

Description

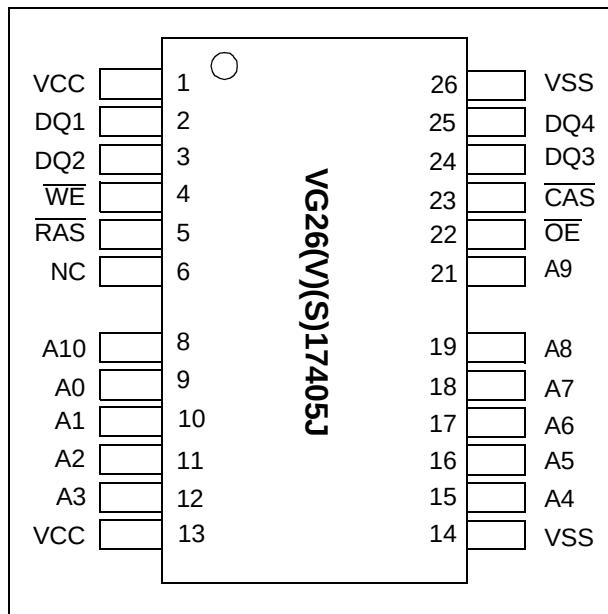
The device CMOS Dynamic RAM organized as 4,194,304 words x 4 bits with extended data out access mode. It is fabricated with an advanced submicron CMOS technology and designed to operate from a single 5V only or 3.3V only power supply. Low voltage operation is more suitable to be used on battery backup, portable electronic application. A new refresh feature called "self-refresh" is supported and very slow CBR cycles are being performed. It is packaged in JEDEC standard 26/24-pin plastic SOJ or TSOP(II).

Features

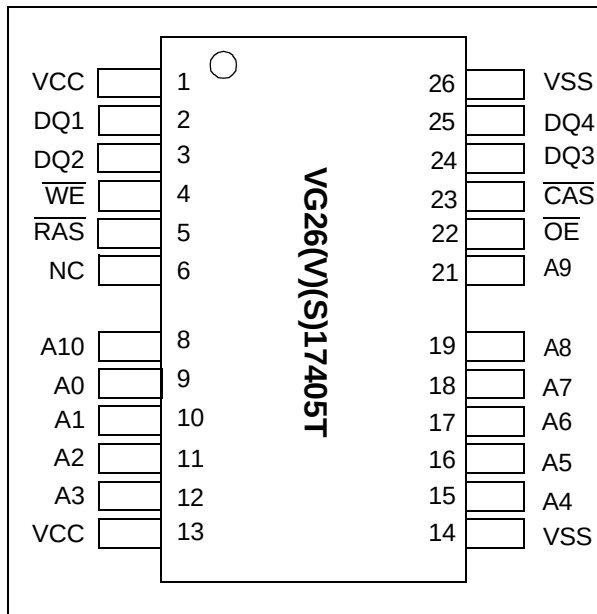
- Single 5V($\pm 10\%$) or 3.3V($\pm 10\%$) only power supply
- High speed t_{RAC} access time: 50/60ns
- Low power dissipation
 - Active mode : 5V version 660/605 mW (Mas)
3.3V version 432/396 mW (Mas)
 - Standby mode: 5V version 1.375 mW (Mas)
3.3V version 0.54 mW (Mas)
- Extended - data - out(EDO) page mode access
- I/O level: TTL compatible ($V_{cc} = 5V$)
LVTTL compatible ($V_{cc} = 3.3V$)
- 2048 refresh cycle in 32 ms(Std.) or 128 ms(S-version)
- 4 refresh modes:
 - $\overline{RAS}$ only refresh
 - $\overline{CAS}$ - before - $\overline{RAS}$ refresh
 - Hidden refresh
 - Self-refresh(S-version)

Pin Configuration

26/24-PIN 300mil Plastic SOJ



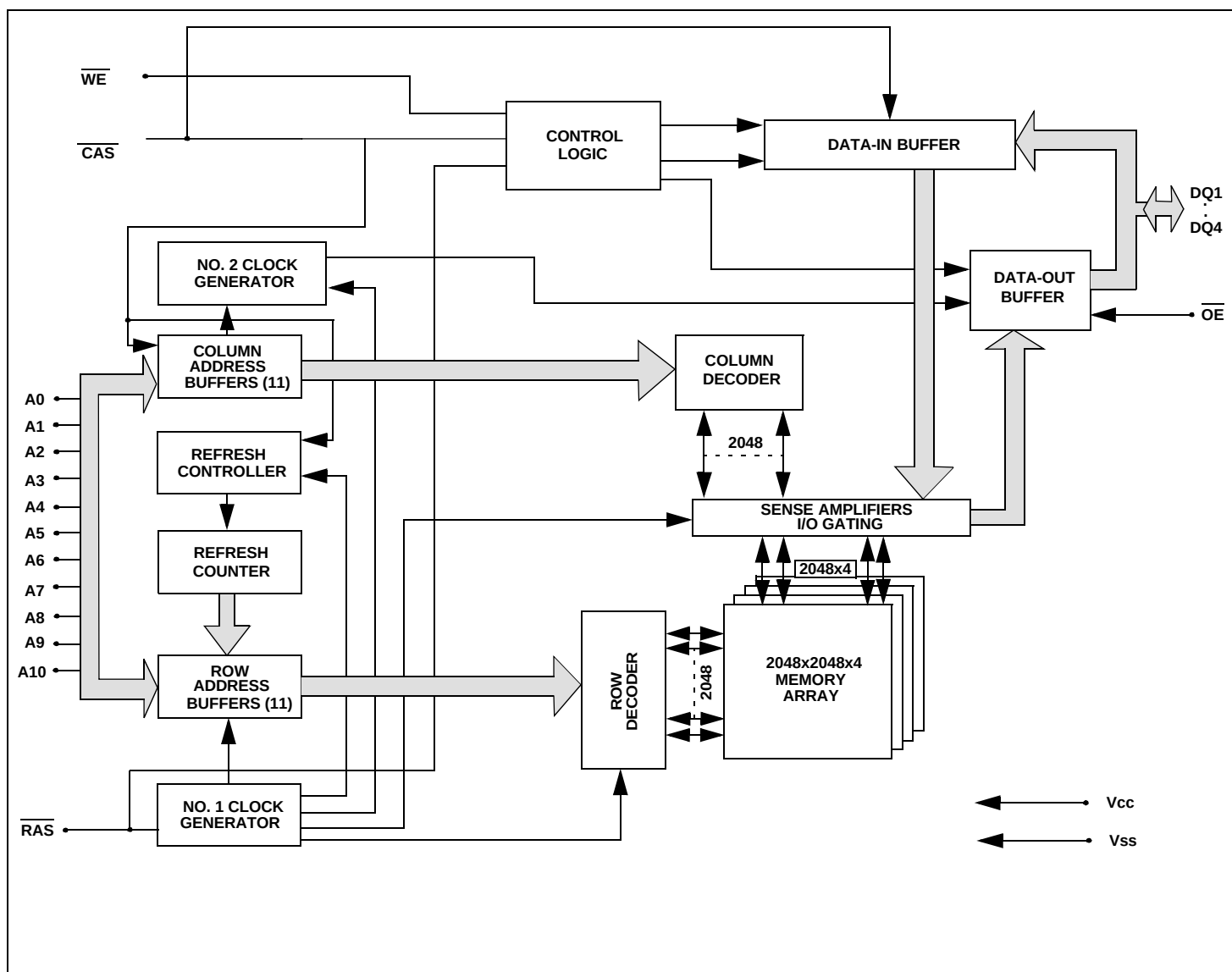
26/24-PIN 300mil Plastic TSOP (II)



Pin Description

Pin Name	Function
A0-A10	Address inputs - Row address A0-A10 - Column address A0-A10 - Refresh address A0-A10
DQ1~DQ4	Data-in / data-out
$\overline{\text{RAS}}$	Row address strobe
$\overline{\text{CAS}}$	Column address strobe
$\overline{\text{WE}}$	Write enable
$\overline{\text{OE}}$	Output enable
Vcc	Power (+5 V or + 3.3V)
Vss	Ground

Block Diagram



TRUTH TABLE

FUNCTION		$\overline{\text{RAS}}$	$\overline{\text{CAS}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	ADDRESSES		DQ _S	Notes
						ROW	COL		
STANDBY		H	H → X	X	X	X	X	High-Z	
READ		L	L	H	L	ROW	COL	Data-Out	
WRITE: (EARLY WRITE)		L	L	L	X	ROW	COL	Data-In	
READ WRITE		L	L	H → L	L → H	ROW	COL	Data-Out,Data-In	
EDO-PAGE-MODE READ	1st Cycle	L	H → L	H	L	ROW	COL	Data-Out	
	2nd Cycle	L	H → L	H	L	n/a	COL	Data-Out	
EDO-PAGE MODE WRITE	1st Cycle	L	H → L	L	X	ROW	COL	Data-In	
	2nd Cycle	L	H → L	L	X	n/a	COL	Data-In	
EDO-PAGE-MODE READ-WRITE	1st Cycle	L	H → L	H → L	L → H	ROW	COL	Data-Out, Data-In	
	2nd Cycle	L	H → L	H → L	L → H	n/a	COL	Data-Out, Data-In	
HIDDEN REFRESH	READ	L → H → L	L	H	L	ROW	COL	Data-Out	
	WRITE	L → H → L	L	L	X	ROW	COL	Data-In	1
RAS-ONLY REFRESH		L	H	X	X	ROW	n/a	High-Z	
CBR REFRESH		H → L	L	H	X	X	X	High-Z	

Notes: 1. EARLY WRITE only.

