M53230224DE2/DJ2 Extended Data Out

2M x 32 DRAM SIMM using 1Mx16 , 1K Refresh, 5V

GENERAL DESCRIPTION

The Samsung M53230224D is a 2Mx32bits Dynamic RAM high density memory module. The Samsung M53230224D consists of four CMOS 1Mx16bits DRAMs in 42-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 M53230224D is a Single In-line Memory Module with edge connections and is intended for mounting into 72 pin edge connector sockets.

FEATURES

- Part Identification
  - M53230224DE2-C(1024 cycles/16ms Ref, SOJ, Solder)
  - M53230224DJ2-C(1024 cycles/16ms Ref, SOJ, Gold)
- Extended Data Out
- $\overline{CAS}$-before-$\overline{RAS}$ refresh capability
- $\overline{RAS}$-only and Hidden refresh capability
- TTL compatible inputs and outputs
- Single +5V±10% power supply
- JEDEC standard PDPin & pinout
- PCB : Height(750mil), double sided component

PERFORMANCE RANGE

Speed	t_{RAC}	t_{CAC}	t_{RC}	t_{HPC}
-50	50ns	15ns	90ns	25ns
-60	60ns	15ns	110ns	30ns

PIN CONFIGURATIONS

Pin	Symbol	Pin	Symbol
1	V_{SS}	37	NC
2	DQ0	38	NC
3	DQ16	39	$\overline{Vss}$
4	DQ1	40	$\overline{CAS0}$
5	DQ17	41	$\overline{CAS2}$
6	DQ2	42	$\overline{CAS3}$
7	DQ18	43	$\overline{CAS1}$
8	DQ3	44	$\overline{RAS0}$
9	DQ19	45	RAS1
10	Vcc	46	$\overline{NC}$
11	NC	47	$\overline{W}$
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	NC	55	DQ11
20	DQ4	56	DQ27
21	DQ20	57	DQ12
22	DQ5	58	DQ28
23	DQ21	59	Vcc
24	DQ6	60	DQ29
25	DQ22	61	DQ13
26	DQ7	62	DQ30
27	DQ23	63	DQ14
28	A7	64	DQ31
29	NC	65	DQ15
30	Vcc	66	NC
31	A8	67	PD1
32	$\overline{A9}$	68	PD2
33	$\overline{RAS1}$	69	PD3
34	RAS0	70	PD4
35	NC	71	NC
36	NC	72	Vss

PIN NAMES

Pin Name	Function
A0 - A9	Address Inputs
DQ0 - DQ31	Data In/Out
$\overline{W}$	Read/Write Enable
$\overline{RAS0}$, $\overline{RAS1}$	Row Address Strobe
$\overline{CAS0}$ - $\overline{CAS3}$	Column Address Strobe
PD1 -PD4	Presence Detect
Vcc	Power(+5V)
Vss	Ground
NC	No Connection
Res	Reserved Pin

PRESENCE DETECT PINS (Optional)

Pin	50NS	60NS
PD1	NC	NC
PD2	NC	NC
PD3	Vss	NC
PD4	Vss	NC

* Pin connection changing available

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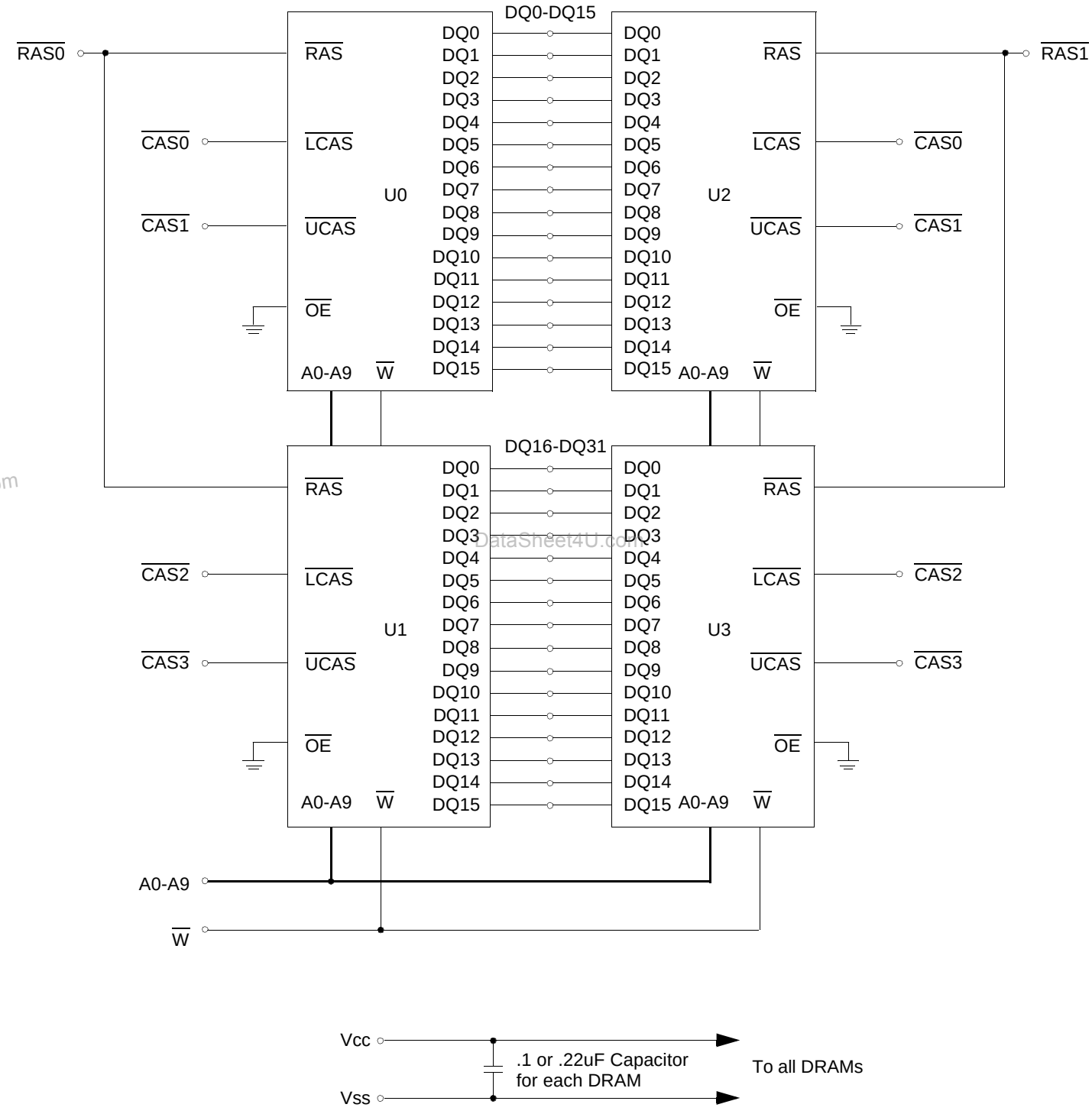
FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS *

