

TC518128BPL/BSPL/BFL/BFWL/BFTL-70/80/10 TC518128BPL/BSPL/BFL/BFWL/BFTL-70L/80L/10L

SILICON GATE CMOS

131,072 WORD x 8 BIT CMOS PSEUDO STATIC RAM

Description

The TC518128B is a 1M bit high speed CMOS pseudo static RAM organized as 131,072 words by 8 bits. The TC518128B utilizes a one transistor dynamic memory cell with CMOS peripheral circuitry to provide high capacity, high speed and low power storage. The TC518128B operates from a single 5V power supply. Refreshing is supported by a refresh (RFSH) input which enables two types of refreshing - auto refresh and self refresh. The TC518128B features a static RAM-like interface with a write cycle in which the input data is written into the memory cell at the rising edge of R/W thus simplifying the microprocessor interface.

The TC518128B is pin-compatible with the 1M bit CMOS static RAM JEDEC standard and is available in a 32-pin, 0.6 inch and 0.3 inch width plastic DIP, a small outline plastic flat package, and a 32-pin thin small outline plastic package (forward type).

Features

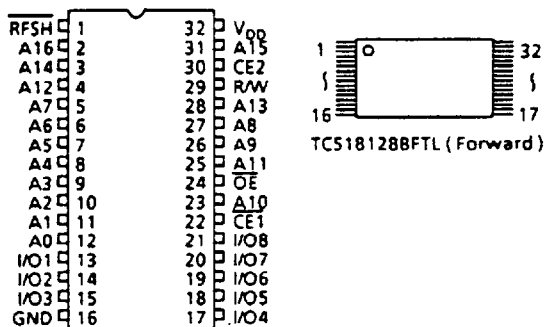
- Organization: 131,072 words x 8 bits
- Single 5V power supply
- Fast access time

	TC518128B Family		
	-70	-80	-10
t _{CEA} CE Access Time	70ns	80ns	100ns
t _{OE} OE Access Time	25ns	30ns	40ns
t _{RC} Cycle Time	115ns	130ns	160ns
Power Dissipation	385mW	330mW	275mW
Self Refresh Current	200µA (L version) 50µA (LL version)		

- Auto refresh is supported by an internal refresh address counter
- Self refresh is supported by an internal timer
- Inputs and outputs TTL compatible
- Refresh: 512 refresh cycles/8ms
- Auto refresh power down feature
- Pin compatible: 1M SRAM (JEDEC)
- Package

- TC518128BPL : DIP32-P-600
- TC518128BFL : SOP32-P-450
- TC518128BSPL : DIP32-P-300
- TC518128BFWL : SOP32-P-525
- TC518128BFTL : TSOP32-P-0820

Pin Connection (Top View)



TC518128BPL/BFL/BSPL/BFWL

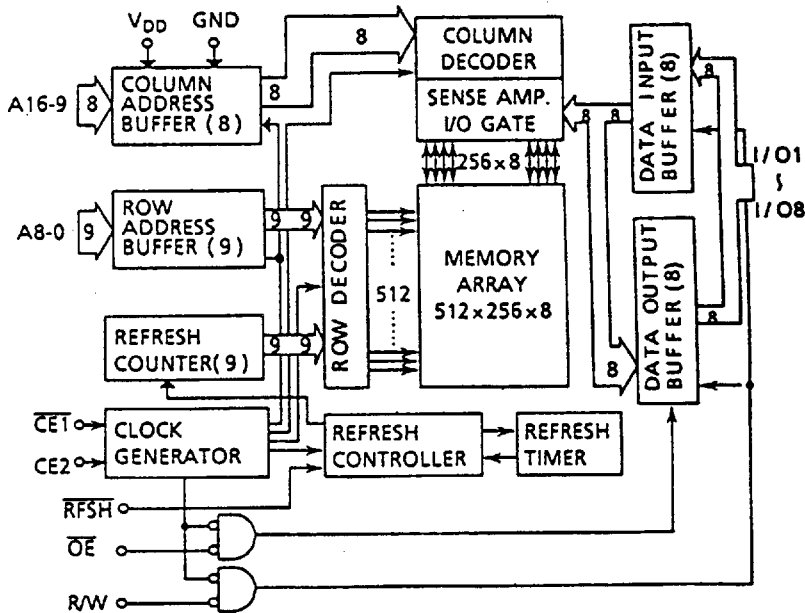
Pin Names

A0 ~ A16	Address Inputs
R/W	Read/Write Control Input
OE	Output Enable Input
RFSH	Refresh Input
CE1, CE2	Chip Enable Inputs
I/O1 ~ I/O8	Data Inputs/Outputs
V _{DD}	Power
GND	Ground