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Voltage on any pin relative to Vss	V_T	5V -1.0 to + 7.0	V
3.3V		-0.5 to + 4.6	
Supply voltage relative to Vss	V_{CC}	5V -1.0 to + 7.0	V
3.3V		-0.5 to + 4.6	
Short circuit output current	I_{OUT}	50	mA
Power dissipation	P_D	1.0	W
Operating temperature	T_{OPT}	0 to + 70	°C
Storage temperature	T_{STG}	-55 to + 125	°C

Recommended DC Operating Conditions

Parameter/Condition	Symbol	5 Volt Version			3.3 Volt Version			Unit
		Min	Typ	Max	Min	Typ	Max	
Supply Voltage	V_{CC}	4.5	5.0	5.5	3.0	3.3	3.6	V
Input High Voltage, all inputs	V_{IH}	2.4	-	$V_{CC} + 1.0$	2.0	-	$V_{CC} + 0.3$	V
Input Low Voltage, all inputs	V_{IL}	-1.0	-	0.8	-0.3	-	0.8	V

Capacitance

Ta = 25°C, V_{CC} = 5V ±10 % or 3.3V ±10 %, f = 1MHz

Parameter	Symbol	Typ	Max	Unit	Note
Input capacitance (Address)	C_{I1}	-	5	pF	1
Input capacitance ($\overline{RAS}$, $\overline{CAS}$, $\overline{OE}$, $\overline{WE}$)	C_{I2}	-	7	pF	1
Output capacitance (Data-in, Data-out)	$C_{I/O}$	-	7	pF	1, 2

Note: 1. Capacitance measured with effective capacitance measuring method.

2. $\overline{RAS}$, $\overline{CAS}$ = V_{IH} to disable Dout.

DC Characteristics; 5- Volt Verion

($T_a = 0$ to $+70$ °C, $V_{CC} = +5V \pm 10\%$, $V_{SS} = 0V$)

Parameter		Symbol	Test Conditions	VG26(V)(S)17405				Unit	Notes
				-5		-6			
				Min	Max	Min	Max		
Operating current		I _{CC1}	$\overline{RAS}$ cycling CAS, cycling t _{RC} = min	-	120	-	110	mA	1, 2
Standby Current	LOW power S-version	I _{CC2}	TTL interface $\overline{RAS}, \overline{CAS} = V_{IH}$ Dout = High-Z	-	2	-	2	mA	
			CMOS interface $\overline{RAS}, \overline{CAS} \geq V_{CC} - 0.2V$ Dout = High-Z	-	0.25	-	0.25	mA	
	Standard power version		TTL interface $\overline{RAS}, \overline{CAS} = V_{IH}$ Dout = High-Z		2	-	2	mA	
			CMOS interface $\overline{RAS}, \overline{CAS} \geq V_{CC} - 0.2V$ Dout = High-Z		1	-	1	mA	
RAS-only refresh current		I _{CC3}	$\overline{RAS}$ cycling, $\overline{CAS} = V_{IH}$ t _{RC} = min	-	120	-	110	mA	1, 2
EDO page mode current		I _{CC4}	t _{RC} = min	-	90	-	80	mA	1, 3
CAS-before- $\overline{RAS}$ refresh current		I _{CC5}	t _{RC} = min $\overline{RAS}, \overline{CAS}$ cycling	-	120	-	110	mA	1, 2
Self-refresh current (S - Version)		I _{CC8}	t _{RAS} ≥ 100μs	-	350	-	350	μA	
CAS- before- $\overline{RAS}$ long refresh current (S-Version)		I _{CC9}	Standby: $V_{CC} - 0.2V \leq \overline{RAS}$ CAS before $\overline{RAS}$ refresh: 2048 cycles / 128ms $\overline{RAS}, \overline{CAS}$: $0V \leq V_{IL} \leq 0.2V$ $V_{CC} - 0.2V \leq V_{IH} \leq V_{IH}$ (Max) Dout = High-Z, t _{RAS} ≤ 300ns	-	500	-	500	μA	

DC Characteristics ; 5-Volt Version (Cont.)

($T_a = 0$ to $+70^\circ\text{C}$, $V_{CC} = +5\text{V} \pm 10\%$, $V_{SS} = 0\text{V}$)

Parameter	Symbol	Test Conditions	VG26(V)(S) 17405				Unit	Notes
			-5		-6			
			Min	Max	Min	Max		
Input leakage current	I _{LI}	0V ≤ V _{IN} ≤ V _{CC} + 0.5V	-5	5	-5	5	μA	
Output leakage current	I _{LO}	0V ≤ V _{OUT} ≤ V _{CC} + 0.5V Dout = Disable	-5	5	-5	5	μA	
Output high Voltage	V _{OH}	I _{OH} = - 5mA	2.4	-	2.4	-	V	
Output low voltage	V _{OL}	I _{OL} = + 4.2mA	-	0.4	-	0.4	V	

Notes:

1. I_{CC} is specified as an average current. It depends on output loading condition and cycle rate when the device is selected. I_{CC} max is specified at the output open condition.
2. Address can be changed once or less while $\overline{RAS} = V_{IL}$.
3. For I_{CC4} , address can be changed once or less within one EDO page mode cycle time.

DC Characteristics ; 3.3 - Volt Version

($T_a = 0$ to 70°C , $V_{CC} = +3.3\text{V} \pm 10\%$, $V_{SS} = 0\text{V}$)

Parameter		Symbol	Test Conditions	VG26(V)(S)17405				Unit	Notes
				-5		-6			
				Min	Max	Min	Max		
Operating current		I _{CC1}	$\overline{\text{RAS}}$ cycling CAS, cycling t _{RC} = min	-	120	-	110	mA	1, 2
Standby Current	LOW power S-version	I _{CC2}	LVTTL interface RAS, $\overline{\text{CAS}} = V_{\text{IH}}$ Dout = High-Z	-	0.5	-	0.5	mA	
			CMOS interface $\overline{\text{RAS}}, \overline{\text{CAS}} \geq V_{\text{CC}} - 0.2\text{V}$ Dout = High-Z	-	0.15	-	0.15	mA	
	Standard power version		LVTTL interface RAS, $\overline{\text{CAS}} = V_{\text{IH}}$ Dout = High-Z	-	2	-	2	mA	
			CMOS interface $\overline{\text{RAS}}, \overline{\text{CAS}} \geq V_{\text{CC}} - 0.2\text{V}$ Dout = High-Z	-	0.5	-	0.5	mA	
$\overline{\text{RAS}}$ - only refresh current		I _{CC3}	$\overline{\text{RAS}}$ cycling, $\overline{\text{CAS}} = V_{\text{IH}}$ t _{RC} = min	-	120	-	110	mA	1, 2
EDO page mode current		I _{CC4}	t _{PC} = min	-	90	-	80	mA	1, 3
$\overline{\text{CAS}}$ - before- $\overline{\text{RAS}}$ refresh current		I _{CC5}	t _{RC} = min RAS, CAS cycling	-	120	-	110	mA	1, 2
Self- refresh current (S-Version)		I _{CC8}	t _{RASS} ≥ 100μs	-	250	-	250	μA	
CAS- before- $\overline{\text{RAS}}$ long refresh current (S-Version)		I _{CC9}	Standby: $V_{\text{CC}} - 0.2\text{V} \leq \overline{\text{RAS}}$ CAS before $\overline{\text{RAS}}$ refresh: 2048 cycles / 128ms RAS, CAS: $0\text{V} \leq V_{\text{IL}} \leq 0.2\text{V}$ $V_{\text{CC}} - 0.2\text{V} \leq V_{\text{IH}} \leq V_{\text{IH}}(\text{max})$ Dout = High-Z, t _{RAS} ≤ 300ns	-	300	-	300	μA	

DC Characteristics ; 3.3 - Volt Version (Cont.)

($T_a = 0$ to 70°C , $V_{CC} = +3.3\text{V} \pm 10\%$, $V_{SS} = 0\text{V}$)

Parameter	Symbol	Test Conditions	VG26(V)(S) 17405				Unit	Notes
			-5		-6			
			Min	Max	Min	Max		
Input leakage current	I _{LI}	0V ≤ Vin ≤ V _{CC} + 0.3V	-5	5	-5	5	μA	
Output leakage current	I _{LO}	0V ≤ Vout ≤ V _{CC} + 0.3V Dout = Disable	-5	5	-5	5	μA	
Output high Voltage	V _{OH}	I _{OH} = -2mA	2.4	-	2.4	-	V	
Output low voltage	V _{OL}	I _{OL} = +2mA	-	0.4	-	0.4	V	

Notes:

1. I_{CC} is specified as an average current. It depends on output loading condition and cycle rate when the device is selected. I_{CC} max is specified at the output open condition.
2. Address can be changed once or less while $\overline{\text{RAS}} = V_{IL}$.
3. For I_{CC4} , address can be changed once or less within one EDO page mode cycle time.