Item	Symbol	Rating	Unit
Voltage on any pin relative to V_{SS}	V_{IN}, V_{OUT}	-1 to +7.0	V
Voltage on V_{CC} supply relative to V_{SS}	V_{CC}	-1 to +7.0	V
Storage Temperature	T_{stg}	-55 to +150	°C
Power Dissipation	P_d	4	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*1	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	M53230224DE2/DJ2		Unit
		Min	Max	
I_{CC1}	-50	-	304	mA
	-60	-	284	mA
I_{CC2}	Don't care	-	8	mA
I_{CC3}	-50	-	304	mA
	-60	-	284	mA
I_{CC4}	-50	-	244	mA
	-60	-	224	mA
I_{CC5}	Don't care	-	4	mA
I_{CC6}	-50	-	304	mA
	-60	-	284	mA
$I_{I(L)}$	Don't care	-20	20	uA
$I_{O(L)}$		-10	10	uA
V_{OH}	Don't care	2.4	-	V
V_{OL}		-	0.4	V

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

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

I_{CC3} : $\overline{RAS}$ Only Refresh Current * ($\overline{CAS}$=V_{IH}, $\overline{RAS}$ cycling @t_{RC}=min)

I_{CC4} : EDO Mode Current * ($\overline{RAS}$=V_{IL}, $\overline{CAS}$ cycling : t_{HPC}=min)

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

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

$I_{I(L)}$: Input Leakage Current (Any input 0≤V_{IN}≤Vcc+0.5V, all other pins not under test=0 V)

$I_{O(L)}$: Output Leakage Current(Data Out is disabled, 0V≤V_{OUT}≤Vcc)

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 $\overline{RAS}$=V_{IL}. In I_{CC4}, address can be changed maximum once within one EDO mode cycle, t_{HPC}.

CAPACITANCE (T_A = 25°C, V_{CC}=5V, f = 1MHz)

Item	Symbol	Min	Max	Unit
Input capacitance[A0-A9]	C_{IN1}	-	44	pF
Input capacitance[$\overline{W}$]	C_{IN2}	-	48	pF
Input capacitance[$\overline{RAS0}$, $\overline{RAS1}$]	C_{IN3}	-	40	pF
Input capacitance[$\overline{CAS0}$ - $\overline{CAS3}$]	C_{IN4}	-	29	pF
Input/Output capacitance[DQ0-31]	C_{DQ1}	-	29	pF

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}=2.0/0.8V, Output loading CL=100pF

Parameter	Symbol	-50		-60		Unit	Note
		Min	Max	Min	Max		
Random read or write cycle time	t_{RC}	90		110		ns	
Access time from $\overline{RAS}$	t_{RAC}		50		60	ns	3,4,10
Access time from $\overline{CAS}$	t_{CAC}		15		17	ns	3,4,5
Access time from column address	t_{AA}		25		30	ns	3,10
$\overline{CAS}$ to output in Low-Z	t_{CLZ}	3		3		ns	3
Output buffer turn-off delay from $\overline{CAS}$	t_{CEZ}	3	13	3	15	ns	6,11,12
Transition time(rise and fall)	t_T	2	50	2	50	ns	2
$\overline{RAS}$ precharge time	t_{RP}	30		40		ns	
$\overline{RAS}$ pulse width	t_{RAS}	50	10K	60	10K	ns	
$\overline{RAS}$ hold time	t_{RSH}	13		17		ns	
$\overline{CAS}$ hold time	t_{CSH}	40		50		ns	
$\overline{CAS}$ pulse width	t_{CAS}	8	10K	10	10K	ns	13
$\overline{RAS}$ to $\overline{CAS}$ delay time	t_{RCD}	20	37	20	45	ns	4
$\overline{RAS}$ to column address delay time	t_{RAD}	15	25	15	30	ns	10
$\overline{CAS}$ to $\overline{RAS}$ precharge time	t_{CRP}	5		5		ns	
Row address set-up time	t_{ASR}	0		0		ns	
Row address hold time	t_{RAH}	10		10		ns	
Column address set-up time	t_{ASC}	0		0		ns	
Column address hold time	t_{CAH}	8		10		ns	
Column address to $\overline{RAS}$ lead time	t_{RAL}	25		30		ns	
Read command set-up time	t_{RCS}	0		0		ns	
Read command hold time referenced to $\overline{CAS}$	t_{RCH}	0		0		ns	8
Read command hold time referenced to $\overline{RAS}$	t_{RRH}	0		0		ns	8
Write command hold time	t_{WCH}	10		10		ns	
Write command pulse width	t_{WP}	10		10		ns	
Write command to $\overline{RAS}$ lead time	t_{RWL}	13		15		ns	
Write command to $\overline{CAS}$ lead time	t_{CWL}	13		10		ns	
Data-in set-up time	t_{DS}	0		0		ns	9
Data-in hold time	t_{DH}	8		10		ns	9
Refresh period	t_{REF}		16		16	ms	
Write command set-up time	t_{WCS}	0		0		ns	7
$\overline{CAS}$ setup time($\overline{CAS}$-before-$\overline{RAS}$ refresh)	t_{CSR}	5		5		ns	
$\overline{CAS}$ hold time($\overline{CAS}$-before-$\overline{RAS}$ refresh)	t_{CHR}	10		10		ns	
$\overline{RAS}$ precharge to $\overline{CAS}$ hold time	t_{RPC}	5		5		ns	
Access time from $\overline{CAS}$ precharge	t_{CPA}		30		35	ns	3