(TSOP)

PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PIN NAME	A ₁₁	A ₉	A ₈	A ₁₃	R/W	CE2	A ₁₅	V _{DD}	RFSH	A ₁₆	A ₁₄	A ₁₂	A ₇	A ₆	A ₅	A ₄
PIN NO.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
PIN NAME	A ₃	A ₂	A ₁	A ₀	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	CE1	A ₁₀	OE

Block Diagram



Operating Mode

MODE \ PIN	CE1	CE2	OE	R/W	RFSH	A0 ~ A16	I/O1 ~ 8
Read	L	H	L	H	*	V*	OUT
Write	L	H	*	L	*	V*	IN
CE only Refresh	L	H	H	H	*	V*	HZ
Auto/Self Refresh	H	*	*	*	L	*	HZ
Auto/Self Refresh	*	L	*	*	L	*	HZ
Standby	H	*	*	*	H	*	HZ
Standby	*	L	*	*	H	*	HZ

H = High level input (V_{IH})

L = Low level input (V_{IL})

* = V_{IH} or V_{IL}

V* = At the falling edge of $\overline{CE1}$ ($CE2 = H$) or the rising edge of $CE2$ ($\overline{CE1} = L$), all address inputs are latched. At all other times, the address inputs are ***.

HZ = High impedance

Maximum Ratings

SYMBOL	ITEM	RATING	UNIT	NOTES
V_{IN}	Input Voltage	-1.0 ~ 7.0	V	1
V_{OUT}	Output Voltage	-1.0 ~ 7.0	V	
V_{DD}	Power Supply Voltage	-1.0 ~ 7.0	V	
T_{OPR}	Operating Temperature	0 ~ 70	°C	
T_{STRG}	Storage Temperature	-55 ~ 150	°C	
T_{SOLDER}	Soldering Temperature • Time	260 • 10	°C • sec	
P_D	Power Dissipation	600	mW	
I_{OUT}	Short Circuit Output Current	50	mA	

DC Recommended Operating Conditions

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT	NOTES
V _{DD}	Power Supply Voltage	4.5	5.0	5.5	V	2
V _{IH}	Input High Voltage	2.4	-	V _{DD} + 1.0	V	
V _{IL}	Input Low Voltage	-1.0	-	0.8	V	

DC Characteristics (Ta = 0 ~ 70°C, V_{DD} = 5V±10%)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT	NOTES	
I _{DDO}	Operating Current (Average) CE1, CE2, Address cycling: t _{RC} = t _{RC} min.	70ns version	-	50	70	mA	3,4
		80ns version	-	40	60		
		100ns version	-	35	50		
I _{DDs1}	Standby Current CE1 = V _{IH} or CE2 = V _{IL} , RFSH = V _{IH}	-	-	1	mA		
I _{DDs2}	Standby Current CE1 = V _{DD} - 0.2V or CE2 = 0.2V, RFSH = V _{DD} - 0.2V	L version	-	100	200	μA	
		LL version	-	35	50	μA	
I _{DDf1}	Self Refresh Current (Average) CE1 = V _{IH} or CE2 = V _{IL} , RFSH = V _{IL}	-	-	1	mA		
I _{DDf2}	Self Refresh Current (Average) CE1 = V _{DD} - 0.2V or CE2 = 0.2V, RFSH = 0.2V	L version	-	100	200	μA	
		LL version	-	35	50	μA	
I _{DDf3}	Auto Refresh Current (Average) RFSH cycling: t _{FC} = t _{FC} min	-	-	2	mA		
I _{DDf4}	CE only Refresh Current (Average) CE1, CE2, Address cycling: t _{RC} = t _{RC} min.	70ns version	-	50	70	mA	3
		80ns version	-	40	60		
		100ns version	-	35	50		
I _{I(L)}	Input Leakage Current 0V ≤ V _{IN} ≤ V _{DD} , All other Inputs not under test = 0V	-	-	±10	μA		
I _{O(L)}	Output Leakage Current Output Disabled (CE1 = V _{IH} or CE2 = V _{IL} or OE = V _{IH} or R/W = V _{IL}), 0V ≤ V _{OUT} ≤ V _{DD}	-	-	±10	μA		
V _{OH}	Output High Level I _{OH} = -1mA	2.4	-	-	V		
V _{OL}	Output Low Level I _{OL} = 2.1mA	-	-	0.4	V		