AC Characteristics

($T_a = 0$ to $+70^\circ\text{C}$, $V_{CC} = 5\text{V} \pm 10\%$ or $3.3\text{V} \pm 10\%$, $V_{SS} = 0\text{V}$) *1, *2, *3, *4

Test conditions

- Output load: two TTL Loads and 100pF ($V_{CC} = 5.0\text{V} \pm 10\%$)
one TTL Load and 100pF ($V_{CC} = 3.3\text{V} \pm 10\%$)
- Input timing reference levels:
 $V_{IH} = 2.4\text{V}$, $V_{IL} = 0.8\text{V}$ ($V_{CC} = 5.0\text{V} \pm 10\%$); $V_{IH} = 2.0\text{V}$, $V_{IL} = 0.8\text{V}$ ($V_{CC} = 3.3\text{V} \pm 10\%$)
- Output timing reference levels:
 $V_{OH} = 2.0\text{V}$, $V_{OL} = 0.8\text{V}$ ($V_{CC} = 5\text{V} \pm 10\%$, $3.3\text{V} \pm 10\%$)

Read, Write, Read- Modify- Write and Refresh Cycles

(Common Parameters)

Parameter	Symbol	VG26(V)(S) 17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
Random read or write cycle time	t _{RC}	84	-	104	-	ns	
$\overline{\text{RAS}}$ precharge time	t _{RP}	30	-	40	-	ns	
$\overline{\text{CAS}}$ precharge time in normal mode	t _{CPN}	10	-	10	-	ns	
$\overline{\text{RAS}}$ pulse width	t _{RAS}	50	10000	60	10000	ns	5
$\overline{\text{CAS}}$ pulse width	t _{CAS}	8	10000	10	10000	ns	6
Row address setup time	t _{ASR}	0	-	0	-	ns	
Row address hold time	t _{RAH}	8	-	10	-	ns	
Column address setup time	t _{ASC}	0	-	0	-	ns	7
Column address hold time	t _{CAH}	8	-	10	-	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ delay time	t _{RCD}	12	37	14	45	ns	8
$\overline{\text{RAS}}$ to column address delay time	t _{RAD}	10	25	12	30	ns	9
Column address to $\overline{\text{RAS}}$ lead time	t _{RAL}	25	-	30	-	ns	
$\overline{\text{RAS}}$ hold time	t _{RSH}	8	-	10	-	ns	
$\overline{\text{CAS}}$ hold time	t _{CSH}	38	-	40	-	ns	
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ precharge time	t _{CRP}	5	-	5	-	ns	10
$\overline{\text{OE}}$ to Din delay time	t _{OED}	12	-	15	-	ns	
Transition time (rise and fall)	t _T	1	50	1	50	ns	11
Refresh period	t _{REF}	-	32	-	32	ms	
Refresh period (S- Version)	t _{REF}	-	128	-	128	ms	
$\overline{\text{CAS}}$ to output in Low- Z	t _{CLZ}	0	-	0	-	ns	
$\overline{\text{CAS}}$ delay time from Din	t _{DZC}	0	-	0	-	ns	
$\overline{\text{OE}}$ delay time from Din	t _{DZO}	0	-	0	-	ns	

Read Cycle

Parameter	Symbol	VG26(V)(S)17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
Access time from $\overline{\text{RAS}}$	t_{RAC}	-	50	-	60	ns	12
Access time from $\overline{\text{CAS}}$	t_{CAC}	-	13	-	15	ns	13, 14
Access time from column address	t_{AA}	-	25	-	30	ns	14, 15
Access time from $\overline{\text{OE}}$	t_{OEA}	-	12	-	15	ns	
Read command setup time	t_{RCS}	0	-	0	-	ns	7
Read command hold time to $\overline{\text{CAS}}$	t_{RCH}	0	-	0	-	ns	10, 16
Read command hold time to $\overline{\text{RAS}}$	t_{RRH}	10	-	10	-	ns	16
Output buffer turn-off time	t_{OFF}	0	12	0	15	ns	17
Output buffer turn-off time from $\overline{\text{OE}}$	t_{OEZ}	0	12	0	15	ns	17

Write Cycle

Parameter	Symbol	VG26(V)(S) 17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
Write command setup time	t _{WCS}	0	-	0	-	ns	7, 18
Write command hold time	t _{WCH}	8	-	10	-	ns	
Write command pulse width	t _{WP}	8	-	10	-	ns	
Write command to $\overline{\text{RAS}}$ lead time	t _{RWL}	13	-	15	-	ns	
Write command to $\overline{\text{CAS}}$ lead time	t _{CWL}	8	-	10	-	ns	
Data-in setup time	t _{DS}	0	-	0	-	ns	19
Data-in hold time	t _{DH}	8	-	10	-	ns	19
$\overline{\text{WE}}$ to Data-in delay	t _{WED}	10	-	10	-	ns	

Read- Modify- Write Cycle

Parameter	Symbol	VG26(V)(S) 17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
Read-modify- write cycle time	t _{RWC}	108	-	133	-	ns	
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ delay time	t _{RWD}	64	-	77	-	ns	18
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ dealy time	t _{CWD}	26	-	32	-	ns	18
Column address to $\overline{\text{WE}}$ delay time	t _{AWD}	39	-	47	-	ns	18
$\overline{\text{OE}}$ hold time from $\overline{\text{WE}}$	t _{OEH}	8	-	10	-	ns	

Refresh Cycle

Parameter	Symbol	VG26(V)(S)17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
$\overline{\text{CAS}}$ setup time (CBR refresh)	t_{CSR}	5	-	5	-	ns	
$\overline{\text{CAS}}$ hold time (CBR refresh)	t_{CHR}	8	-	10	-	ns	10
$\overline{\text{RAS}}$ precharge to $\overline{\text{CAS}}$ hold time	t_{RPC}	5	-	5	-	ns	7
$\overline{\text{RAS}}$ pulse width (self refresh)	t_{RASS}	100	-	100	-	μs	
$\overline{\text{RAS}}$ precharge time (self refresh)	t_{RPS}	90	-	110	-	ns	
$\overline{\text{CAS}}$ hold time (CBR self refresh)	t_{CHS}	-50	-	-50	-	ns	
$\overline{\text{WE}}$ setup time	t_{WSR}	0	-	0	-	ns	
$\overline{\text{WE}}$ hold time	t_{WHR}	10	-	10	-	ns	

EDO Page Mode Cycle

Parameter	Symbol	VG26(V)(S) 17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
EDO page mode cycle time	t _{PC}	20	-	25	-	ns	
EDO page mode $\overline{\text{CAS}}$ precharge time	t _{CP}	10	-	10	-	ns	
EDO page mode $\overline{\text{RAS}}$ pulse width	t _{RASP}	50	10 ⁵	60	10 ⁵	ns	20
Access time from $\overline{\text{CAS}}$ precharge	t _{CPA}	-	30	-	35	ns	10, 14
$\overline{\text{RAS}}$ hold time from $\overline{\text{CAS}}$ precharge	t _{CPRH}	30	-	35	-	ns	
$\overline{\text{OE}}$ high hold time from $\overline{\text{CAS}}$ high	t _{OEHC}	5	-	5	-	ns	
$\overline{\text{OE}}$ high pulse width	t _{OEP}	10	-	10	-	ns	
Data output hold time after $\overline{\text{CAS}}$ low	t _{COH}	5	-	5	-	ns	
Output disable delay from $\overline{\text{WE}}$	t _{WHZ}	3	10	3	10	ns	
$\overline{\text{WE}}$ pulse width for output disable when $\overline{\text{CAS}}$ high	t _{WPZ}	7	-	7	-	ns	

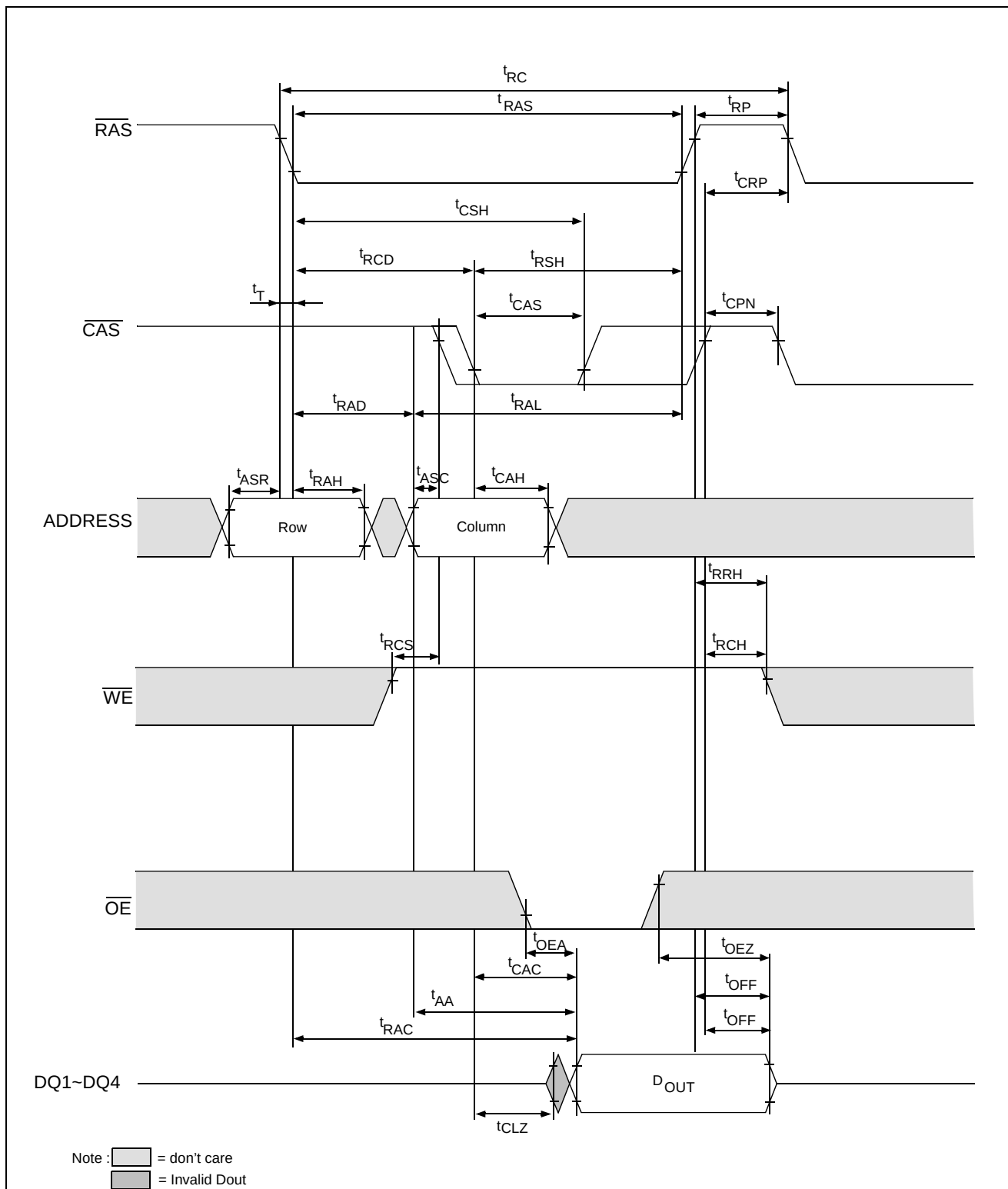
EDO Page Mode Read Modify Write Cycle

Parameter	Symbol	VG26(V)(S) 17405				Unit	Notes
		-5		-6			
		Min	Max	Min	Max		
EDO page mode <u>read</u> - modify- write cycle CAS precharge to WE delay time	t _{CPW}	45	-	55	-	ns	10
EDO page mode read- modify- write cycle time	t _{PRWC}	56	-	68	-	ns	