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

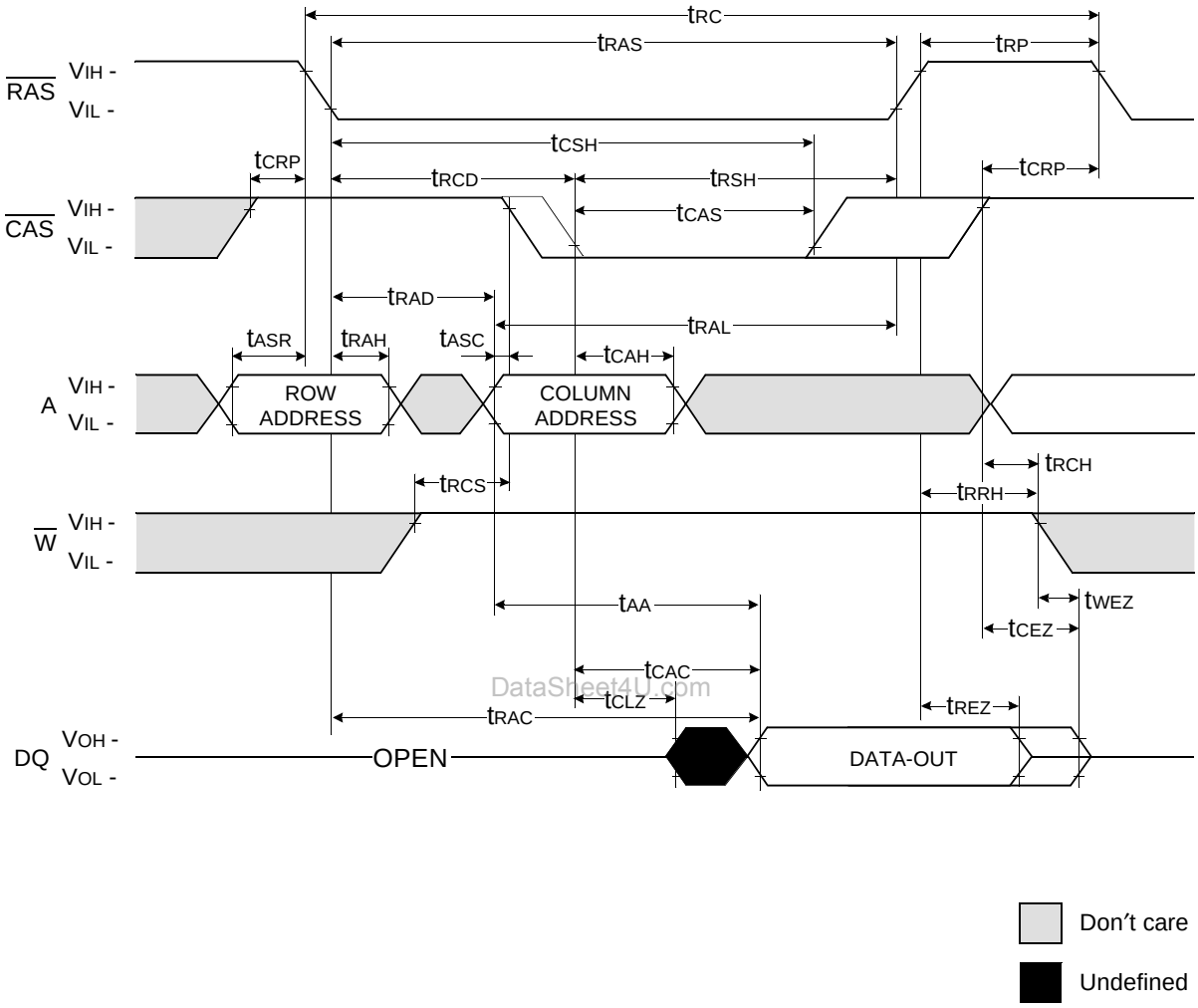
Test condition : Vih/Vil=2.4/0.8V, Voh/Vol=2.0/0.8V, Output loading CL=100pF

Parameter	Symbol	-50		-60		Unit	Note
		Min	Max	Min	Max		
Hyper page mode cycle time	t_{HPC}	25		30		ns	13
$\overline{CAS}$ precharge time(Hyper page cycle)	t_{CP}	8		10		ns	
$\overline{RAS}$ pulse width(Hyper page cycle)	t_{RASP}	50	200K	60	200K	ns	
$\overline{RAS}$ hold time from $\overline{CAS}$ precharge	t_{RHCP}	30		35		ns	
$\overline{W}$ to $\overline{RAS}$ precharge time(C-B-R refresh)	t_{WRP}	10		10		ns	
$\overline{W}$ to $\overline{RAS}$ hold time(C-B-R refresh)	t_{WRH}	10		10		ns	
Output data hold time	t_{DOH}	5		5		ns	
Output buffer turn off delay from $\overline{RAS}$	t_{REZ}	3	13	3	15	ns	6,11,12
Output buffer turn off delay from $\overline{W}$	t_{WEZ}	3	13	3	15	ns	6,11
$\overline{W}$ to data delay	t_{WED}	15		15		ns	
$\overline{W}$ pulse width (Hyper Page Cycle)	t_{WPE}	5		5		ns	

NOTES

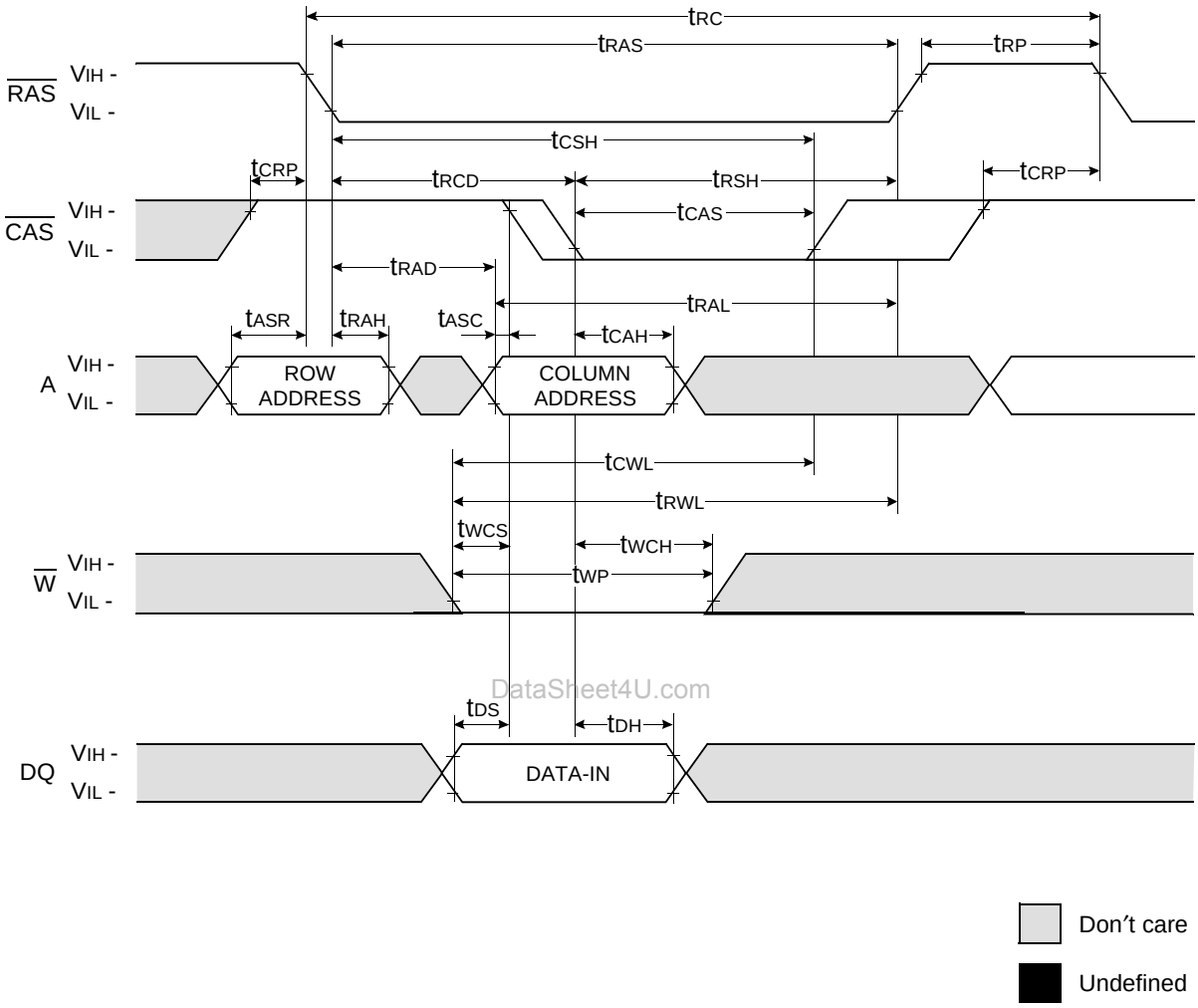
1. An initial pause of 200us is required after power-up followed by any 8 $\overline{RAS}$-only or $\overline{CAS}$-before-$\overline{RAS}$ refresh cycles before proper device operation is achieved.
2. V_{IH}(min) and V_{IL}(max) are reference levels for measuring timing of input signals. Transition 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 $t_{RCD} \geq t_{RCD}$(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. t_{WCS} is non-restrictive operating parameter. It is included in the data sheet as electrical characteristics only. If $t_{WCS} \geq t_{WCS}$(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 $\overline{CAS}$ leading edge in early write cycles and to the $\overline{W}$ leading edge in read-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}.
11. t_{CEZ}(max), t_{REZ}(max), t_{WEZ}(max) and t_{OEZ}(max) define the time at which the output achieves the open circuit condition and are not referenced to output voltage level.
12. If $\overline{RAS}$ goes to high before $\overline{CAS}$ high going, the open circuit condtion of the output is achieved by $\overline{CAS}$ high going. If $\overline{CAS}$ goes to high before $\overline{RAS}$ high going, the open circuit condition of the output is achieved by $\overline{RAS}$ high going.
13. $t_{ASC} \geq t_{CP}$ min