Note: For I_{DDs1} and I_{DDf1} with CE1 = V_{IH} (CE2 = V_{IL}), the specified limits are guaranteed under the condition CE2 = V_{IH} or CE2 = V_{IL} (CE1 = V_{IH} or CE1 = V_{IL}).
For I_{DDs2} and I_{DDf2} with CE1 ≥ V_{DD} - 0.2V (CE2 ≤ 0.2V), the specified limits are guaranteed under the condition CE2 ≥ V_{DD} - 0.2V or CE2 ≤ 0.2V (CE1 ≥ V_{DD} - 0.2V or CE1 ≤ 0.2V).

Capacitance* (V_{DD} = 5V, Ta = 25°C, f = 1MHz)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
C _{I1}	Input Capacitance (A0 ~ A16)	-	5	pF
C _{I2}	Input Capacitance (CE1, CE2, OE, R/W, RFSH)	-	7	
C _{IO}	Input/Output Capacitance	-	7	

*This parameter is periodically sampled and is not 100% tested.

AC Characteristics (Ta = 0 ~ 70°C, VDD = 5V±10%) (Notes: 5, 6, 7, 8)

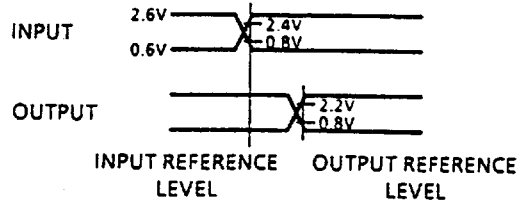
SYMBOL	PARAMETER	-70		-80		-10		UNIT	NOTES
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
t _{RC}	Random Read, Write Cycle Time	115	–	130	–	160	–		
t _{RMW}	Read Modify Write Cycle Time	160	–	180	–	220	–		
t _{CE}	CE Pulse Width	70	10,000	80	10,000	100	10,000		13
t _p	CE Precharge Time	35	–	40	–	50	–		
t _{CEA}	CE Access Time	–	70	–	80	–	100		
t _{OEa}	\overline{OE} Access Time	–	25	–	30	–	40		
t _{CLZ}	CE to Output in Low-Z	20	–	20	–	20	–		
t _{OLZ}	\overline{OE} to Output in Low-Z	0	–	0	–	0	–		
t _{WLZ}	Output Active from End of Write	0	–	0	–	0	–		
t _{CHZ}	Chip Disable to Output in High-Z	0	20	0	20	0	25		9
t _{OHZ}	\overline{OE} Disable to Output in High-Z	0	20	0	20	0	25		9
t _{WHZ}	Write Enable to Output in High-Z	0	25	0	25	0	30		9
t _{ODS}	\overline{OE} Output Disable Setup Time	0	–	0	–	0	–		
t _{ODH}	\overline{OE} Output Disable Hold Time	10	–	10	–	10	–		
t _{RCS}	Read Command Setup Time	0	–	0	–	0	–		
t _{RCH}	Read Command Hold Time	0	–	0	–	0	–	ns	
t _{WP}	Write Pulse Width	20	–	25	–	30	–		
t _{WCH}	Write Command Hold Time	35	10,000	40	10,000	50	10,000		
t _{CWL}	Write Command to CE Lead Time	20	10,000	25	10,000	30	10,000		
t _{DSW}	Data Setup Time from R/W	15	–	20	–	25	–		10
t _{DSC}	Data Setup Time from CE	15	–	20	–	25	–		10
t _{DHW}	Data Hold Time from R/W	0	–	0	–	0	–		10
t _{DHC}	Data Hold Time from CE	0	–	0	–	0	–		10
t _{ASC}	Address Setup Time	0	–	0	–	0	–		11
t _{AHC}	Address Hold Time	20	–	25	–	30	–		11
t _{RHC}	\overline{RFSH} Command Hold Time	15	–	15	–	15	–		
t _{FC}	Auto Refresh Cycle Time	115	–	130	–	160	–		
t _{RFD}	\overline{RFSH} Delay Time from CE	35	–	40	–	50	–		
t _{FAP}	\overline{RFSH} Pulse Width (Auto Refresh)	30	8,000	30	8,000	30	8,000		12
t _{FP}	\overline{RFSH} Precharge Time	30	–	30	–	30	–		12
t _{FAS}	\overline{RFSH} Pulse Width (Self Refresh)	8,000	–	8,000	–	8,000	–		12
t _{FRS}	CE Delay Time from \overline{RFSH} (Self Refresh)	160	–	160	–	190	–		12
t _{REF}	Refresh Period (512 cycles, A0 ~ A8)	–	8	–	8	–	8	ms	
t _T	Transition Time (Rise and Fall)	3	50	3	50	3	50	ns	
t _{CES}	CE2 Low Setup Time	5	–	5	–	5	–	ns	14
t _{CEH}	CE2 Low Hold Time	5	–	5	–	5	–	ns	14