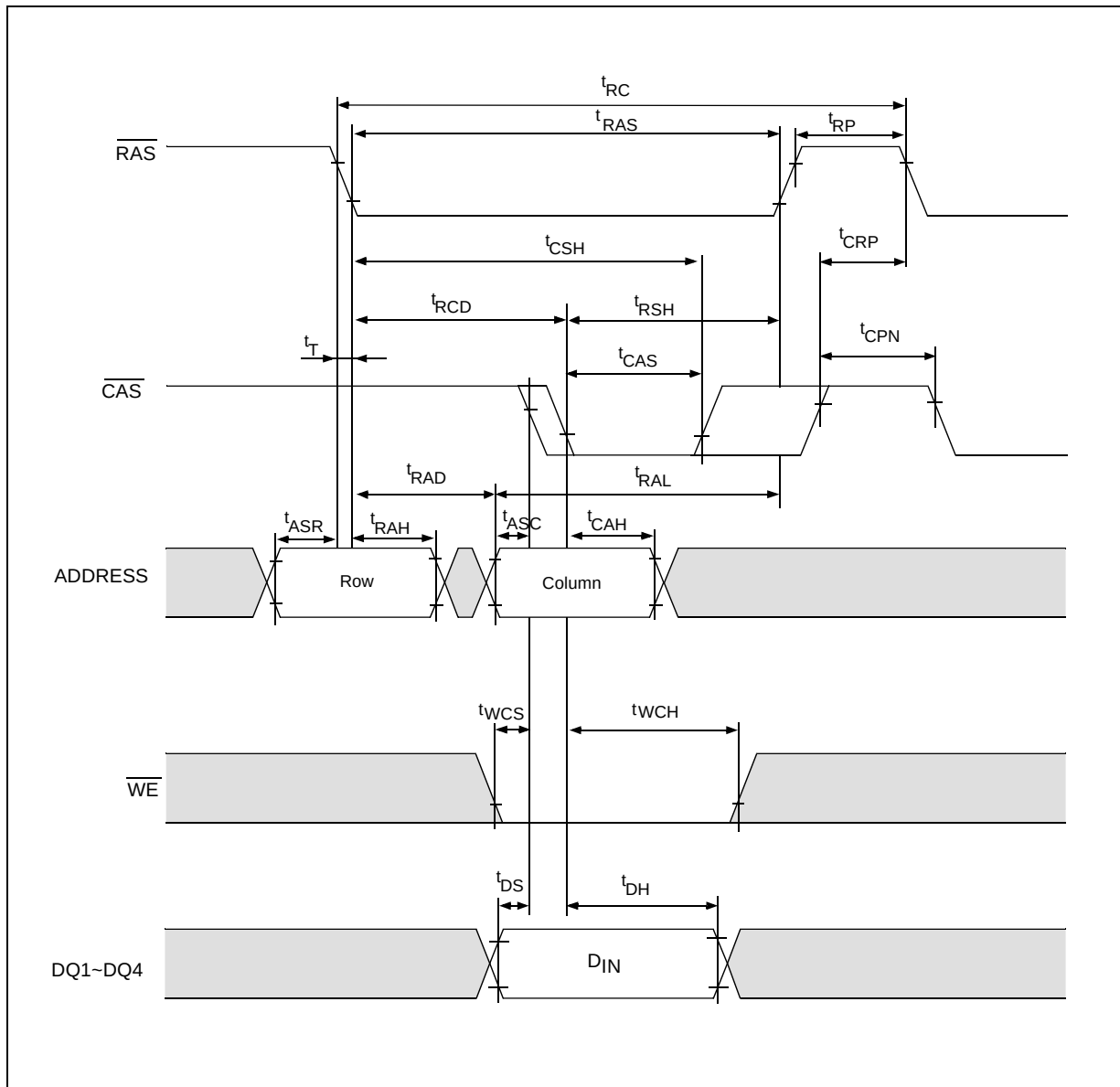
Notes :

1. AC measurements assume $t_T = 2\text{ns}$.
2. An initial pause of 100 μs is required after power up, and it followed by a minimum of eight initialization cycles ($\overline{\text{RAS}}$ - only refresh cycle or $\overline{\text{CAS}}$ - before - $\overline{\text{RAS}}$ refresh cycle). If the internal refresh counter is used, a minimum of eight $\overline{\text{CAS}}$ - before - $\overline{\text{RAS}}$ refresh cycles are required.
3. In delayed write or read-modify-write cycles, $\overline{\text{OE}}$ must disable output buffer prior to applying data to the device.
4. All the V_{CC} and V_{SS} pins shall be supplied with the same voltages.
5. $t_{\text{RAS}}(\text{min}) = t_{\text{RWD}}(\text{min}) + t_{\text{RWL}}(\text{min}) + t_T$ in read-modify-write cycle.
6. $t_{\text{CAS}}(\text{min}) = t_{\text{CWD}}(\text{min}) + t_{\text{CWL}}(\text{min}) + t_T$ in read-modify-write cycle.
7. $t_{\text{ASC}}(\text{min})$, $t_{\text{RCS}}(\text{min})$, $t_{\text{WCS}}(\text{min})$, and t_{RPC} are determined by the falling edge of $\overline{\text{CAS}}$.
8. $t_{\text{RCD}}(\text{max})$ is specified as a reference point only, and $t_{\text{RAC}}(\text{max})$ can be met with the $t_{\text{RCD}}(\text{max})$ limit. Otherwise, t_{RAC} is controlled exclusively by t_{CAC} if t_{RCD} is greater than the specified $t_{\text{RCD}}(\text{max})$ limit.
9. $t_{\text{RAD}}(\text{max})$ is specified as a reference point only, and $t_{\text{RAC}}(\text{max})$ can be met with the $t_{\text{RAD}}(\text{max})$ limit. Otherwise, t_{RAC} is controlled exclusively by t_{AA} if t_{RAD} is greater than the specified $t_{\text{RAD}}(\text{max})$ limit.
10. t_{CRP} , t_{CHR} , t_{RCH} , t_{CPA} and t_{CPW} are determined by the rising edge of $\overline{\text{CAS}}$.
11. $V_{\text{IH}}(\text{min})$ and $V_{\text{IL}}(\text{max})$ are reference levels for measuring timing or input signals. Therefore, transition time is measured between V_{IH} and V_{IL} .
12. Assumes that $t_{\text{RCD}} \leq t_{\text{RCD}}(\text{max})$ and $t_{\text{RAD}} \leq t_{\text{RAD}}(\text{max})$. If t_{RCD} or t_{RAD} is greater than the maximum recommended value shown in this table, t_{RAC} exceeds the value shown.
13. Assumes that $t_{\text{RCD}} \geq t_{\text{RCD}}(\text{max})$ and $t_{\text{RAD}} \leq t_{\text{RAD}}(\text{max})$.
14. Access time is determined by the maximum of t_{AA} , t_{CAC} , t_{CPA} .
15. Assumes that $t_{\text{RCD}} \leq t_{\text{RCD}}(\text{max})$ and $t_{\text{RAD}} \geq t_{\text{RAD}}(\text{max})$.
16. Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.
17. $t_{\text{OFF}}(\text{max})$ and $t_{\text{OEZ}}(\text{max})$ define the time at which the output achieves the open circuit condition (high impedance). t_{OFF} is determined by the later rising edge of $\overline{\text{RAS}}$ or $\overline{\text{CAS}}$.
18. t_{WCS} , t_{RWD} , t_{CWD} , and t_{AWD} are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If $t_{\text{WCS}} \geq t_{\text{WCS}}(\text{min})$, the cycle is an early write cycle and the data out will remain open circuit (high impedance) throughout the entire cycle. If $t_{\text{RWD}} \geq t_{\text{RWD}}(\text{min})$, $t_{\text{CWD}} \geq t_{\text{CWD}}(\text{min})$, $t_{\text{AWD}} \geq t_{\text{AWD}}(\text{min})$ and $t_{\text{CPW}} \geq t_{\text{CPW}}(\text{min})$, the cycle is a read-modify-write and the data output will contain data read from the selected cell. If neither of the above sets of conditions is satisfied, the condition of the data output (at access time) is indeterminate.
19. These parameters are referenced to $\overline{\text{CAS}}$ separately in an early write cycle and to $\overline{\text{WE}}$ edge in a delayed write or a read-modify-write cycle.
20. t_{RASP} defines $\overline{\text{RAS}}$ pulse width in EDO page mode cycles.

