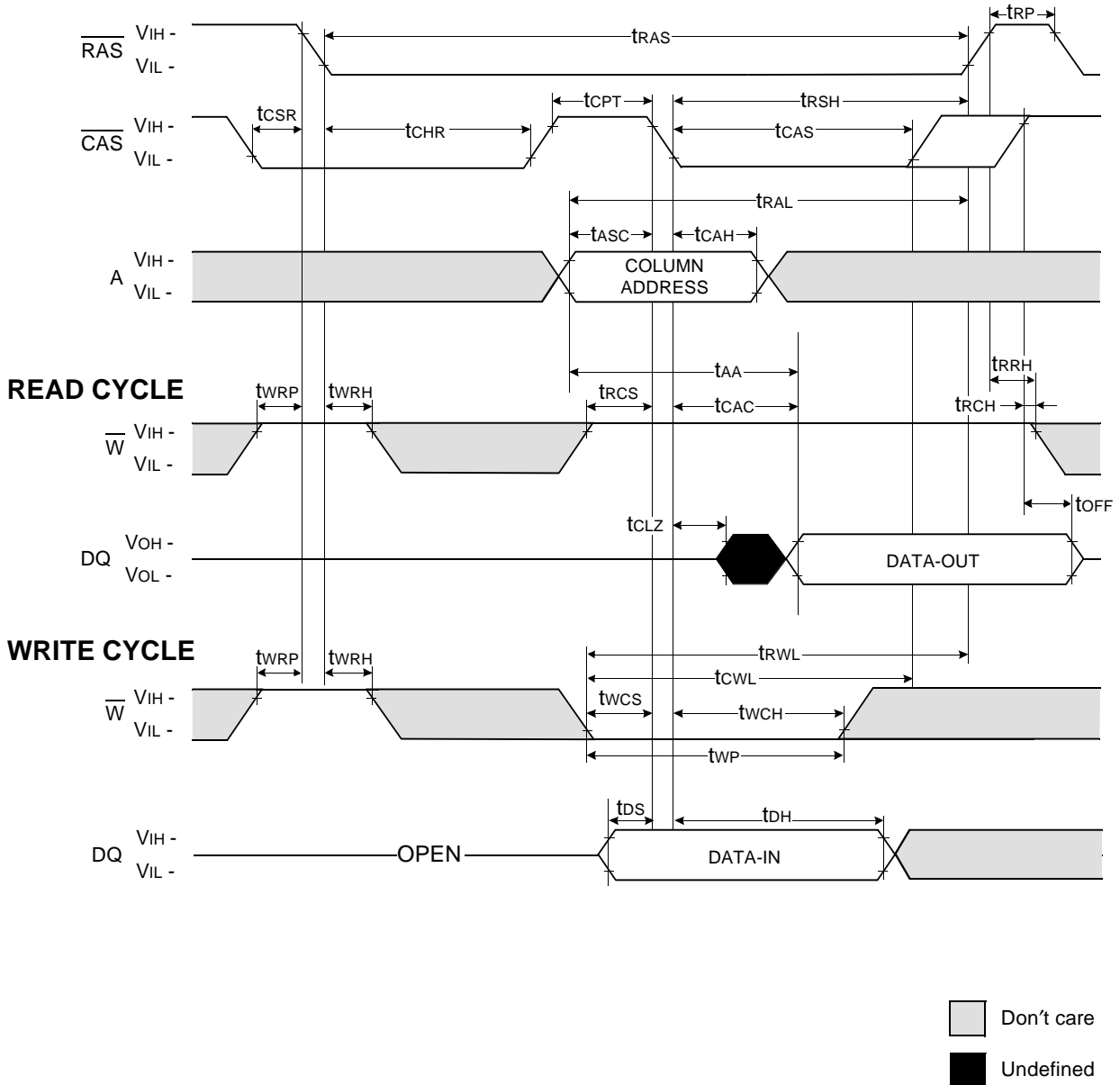
NOTE : DOUT = OPEN



□ Don't care
■ Undefined

DRAM MODULE

CAS-BEFORE-RAS REFRESH CYCLE TEST CYCLE

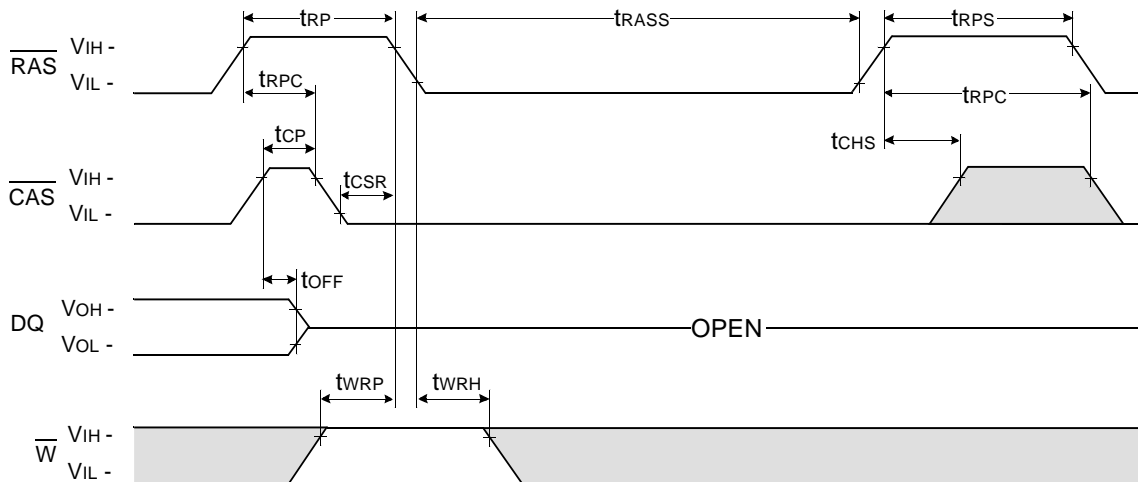


NOTE : This timing diagram is applied