READ CYCLE

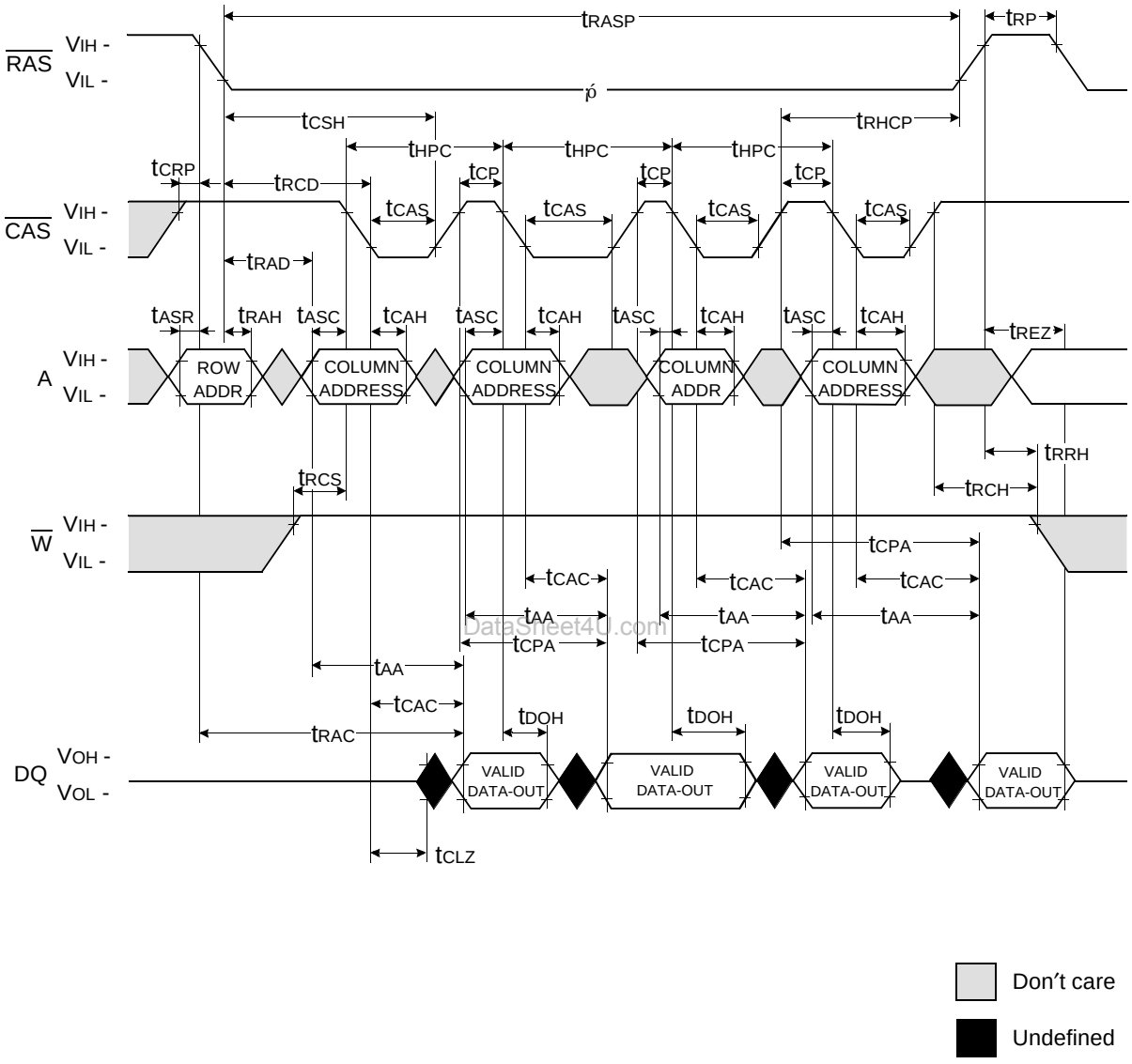


WRITE CYCLE (EARLY WRITE)