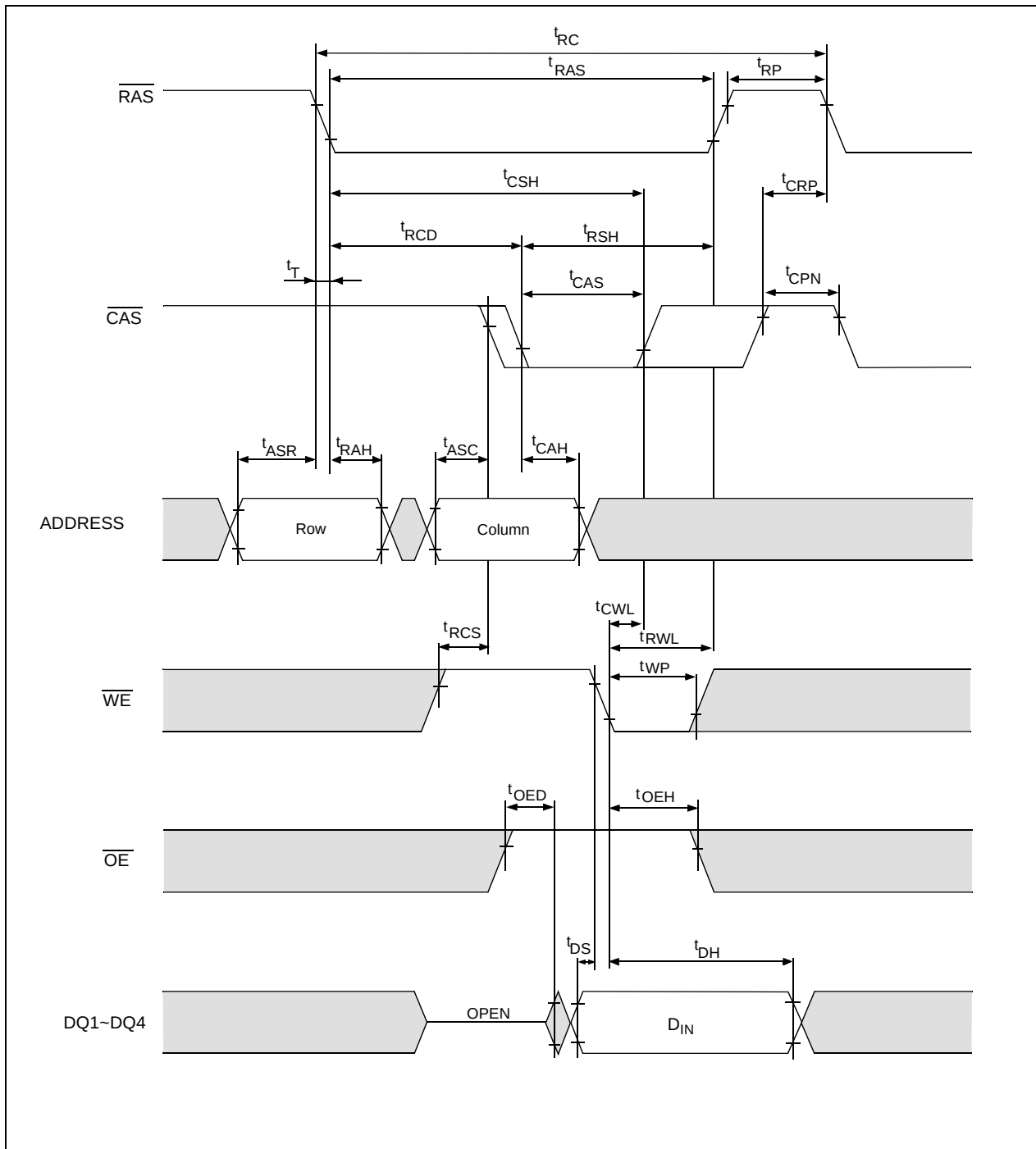
Timing Waveforms • Read Cycle



•Early Write Cycle



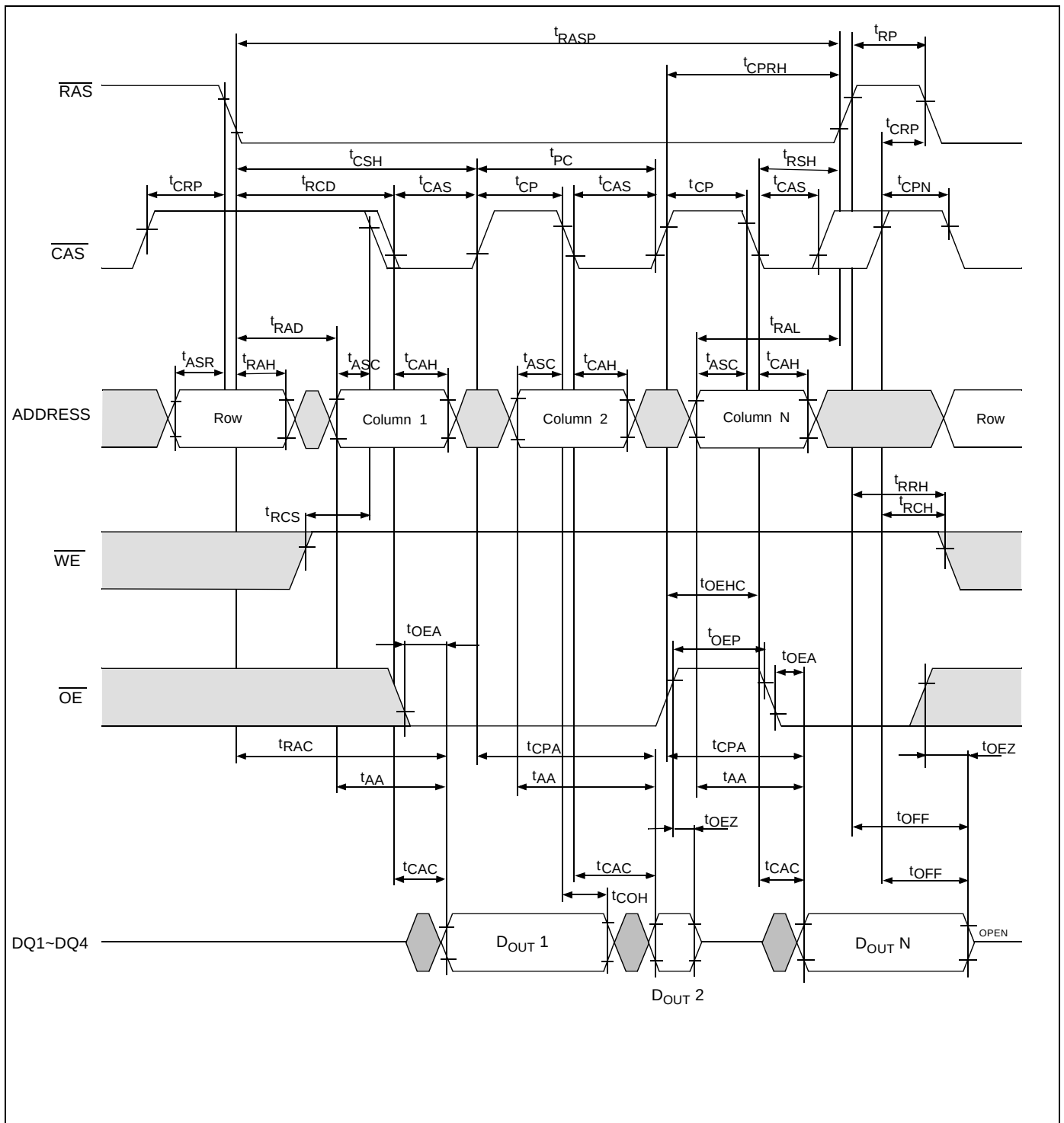
• Delayed Write Cycle



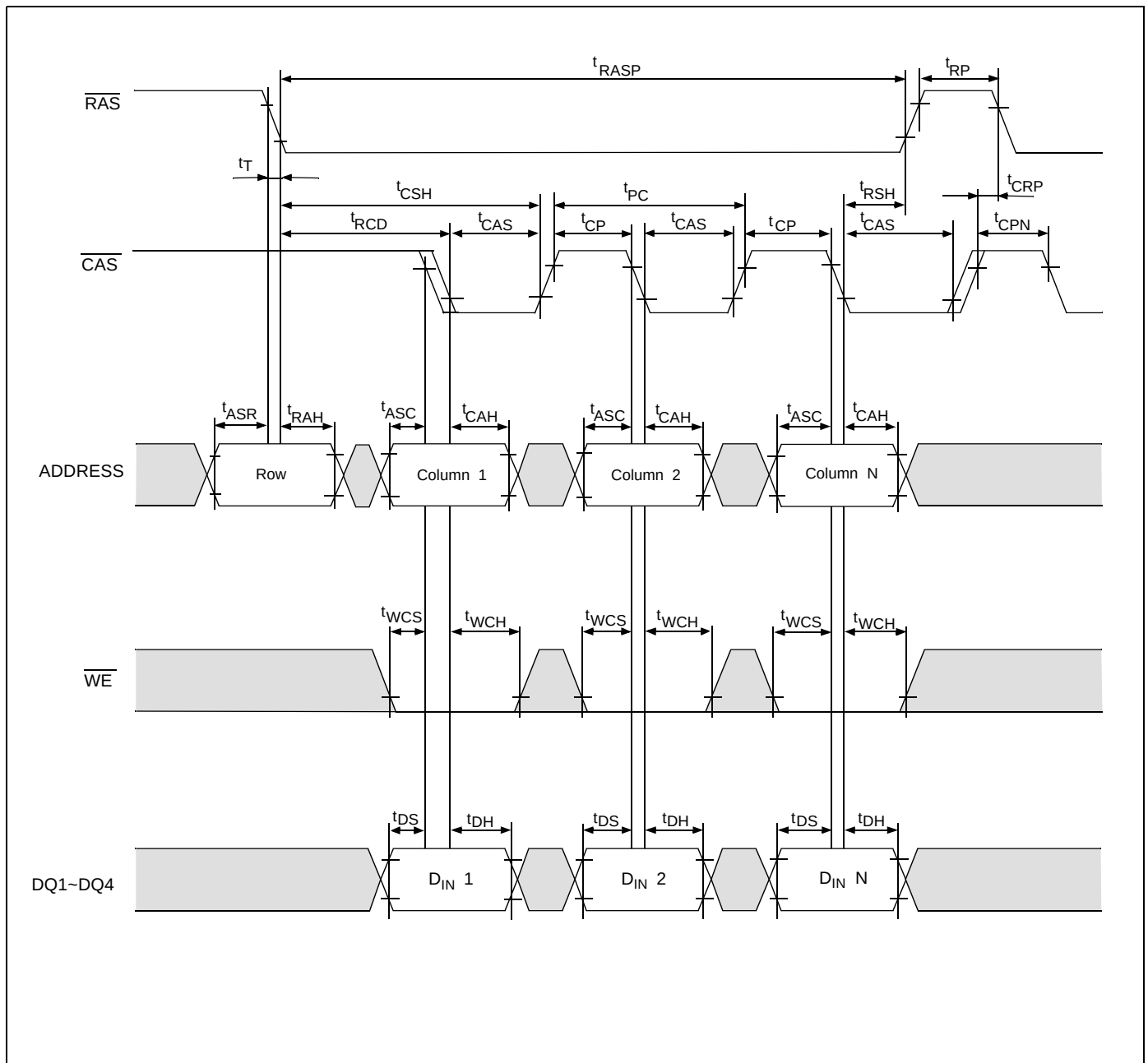
The diagram illustrates the timing relationships for a DRAM device. The signals shown are $\overline{\text{RAS}}$, $\overline{\text{CAS}}$, ADDRESS, $\overline{\text{WE}}$, DQ1-DQ4, and $\overline{\text{OE}}$. The timing parameters are defined as follows:

- t_T : Turn-on time for $\overline{\text{RAS}}$.
- t_{RWC} : Row write cycle time.
- t_{RAS} : Row address strobe pulse width.
- t_{RP} : Row precharge time.
- t_{RCD} : Row to column delay.
- t_{CAS} : Column address strobe pulse width.
- t_{CRP} : Column precharge time.
- t_{CPN} : Column precharge time to next row.
- t_{ASR} : Address strobe to row delay.
- t_{RAH} : Row address hold time.
- t_{ASC} : Address strobe to column delay.
- t_{CAH} : Column address hold time.
- t_{RCS} : Row to column strobe delay.
- t_{CWD} : Column write delay.
- t_{AWD} : Address write delay.
- t_{RWD} : Row write delay.
- t_{WP} : Write pulse width.
- t_{DZC} : Data zone change delay.
- t_{DS} : Data strobe delay.
- t_{DH} : Data hold time.
- t_{DZO} : Data zone output delay.
- t_{OEA} : Output enable to address delay.
- t_{CAC} : Output enable to column address delay.
- t_{AA} : Output enable to address delay.
- t_{RAC} : Row address to column address delay.
- t_{OED} : Output enable delay.
- t_{OEZ} : Output enable to zero delay.
- t_{OEHL} : Output enable to high level delay.
- t_{OEEL} : Output enable to low level delay.