Notes:

- 1) Stress greater than those listed under "Maximum Ratings" may cause permanent damage to the device.
- 2) All voltages are referenced to GND.
- 3) I_{DD0} and I_{DD4} depend on the cycle time.
- 4) I_{DD0} depends on the output loading. Specified values are obtained with the outputs open.
- 5) An initial pause of 100 μ s with high $\overline{CE1}$ or low CE2 is required after power-up before proper device operation is achieved.
- 6) AC measurements assume $t_T = 5$ ns.

7) Timing reference levels:

Input Levels	:	$V_{IH} = 2.6V$ $V_{IL} = 0.6V$
Input Reference Levels	:	$V_{IH} = 2.4V$ $V_{IL} = 0.8V$
Output Reference Levels	:	$V_{OH} = 2.2V$ $V_{OL} = 0.8V$



- 8) Measured with a load equivalent to 1 TTL load and 100pF.
- 9) t_{CHZ} , t_{OHZ} , t_{WHZ} define the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
- 10) For write cycles, the input data is latched at the earlier of R/W or $\overline{CE1}$ rising edge (CE2 falling edge). Therefore, the input data must be valid during the setup time (t_{DSW} or t_{DSC}) and hold time (t_{DHW} or t_{DHC}).
- 11) All address inputs are latched at the falling edge of $\overline{CE1}$ (rising edge of CE2). Therefore, all the address inputs must be valid during t_{ASC} and t_{AHC} .
- 12) The two refresh operations, auto refresh and self refresh, are defined by the \overline{RFSH} pulse width under the condition $\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$.

- Auto refresh : \overline{RFSH} pulse width $\leq t_{FAP}$ (max.)
- Self refresh : \overline{RFSH} pulse width $\geq t_{FAS}$ (min.)

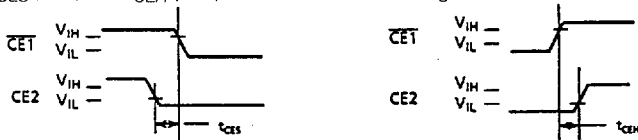
The timing parameter t_{FRS} must be met for proper device operation under the following conditions:

- after self refresh
- if $\overline{RFSH} = "L"$ after power-up

- 13) The timings, t_{CE} (min.) and t_{CE} (max.) must be met for proper device operation.