NOTE : DOUT = OPEN

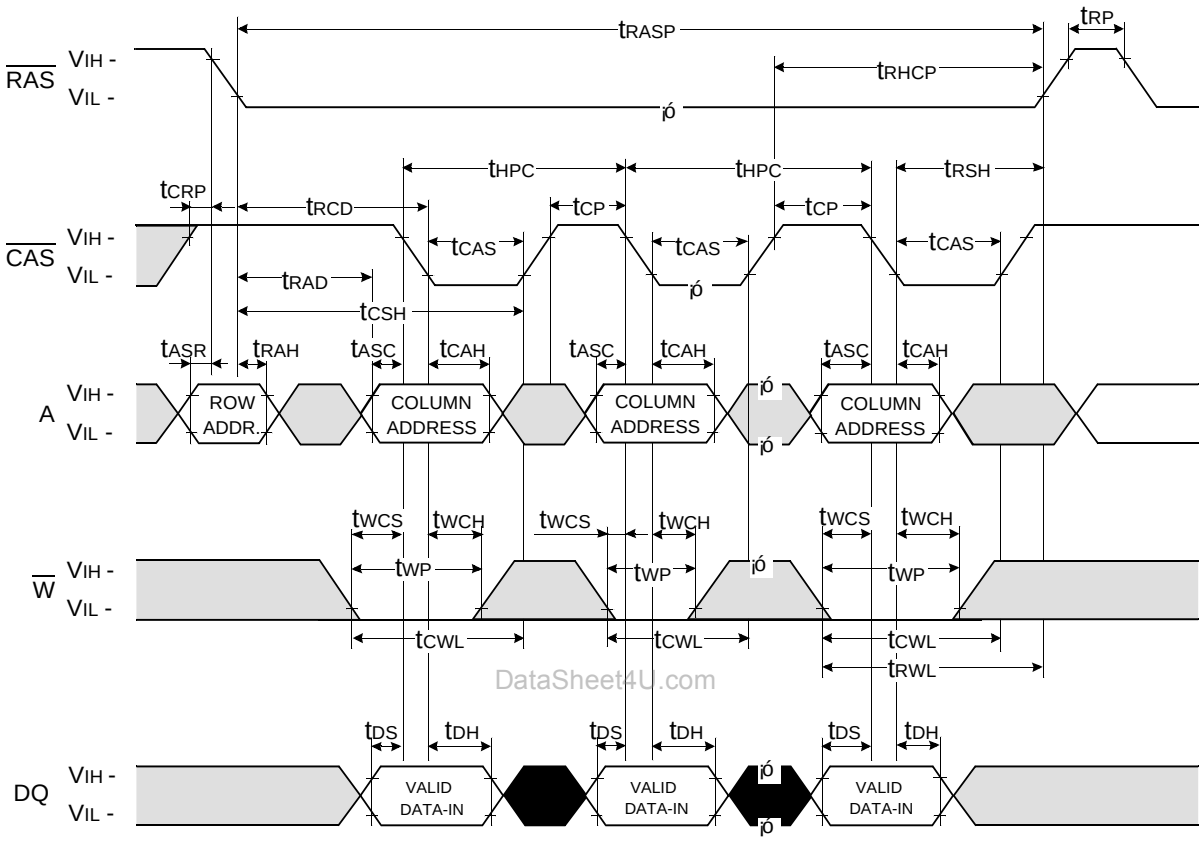


HYPER PAGE READ CYCLE



HYPER PAGE WRITE CYCLE (EARLY WRITE)

NOTE : DOUT = OPEN



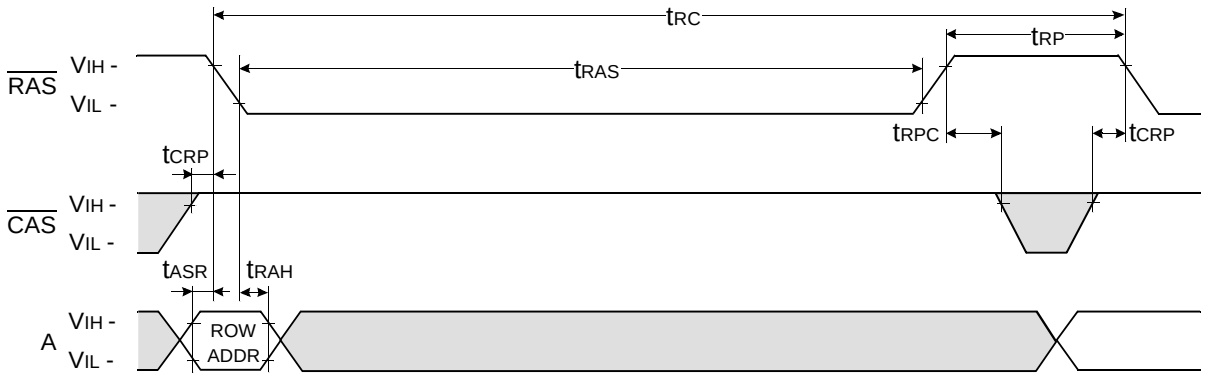
Don't care

Undefined

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

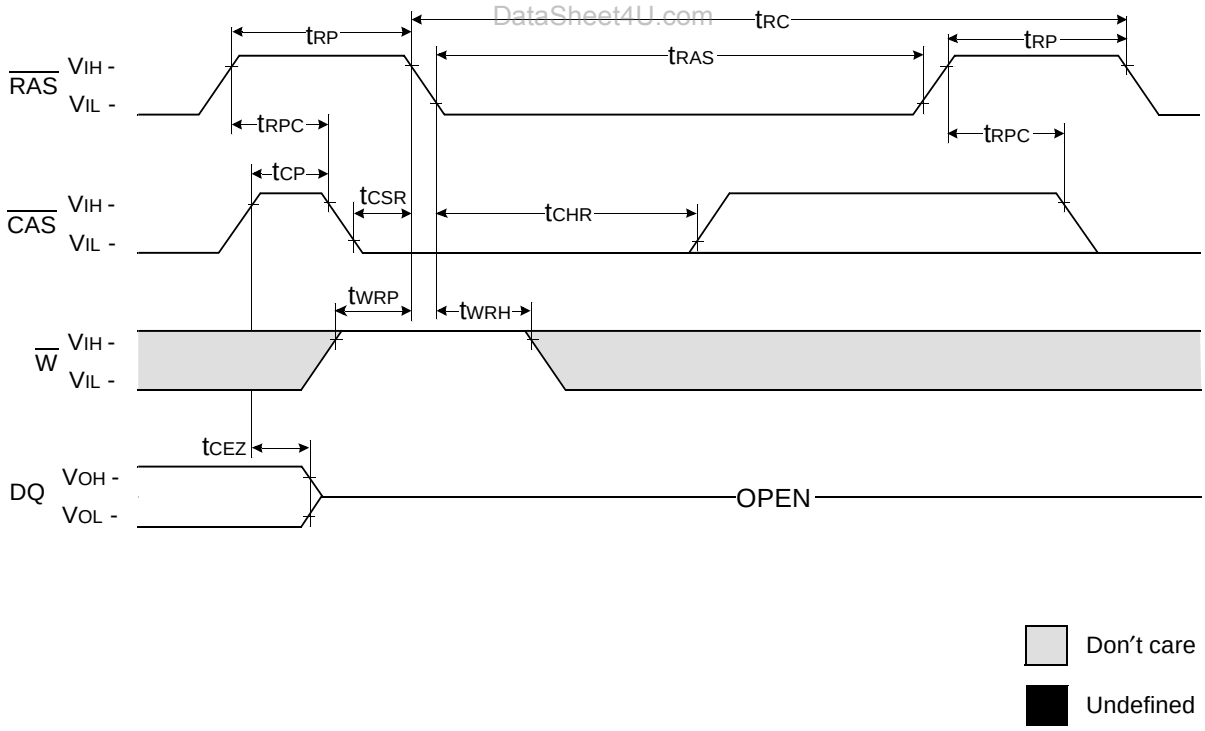
NOTE : $\overline{W}$, $\overline{OE}$, D_{IN} = Don't care

