

SANYO

No. ※ 5398

LC361000AMLL, ATLL, ARLL-70/10**1 MEG (131072 words × 8 bits) SRAM****Preliminary****Overview**

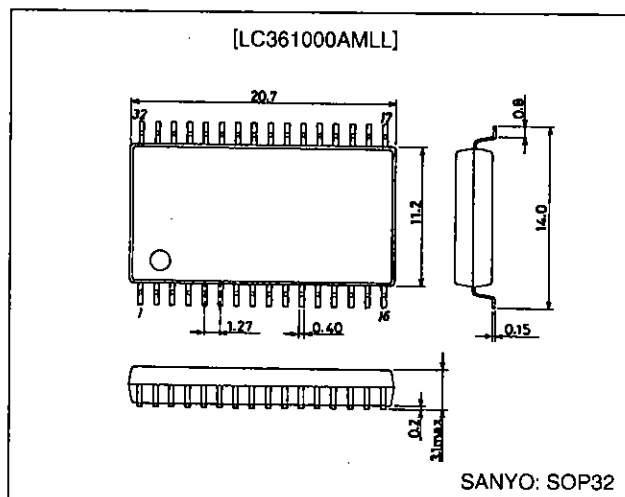
The LC361000AMLL, ATLL, and ARLL are 131072 words × 8 bits asynchronous silicon gate CMOS static RAMs. These SRAMs have two chip enable pins ($\overline{CE1}$ and $\overline{CE2}$) for controlling the device selected/unselected state and one output enable pin (\overline{OE}) for output control and feature high speed and low power. This makes these SRAMs optimal for systems that require high speed, low power, and battery backup, and they furthermore allow easy expansion of memory capacity.

Features

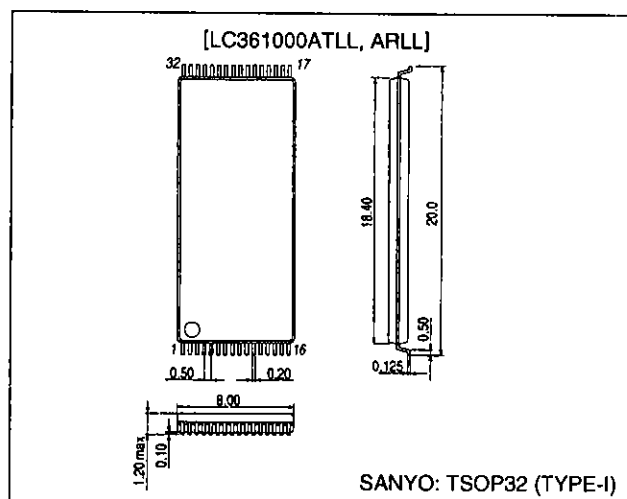
- Access time
70 ns (max.): LC361000AMLL, ATLL, ARLL-70
100 ns (max.): LC361000AMLL, ATLL, ARLL-10
- Low current drain
During standby
2.0 μ A (max.)/ $T_a = 25^\circ\text{C}$
4.0 μ A (max.)/ $T_a = 0$ to $+40^\circ\text{C}$
20.0 μ A (max.)/ $T_a = 0$ to $+70^\circ\text{C}$
During data retention
1.2 μ A (max.)/ $T_a = 25^\circ\text{C}$
2.4 μ A (max.)/ $T_a = 0$ to $+40^\circ\text{C}$
12.0 μ A (max.)/ $T_a = 0$ to $+70^\circ\text{C}$
During operating (DC)
15 mA (max.)
- Single 5 V power supply: $5\text{ V} \pm 10\%$
- Data retention supply voltage: 2.0 to 5.5 V
- No clock required (Fully static memory)
- All input/output levels are TTL compatible
- Common input/output pins, three output states
- Package
SOP 32-pin (525 mil) plastic package:
LC361000AMLL
TSOP 32-pin (8 mm × 20 mm) plastic package, normal:
LC361000ATLL
TSOP 32-pin (8 mm × 20 mm) plastic package, reversed:
LC361000ARLL