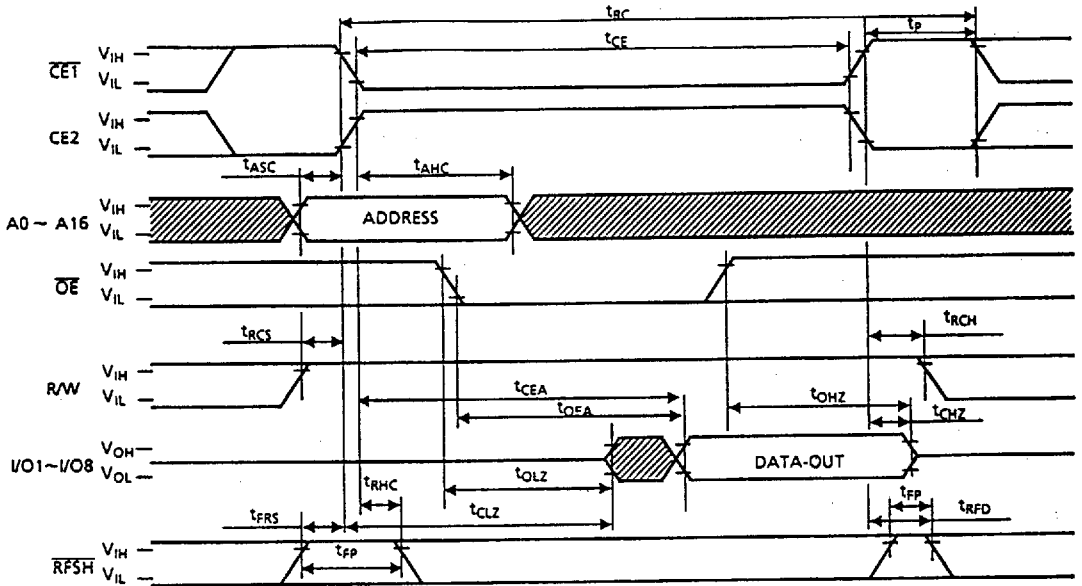


- 14) The timings, t_{CES} (min.) and t_{CEH} (min.) must be met when using $\overline{CE1}$ and CE2 as shown below.