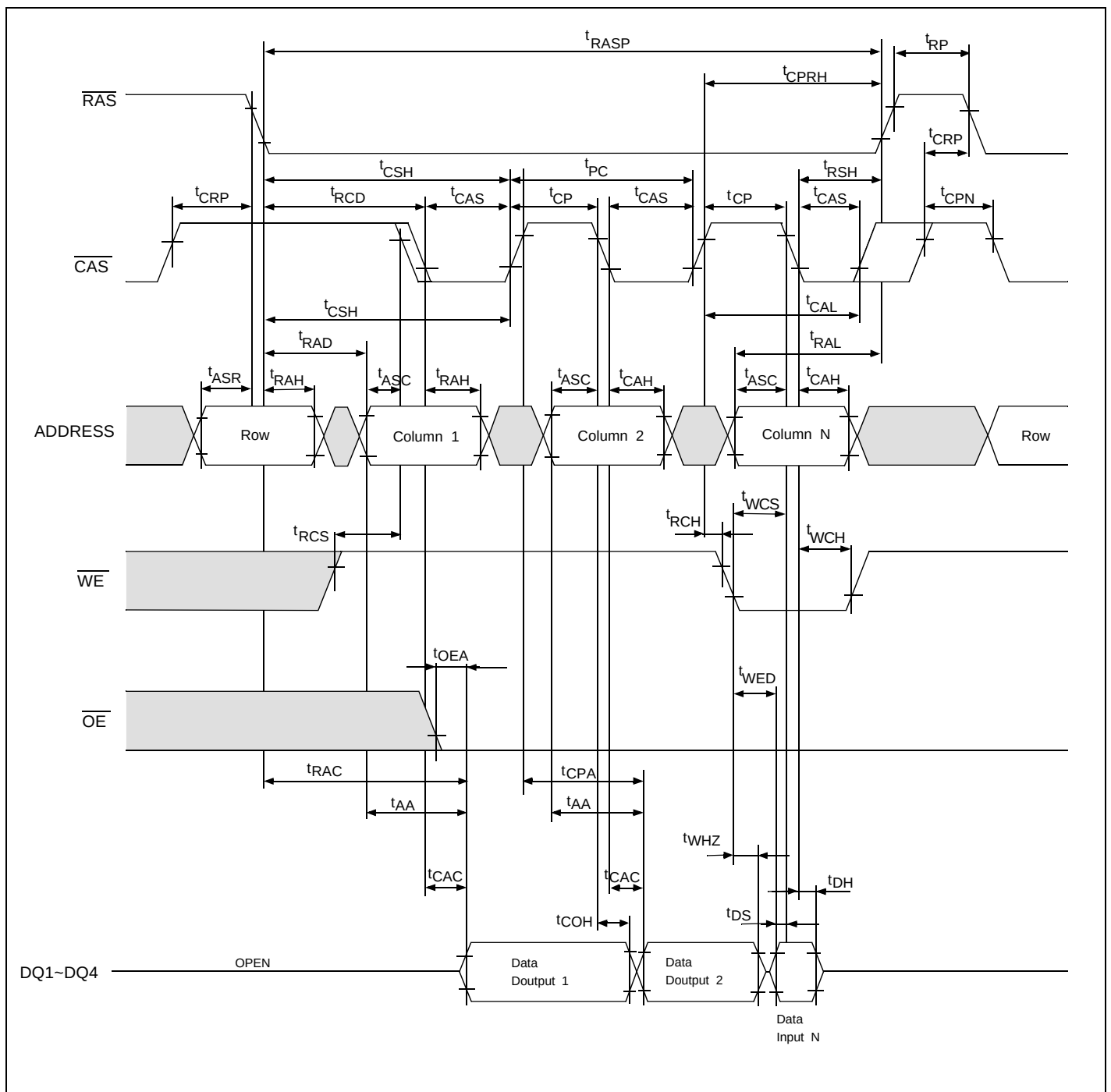
• EDO Page Mode Read Cycle



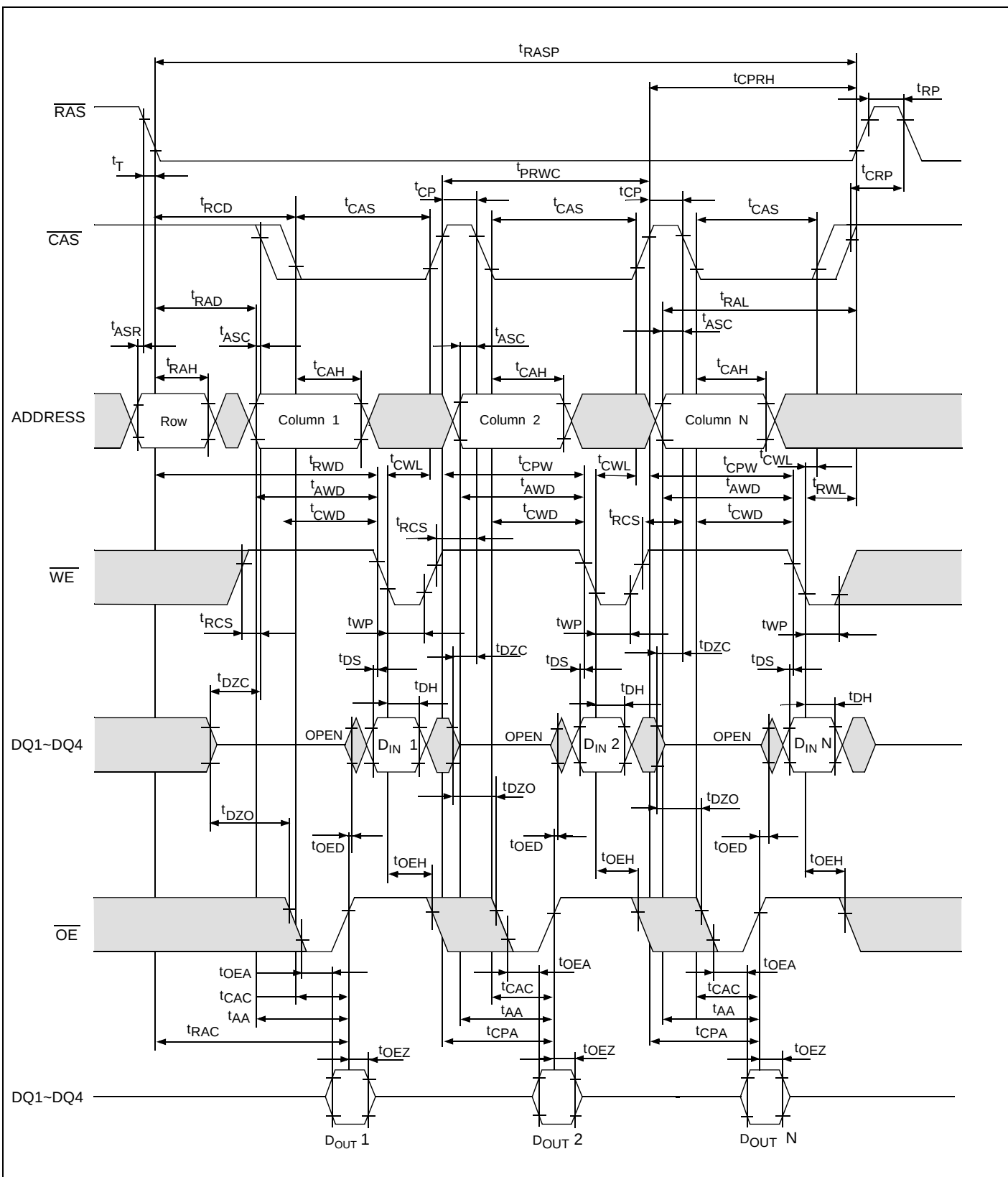
• EDO Page Mode Early Write Cycle



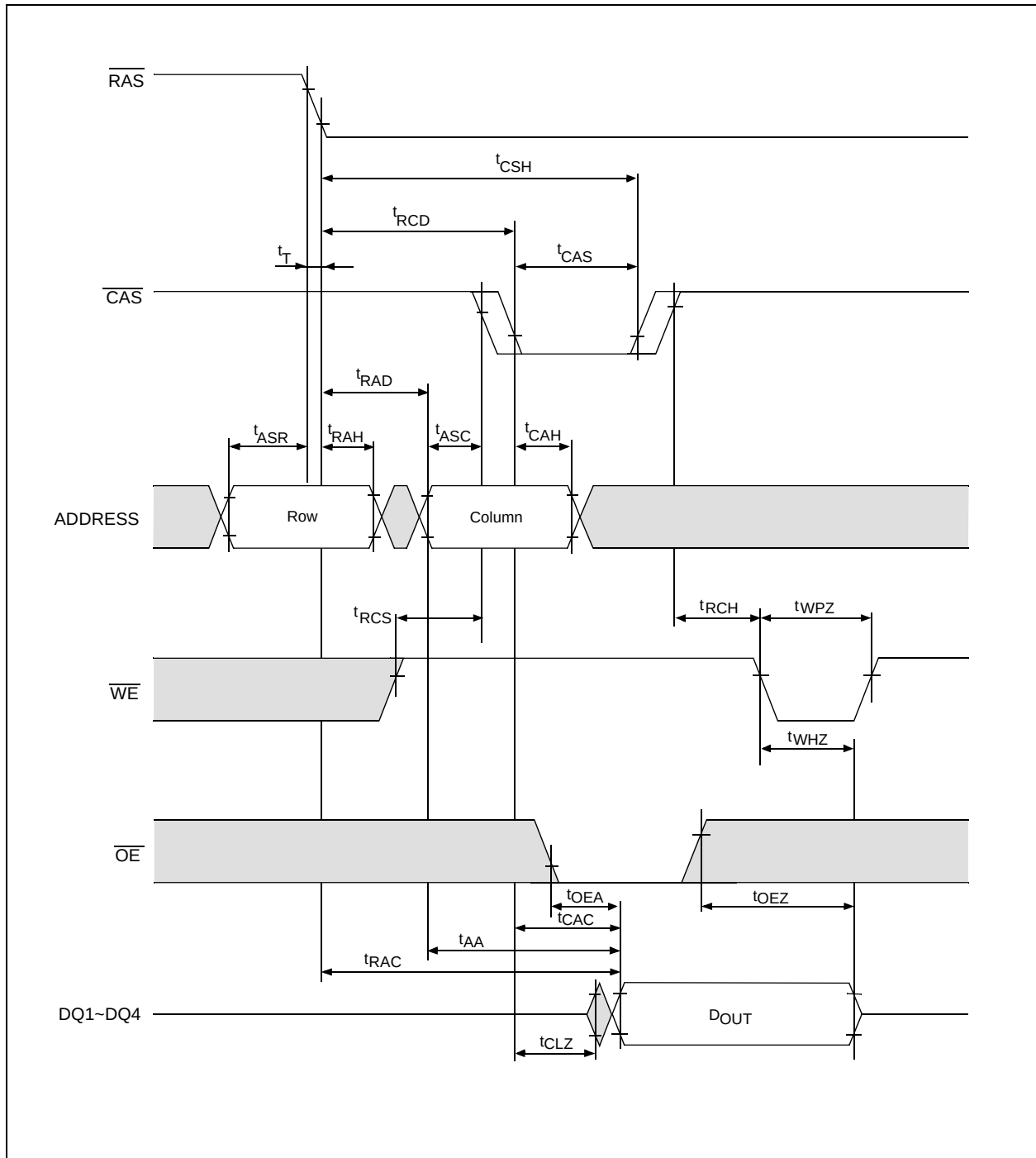
- EDO Page Mode Read-Early-Write Cycle



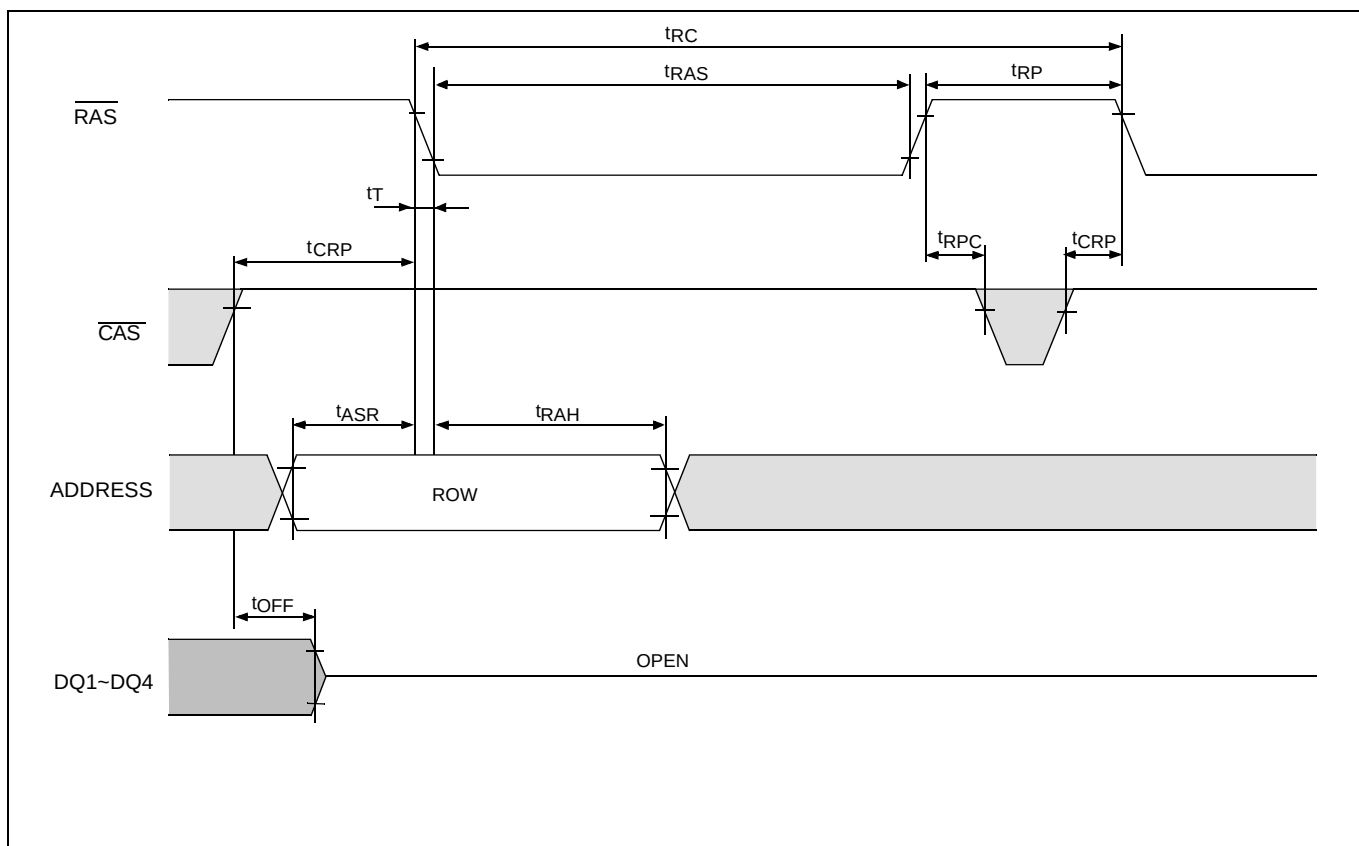
• EDO Page Mode Read-Modify-Write Cycle



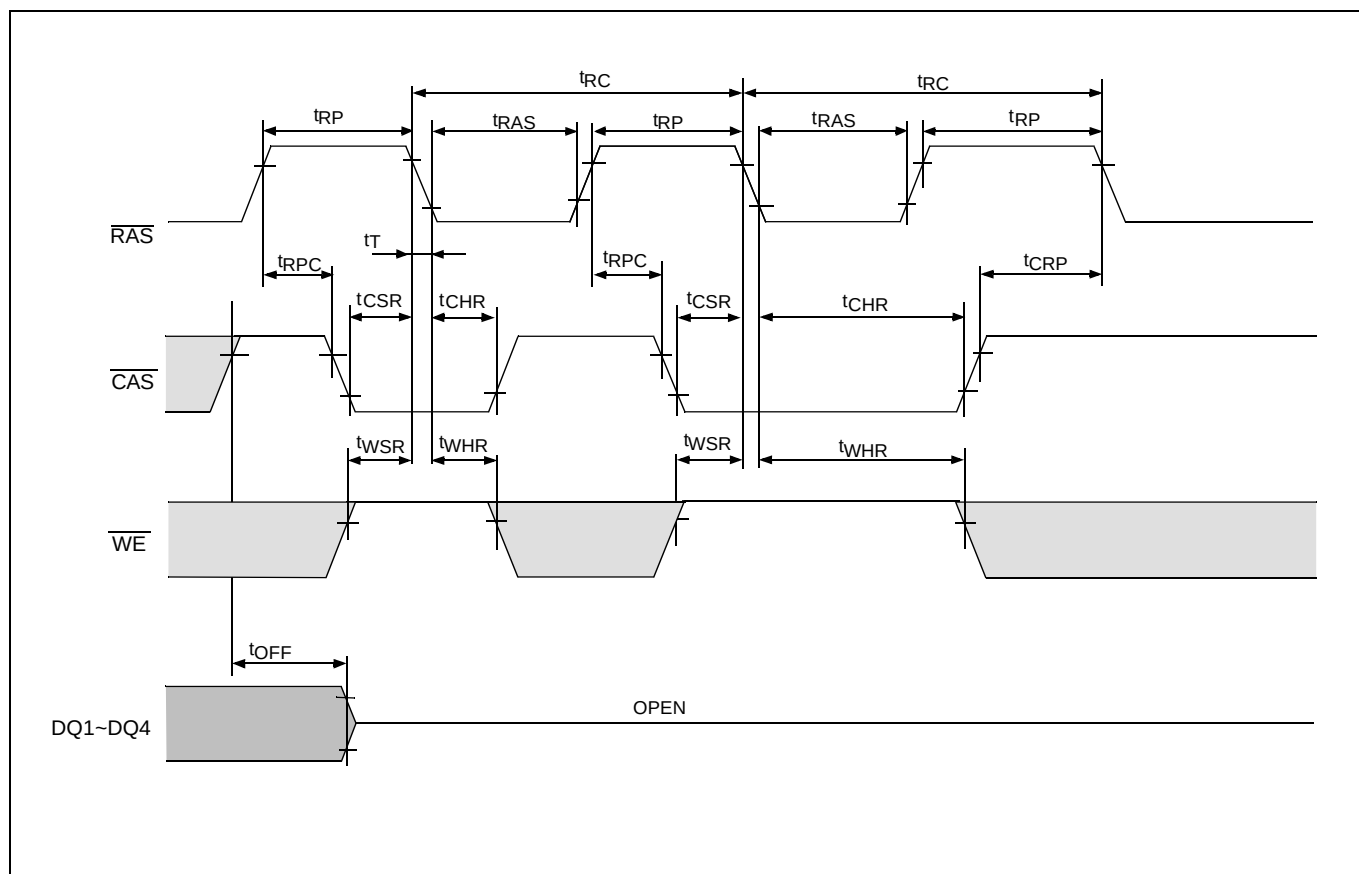
• Read Cycle with $\overline{WE}$ Controlled Disable