D_{OUT} = OPEN



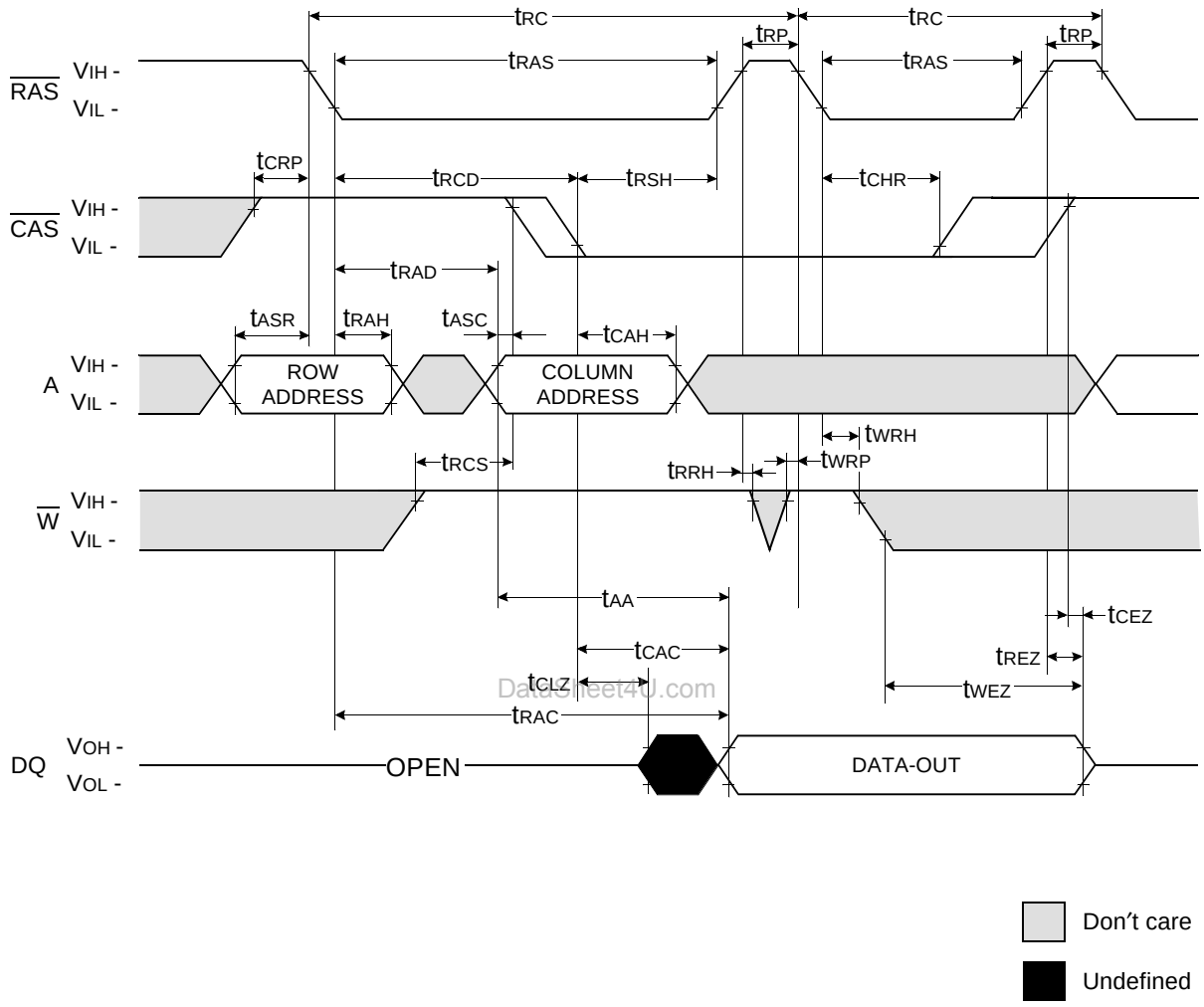
$\overline{CAS}$ - BEFORE - $\overline{RAS}$ REFRESH CYCLE

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



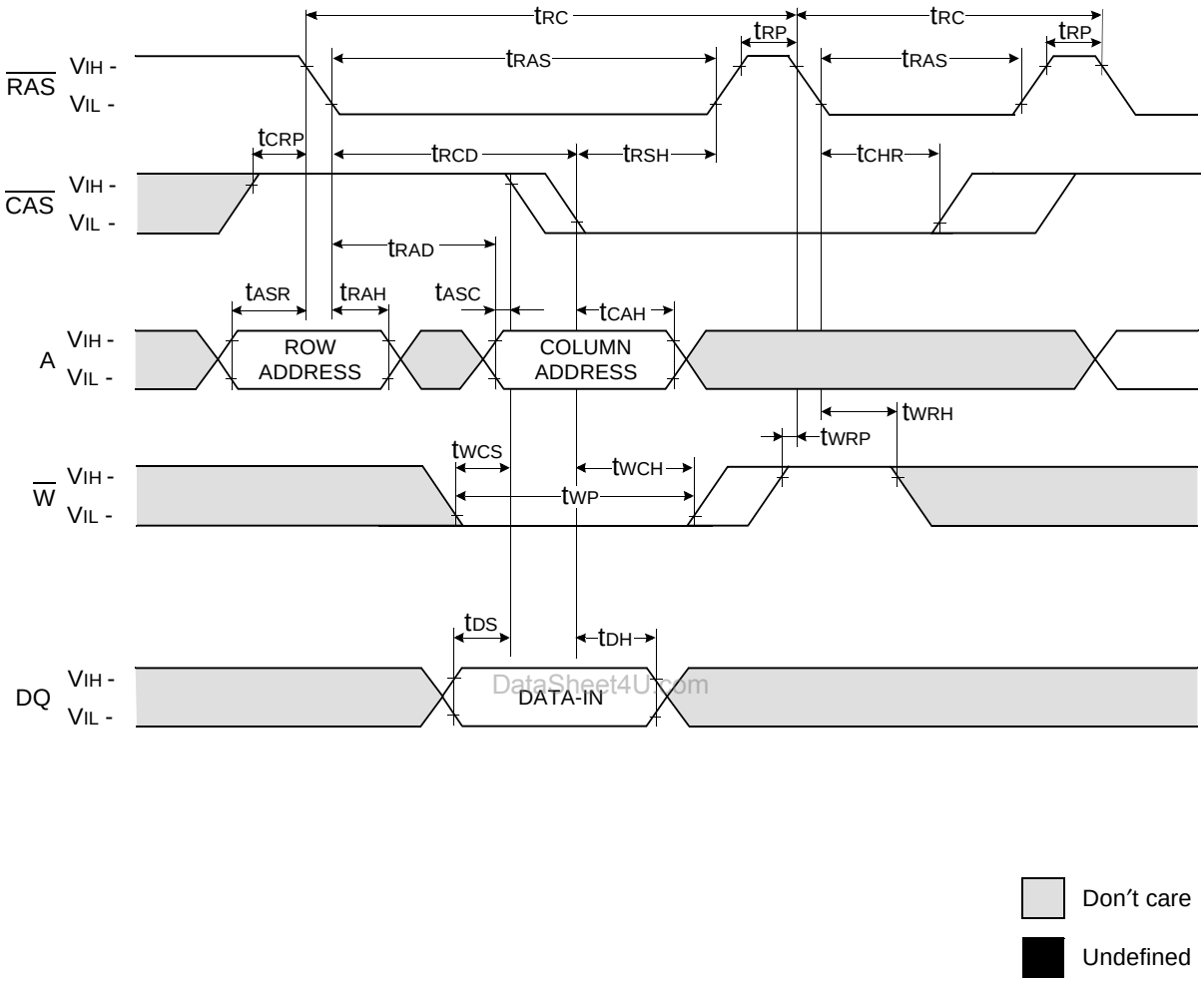
* In $\overline{RAS}$-only refresh cycle of 64Mb A-dile & B-die, when $\overline{CAS}$ signal transits from Low to High, the valid data may be cut off.