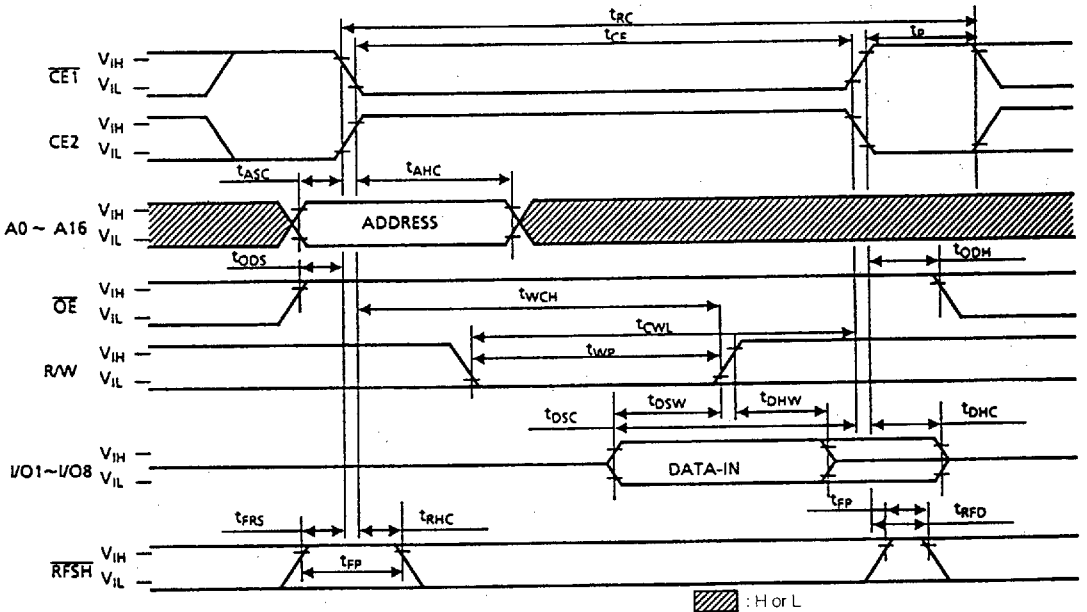


Timing Waveforms

Read Cycle

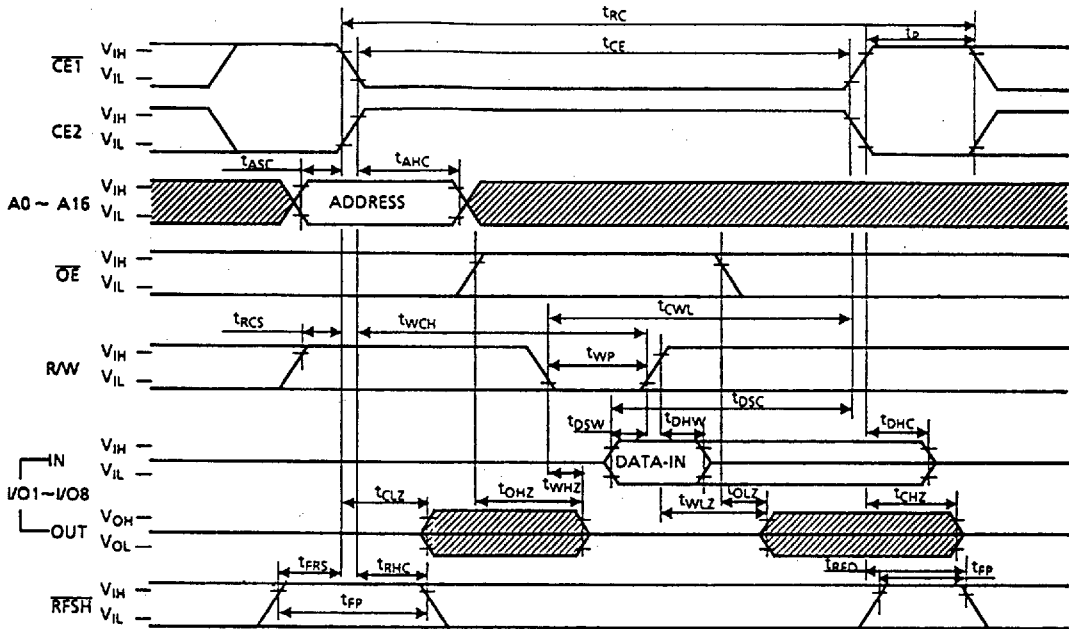


Write Cycle 1 (OE Fixed High)

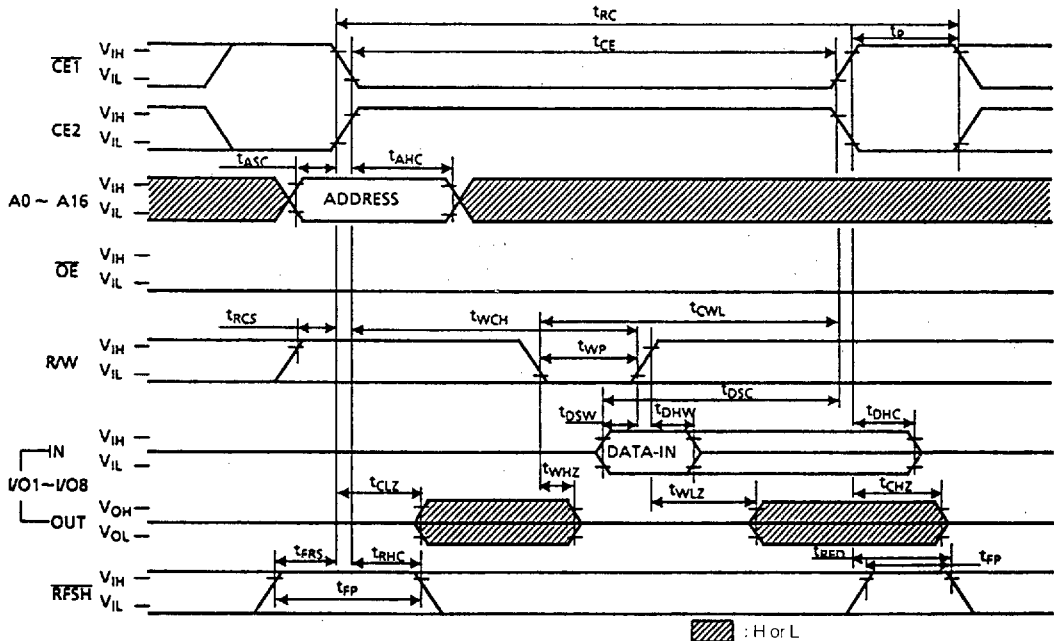


Note: The device can be operated by cycling $\overline{CE1}$ (or $\overline{CE2}$) only provided that $\overline{CE2}$ (or $\overline{CE1}$) is connected to V_{IH} (or V_{IL}).

Write Cycle 2 (\overline{OE} Clocked)