Package Dimensions

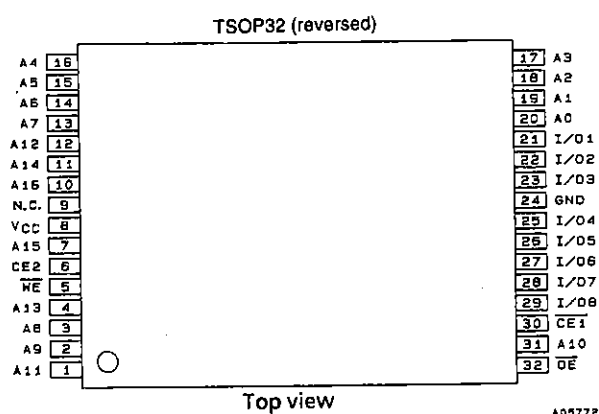
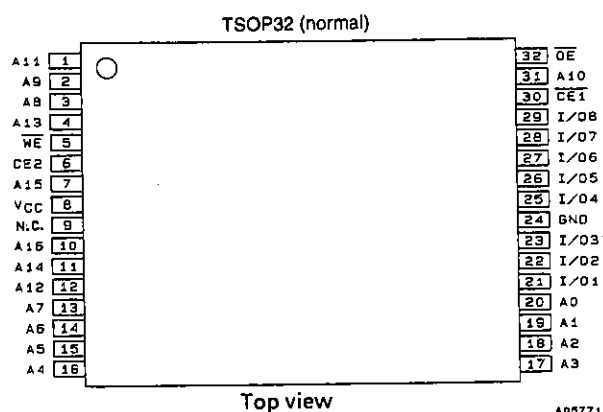
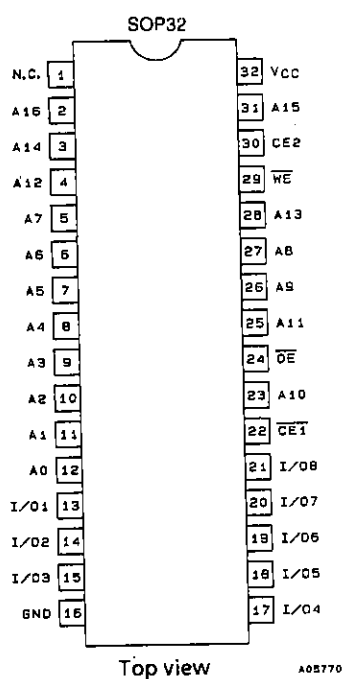
unit: mm