HIDDEN REFRESH CYCLE (READ)

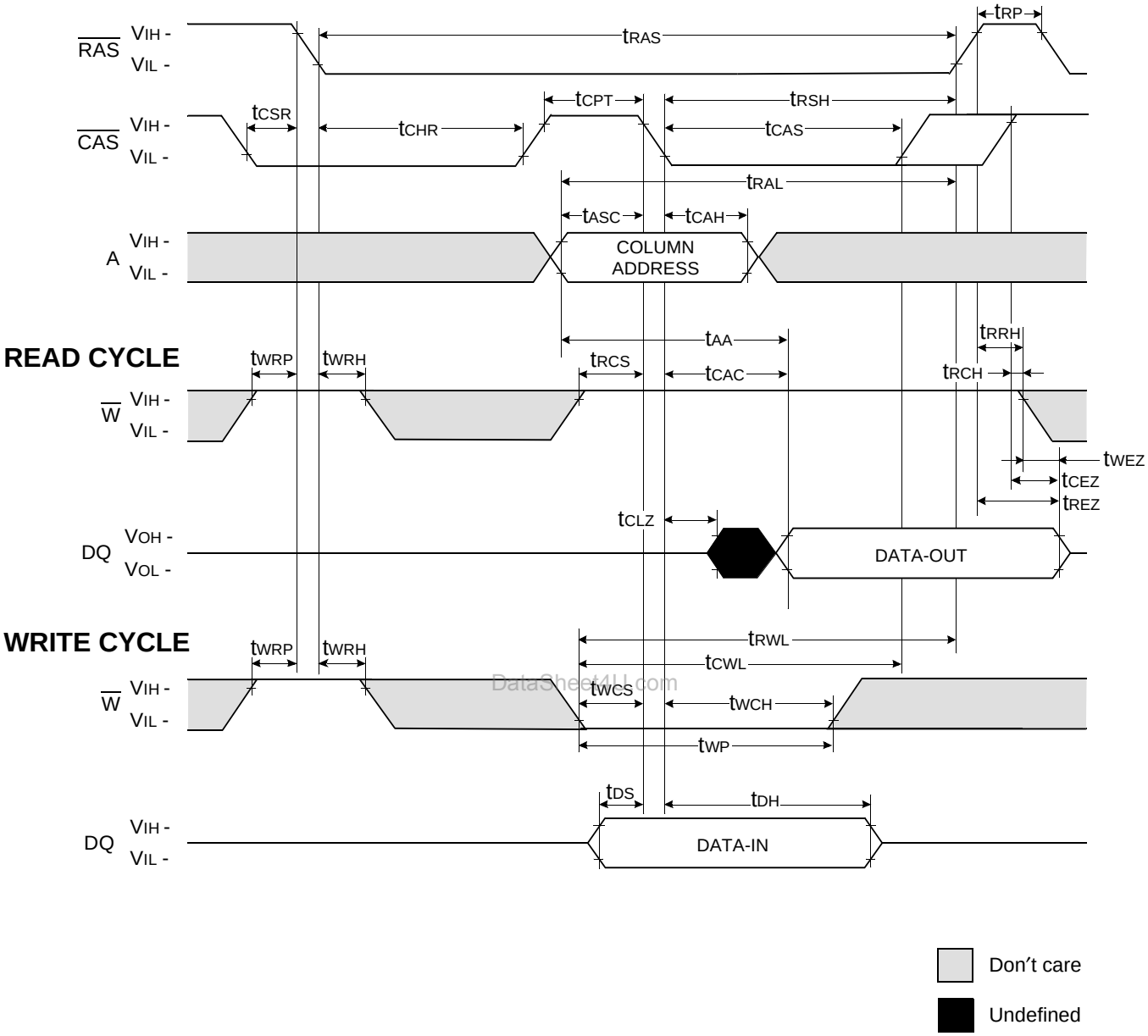


HIDDEN REFRESH CYCLE (WRITE)

NOTE : DOUT = OPEN



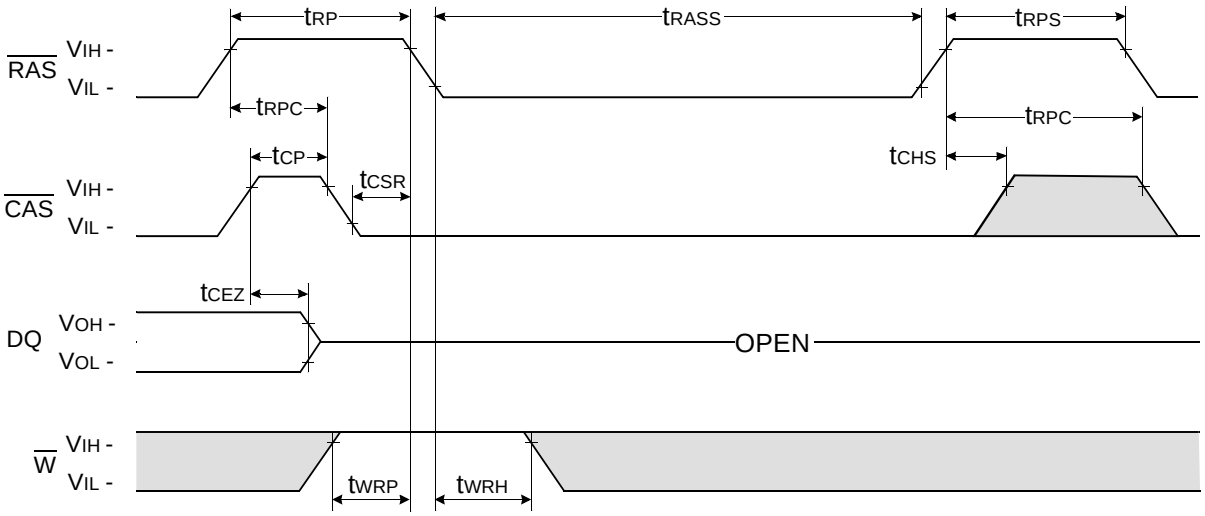
CAS-BEFORE-RAS REFRESH COUNTER TEST CYCLE