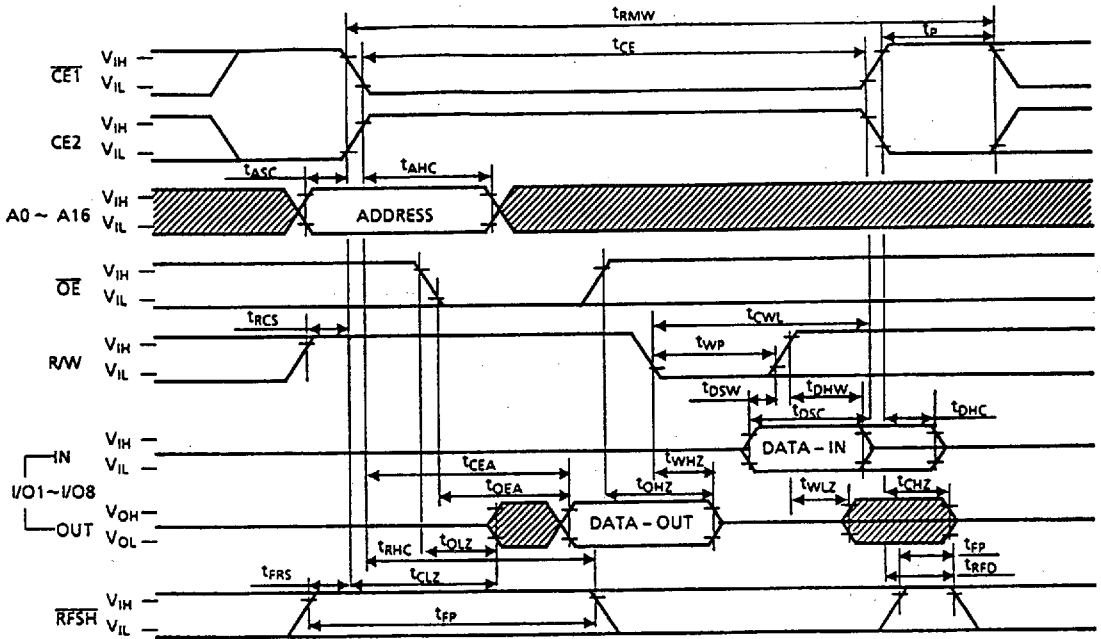


Write Cycle 3 (\overline{OE} Fixed Low)

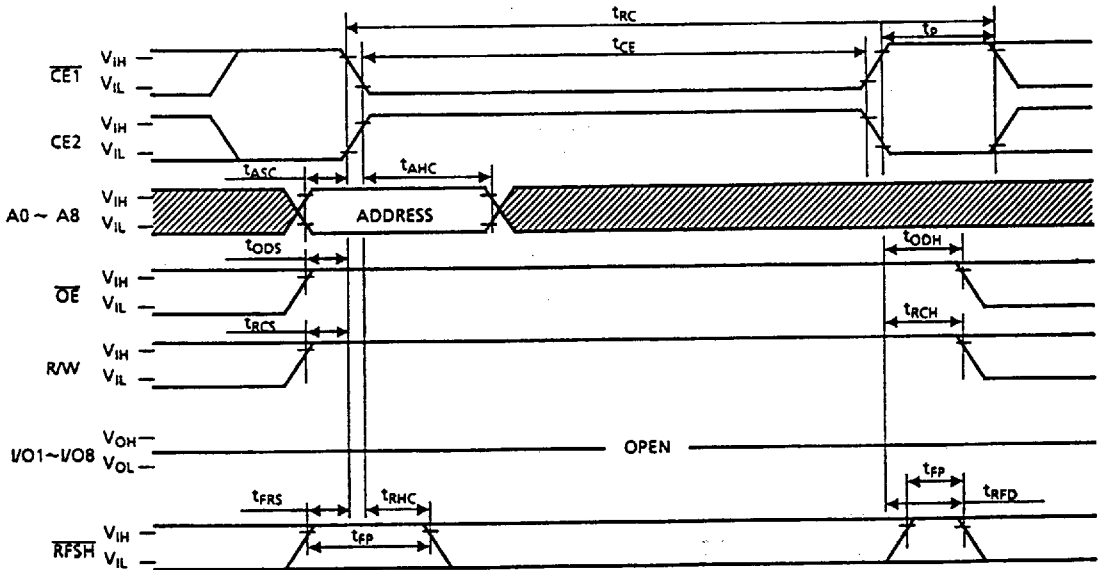


Note: The device can be operated by cycling $\overline{CE1}$ (or CE2) only provided that CE2 (or $\overline{CE1}$) is connected to V_{IH} (or V_{IL}).