3205-SOP32

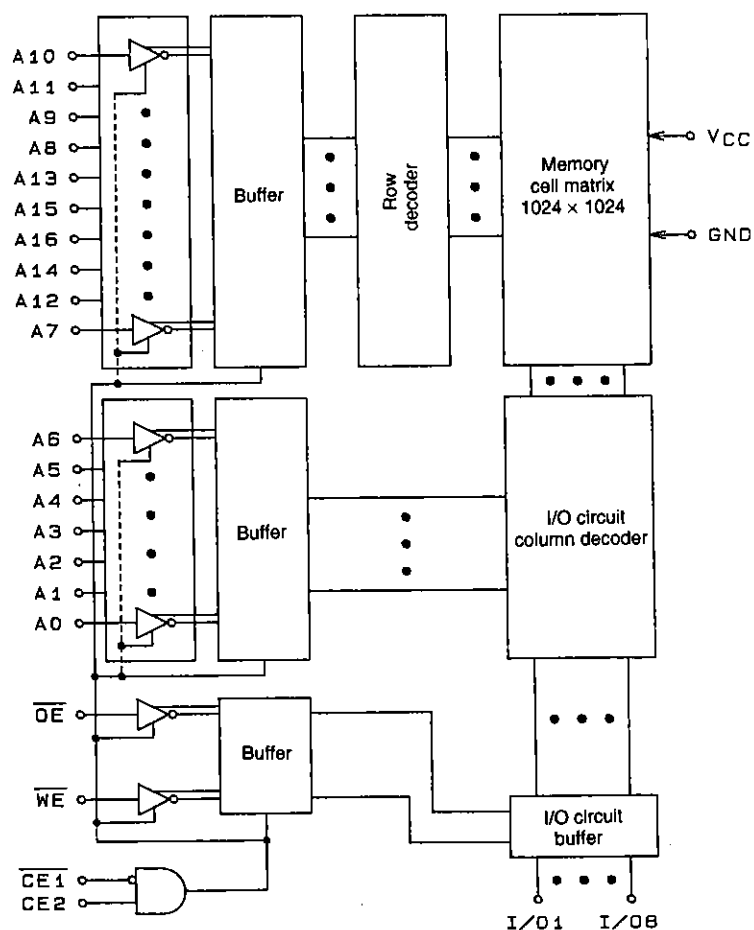
unit: mm

3224-TSOP32

Pin Assignments



Block Diagram



Pin Functions

A0 to A16	Address inputs
\overline{WE}	Read/write control input
\overline{OE}	Output enable input
$\overline{CE1}$, $\overline{CE2}$	Chip enable input
I/O1 to I/O8	Data input/output
V_{CC} , GND	Power supply pins

Function Logic

Mode	$\overline{CE1}$	$\overline{CE2}$	\overline{OE}	\overline{WE}	I/O	Supply current
Read cycle	L	H	L	H	Data output	I_{CCA}
Write cycle	L	H	X	L	Data input	I_{CCA}
Output disable	L	H	H	H	High impedance	I_{CCA}
Nonselect	H	X	X	X	High impedance	I_{CCS}
	X	L	X	X	High impedance	I_{CCS}

X: H or L

Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$	7.0	V
Input pin voltage	V_{IN}	-0.5* to $V_{CC}+0.5$	V
I/O pin voltage	$V_{I/O}$	-0.5* to $V_{CC}+0.5$	V
Allowable power dissipation	$P_d \text{ max}$	0.7	W
Operating temperature	T_{opr}	0 to +70	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

Note: * -3.0 V when pulse width is less than 50 ns.

Stresses greater than the above listed maximum value may result in damage to the device.

DC Recommended Operating Ranges at $T_a = 0$ to $+70^\circ\text{C}$

Parameter	Symbol	min	typ	max	Unit
Power supply voltage	V_{CC}	4.5	5.0	5.5	V
Input high level voltage	V_{IH}	2.2		$V_{CC}+0.3$	V
Input low level voltage	V_{IL}	-0.3*		+0.8	V

Note: * -3.0 V when pulse width is less than 50 ns.

DC Electrical Characteristics at Ta = 0 to +70°C

Parameter	Symbol	Conditions	min	typ*	max	Unit
Operating supply current (DC)	I _{CCA1}	V _{CE1} ≤ 0.2 V, V _{CE2} ≥ V _{CC} - 0.2 V, V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} - 0.2 V, I _{I/O} = 0 mA			10	mA
	I _{CCA2}	V _{CE1} = V _{IL} , V _{CE2} = V _{IH} , V _{IN} = V _{IH} or V _{IL} , I _{I/O} = 0 mA		7	15	mA
Average operating supply current	I _{CCA3}	V _{CE1} = V _{IL} , V _{CE2} = V _{IH} , I _{I/O} = 0 mA, min cycle	70 ns	40	70	mA
			100 ns	35	60	
Standby supply current	I _{CCS1}	{V _{CE2} ≤ 0.2 V} or {V _{CE1} ≥ V _{CC} - 0.2 V, (V _{CE2} ≥ V _{CC} - 0.2 V or V _{CE2} ≤ 0.2 V)}	0 to +70°C		20	μA
			0 to +40°C		4	
			25°C	0.7	2	
	I _{CCS2}	V _{CE2} = V _{IL} or V _{CE1} = V _{IH}		0.6	3	mA
Input leakage current	I _{LI}	V _{IN} = 0 to V _{CC}	-1		+1	μA
I/O leakage current	I _{LO}	V _{CE1} = V _{IH} or V _{CE2} = V _{IL} , or V _{OE} = V _{IH} or V _{WE} = V _{IL} , I _{I/O} = 0 to V _{CC}	-1		+1	μA
Output high level voltage	V _{OH}	I _{OH} = -1.0 mA	2.4			V
Output low level voltage	V _{OL}	I _{OL} = 2.1 mA			0.4	V