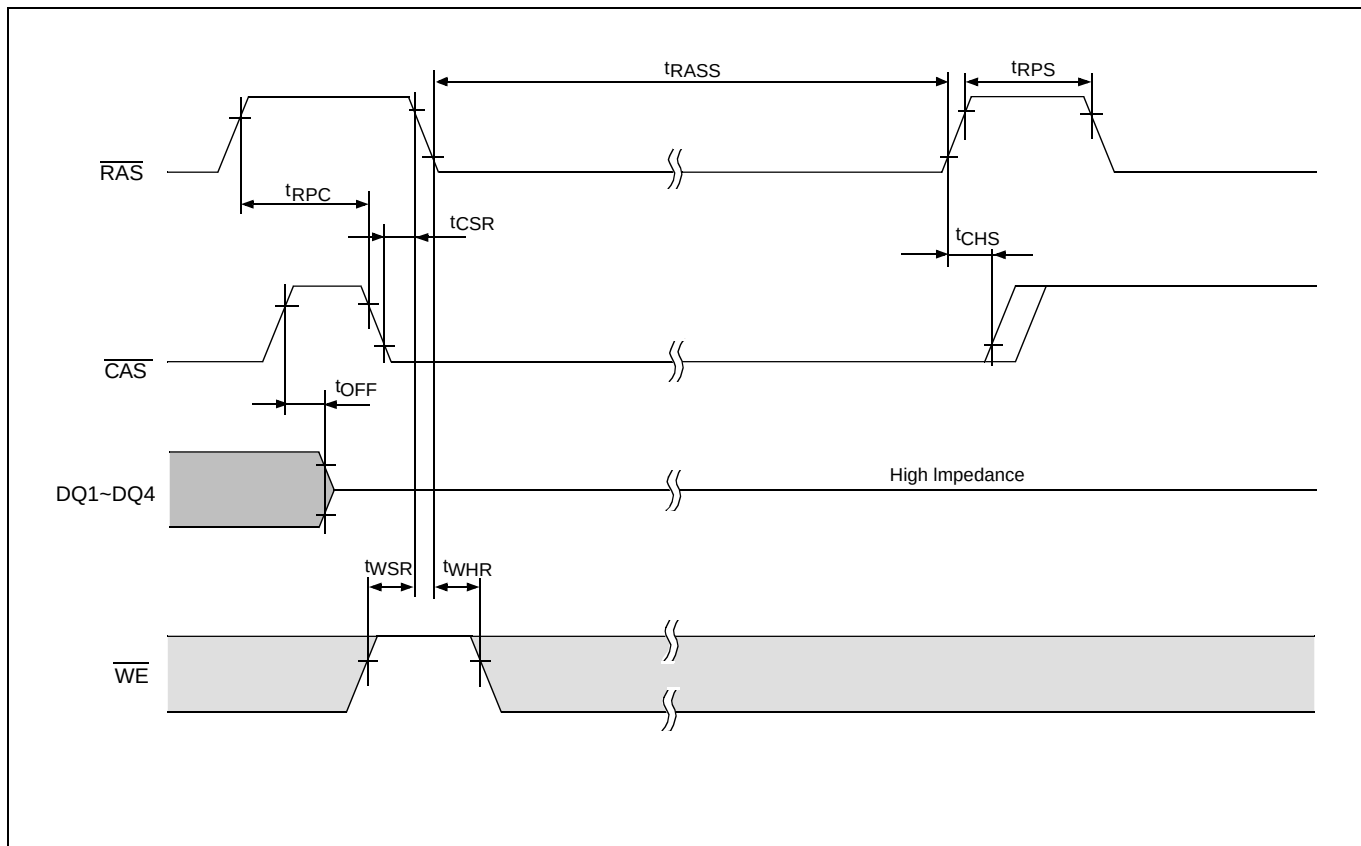
RAS-Only Refresh Cycle



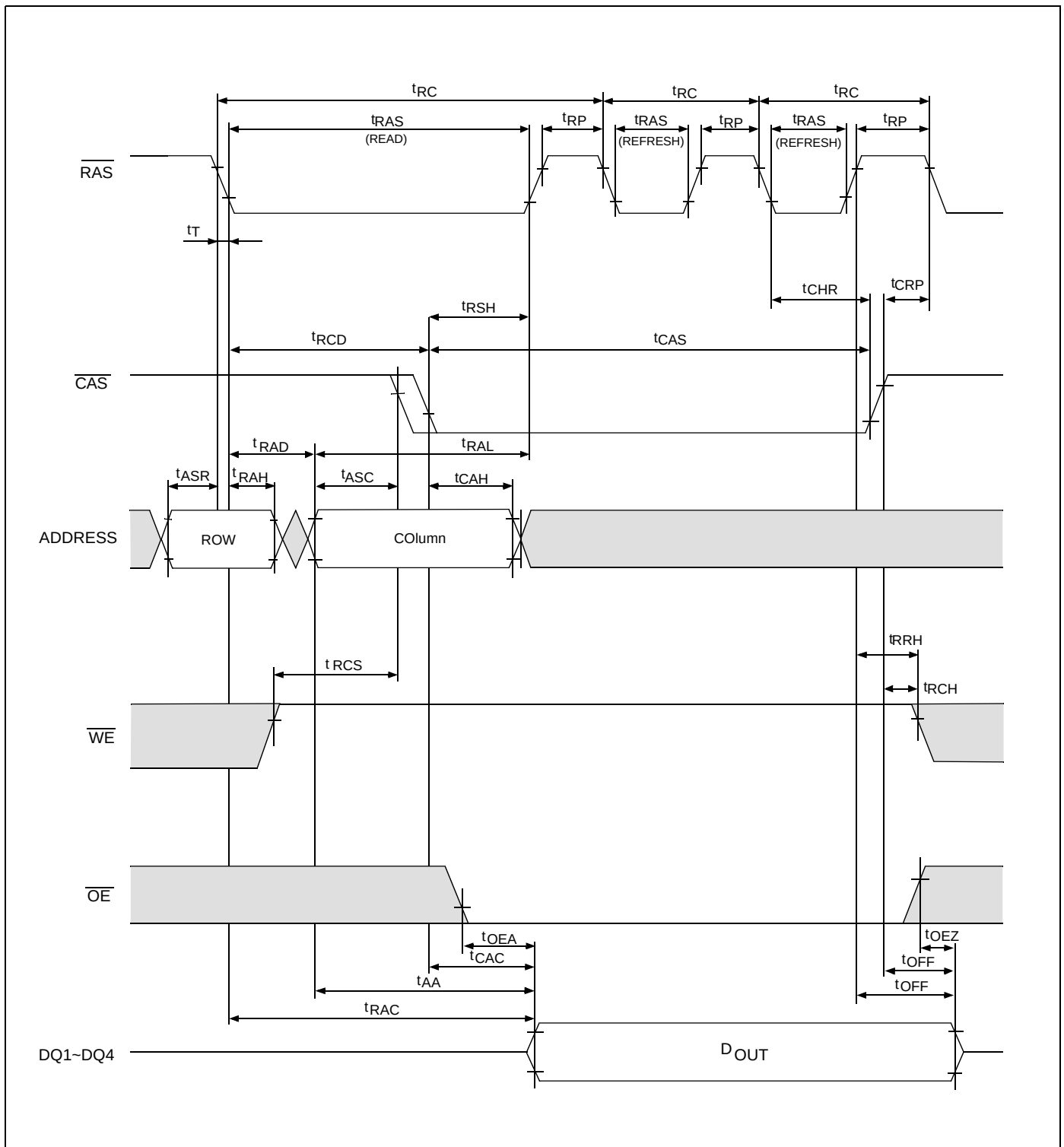
CAS-Before-RAS Refresh Cycle



CBR Self-Refresh Cycle



• Hidden Refresh Cycle



Ordering information

Part Number	Access time	Package
VG26(V)(S)17405DJ-5	50 ns	300mil 26/24-Pin Plastic SOJ
VG26(V)(S)17405DJ-6	60 ns	
VG26(V)(S)17405EJ-5	50 ns	
VG26(V)(S)17405EJ-6	60 ns	

VG26(V)(S) 17405EJ-5

- VG → • VIS Memory Product
- 26 → • Technology
- V → • 3.3V Version
- S → • Self refresh
- 17405 → • Device Type and Configuration
- E → • Revision
- J → • Package Type (J : SOJ, T : TSOP II)
- 5 → • Speed (5 : 50 ns, 6 : 60 ns)

Packaging information

- 300 mil, 26/24-Pin Plastic SOJ