NOTE : This timing diagram is applied to all devices besides 64M DRAM based modules.

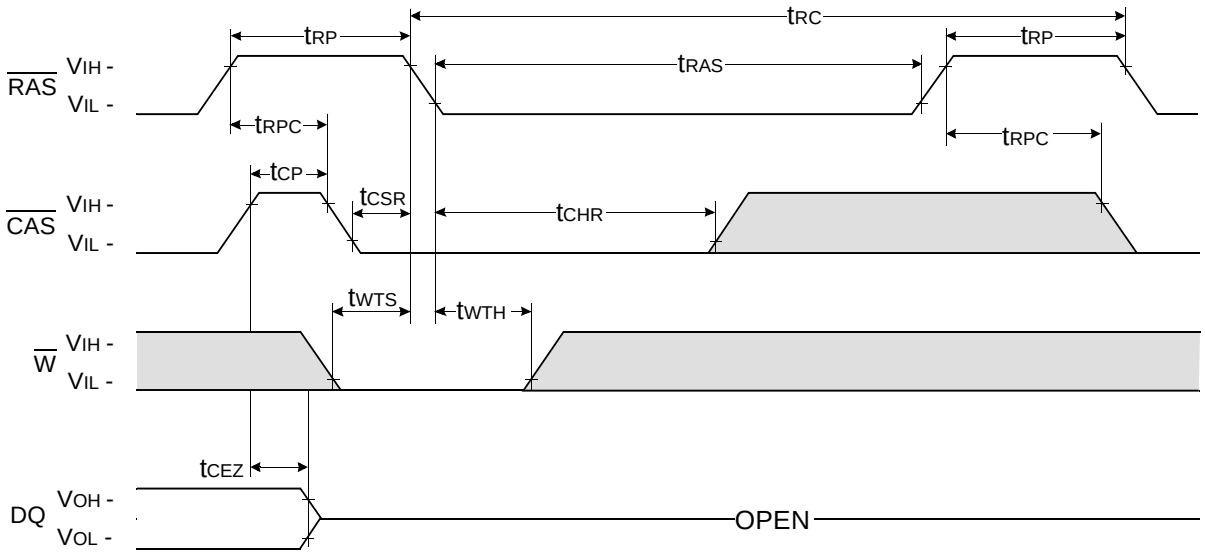
CAS - BEFORE - RAS SELF REFRESH CYCLE

NOTE : OE, A = Don't care



TEST MODE IN CYCLE

NOTE : OE , A = Don't care

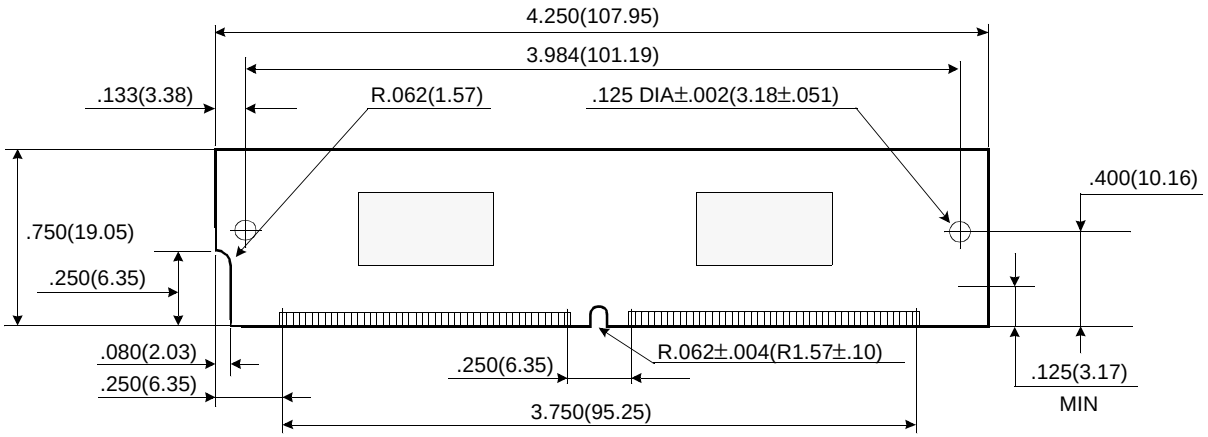


Don't care

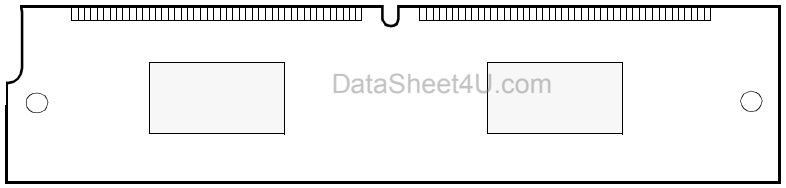
Undefined

PACKAGE DIMENSIONS

Units : Inches (millimeters)

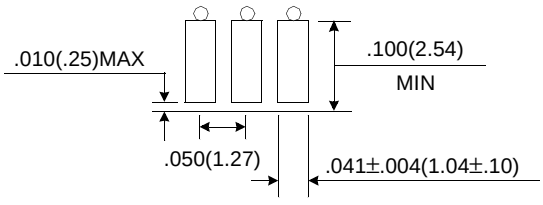


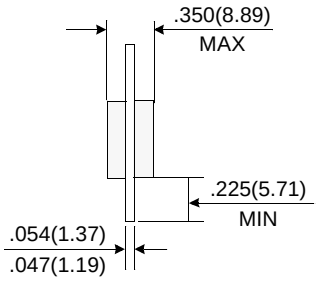
(Front view)



(Back view)

Gold & Solder Plating Lead





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

NOTE : The used device is 1Mx16 DRAM

DRAM Part No. : M53230224DE2/DJ2 -- K4E151611D-J (400 mil)

Revision History
Rev 0.0 : Oct. 1999