to all devices besides 16M DRAM 4th & 64M DRAM.

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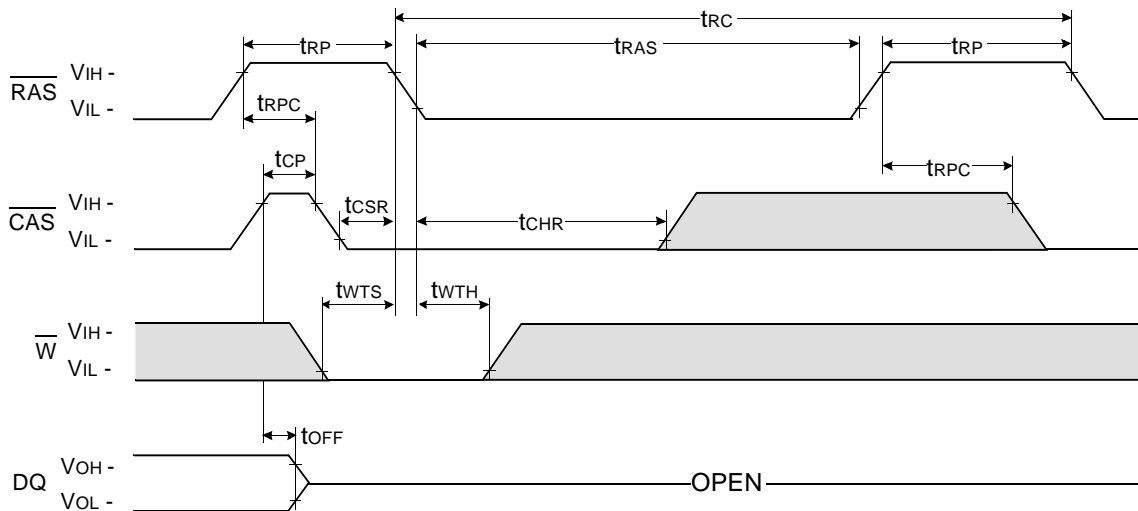
$\overline{\text{CAS}}$ - BEFORE - $\overline{\text{RAS}}$ SELF REFRESH CYCLE