Read Modify Write Cycle



CE Only Refresh

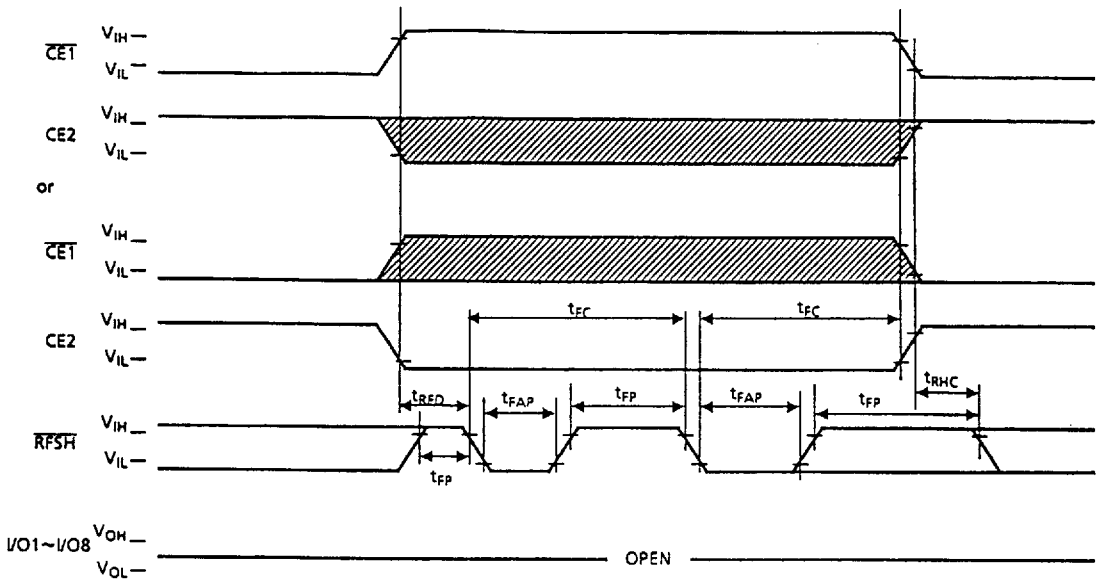


Note: A9 ~ A16 = V_{IH} or V_{IL}

▨: H or L

Note: The device can be operated by cycling $\overline{CE1}$ (or $\overline{CE2}$) only provided that $\overline{CE2}$ (or $\overline{CE1}$) is connected to V_{IH} (or V_{IL}).

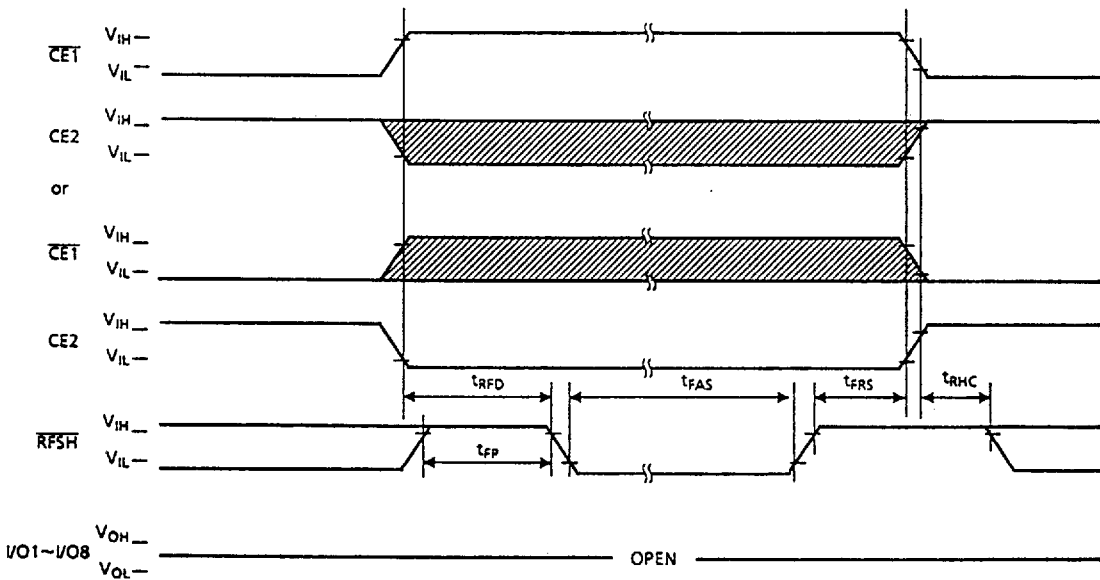
Auto Refresh



Note : \overline{OE} , \overline{RW} , $A0 \sim A16 = V_{IH}$ or V_{IL}

: H or L

Self Refresh



Note : \overline{OE} , \overline{RW} , $A0 \sim A16 = V_{IH}$ or V_{IL}

: H or L

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