NOTE : $\overline{\text{OE}}$, A = Don't care



TEST MODE IN CYCLE

NOTE : $\overline{\text{OE}}$, A = Don't care



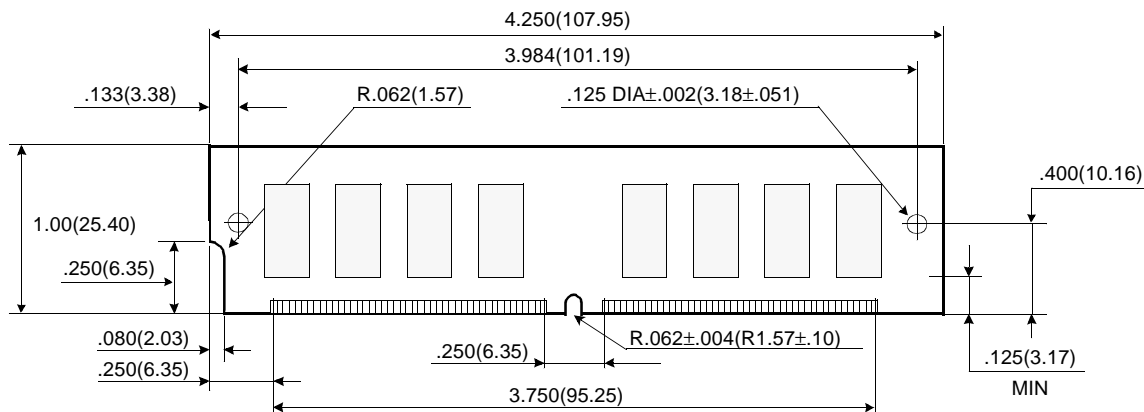
□ Don't care
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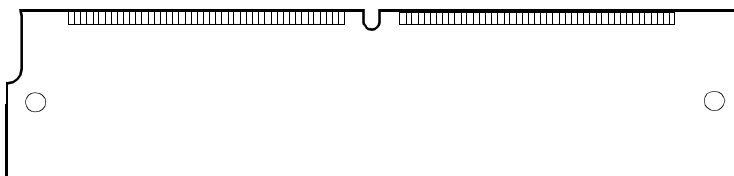
DRAM MODULE

PACKAGE DIMENSIONS

Units : Inches (millimeters)

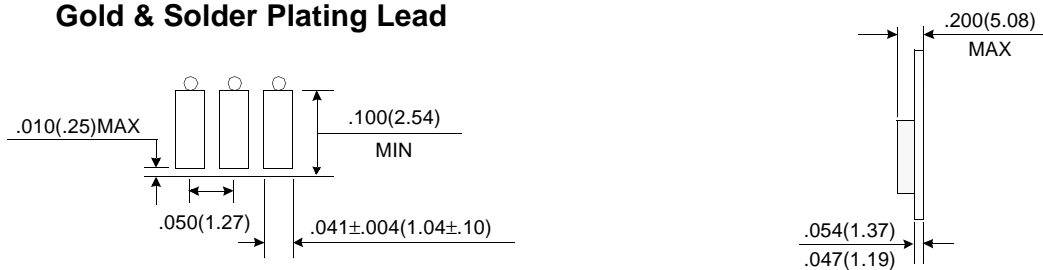


(Front view)



(Back view)

Gold & Solder Plating Lead



Tolerances : ±.005(.13) unless otherwise specified

NOTE : The used device are 4Mx4 EDO DRAM (SOJ & 300mil)
DRAM Part No. : M53210400CW0/CB0 -- K4F170411C-B(300 mil)
M53210410CW0/CB0 -- K4F160411C-B(300 mil)

Revision History
Rev 0.0 : Oct. 1999