Note: * Reference value at V_{CC} = 5 V, Ta = 25°C.

Input/Output Capacitances at Ta = 25°C, f = 1 MHz

Parameter	Symbol	Conditions	min	typ	max	Unit
Input capacitance	C _{IN}	V _{IN} = 0 V			7	pF
Input/output capacitance	C _{I/O}	V _{I/O} = 0 V			8	pF

Note: These parameters were obtained through sampling, and not full-lot measurement.

AC Electrical Characteristics at Ta = 0 to +70°C, V_{CC} = 5 V ±10%

AC Test Conditions

Parameter	Conditions
Input pulse voltage level	0.8 V, 2.2 V
Input rise and fall time	5 ns
Input and output timing level	1.5 V
Output load	1 TTL gate + C _L = 100 pF (70 ns/100 ns) (including scope and jig capacitances)

Read Cycle

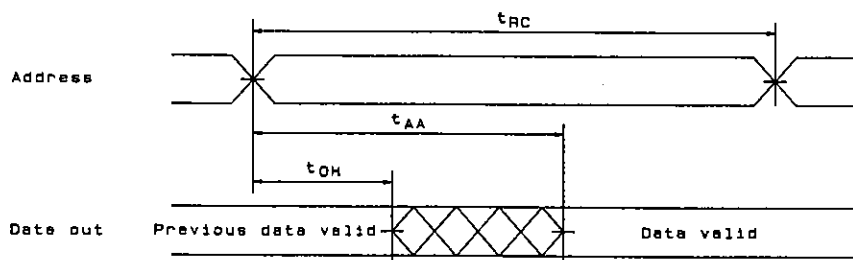
Parameter	Symbol	LC361000AMLL, ATLL, ARLL				Unit
		-70		-10		
		min	max	min	max	
Read cycle time	t _{RC}	70		100		ns
Address access time	t _{AA}		70		100	ns
$\overline{CE1}$ access time	t _{CA1}		70		100	ns
CE2 access time	t _{CA2}		70		100	ns
\overline{OE} access time	t _{OA}		40		50	ns
Output hold time	t _{OH}	15		15		ns
$\overline{CE1}$ output enable time	t _{COE1}	10		10		ns
CE2 output enable time	t _{COE2}	10		10		ns
\overline{OE} output enable time	t _{OOE}	5		5		ns
$\overline{CE1}$ output disable time	t _{COD1}		25		35	ns
CE2 output disable time	t _{COD2}		25		35	ns
\overline{OE} output disable time	t _{OOD}		25		35	ns

Write Cycle

Parameter	Symbol	LC361000AMLL, ATLL, ARLL				Unit
		-70		-10		
		min	max	min	max	
Write cycle time	t _{WC}	70		100		ns
Address valid to end of write	t _{AW}	60		70		ns
Address setup time	t _{AS}	0		0		ns
Write pulse width	t _{WP}	50		70		ns
CE1 setup time	t _{CW1}	60		70		ns
CE2 setup time	t _{CW2}	60		70		ns
Write recovery time	t _{WR}	0		0		ns
CE1 write recovery time	t _{WR1}	0		0		ns
CE2 write recovery time	t _{WR2}	0		0		ns
Data setup time	t _{DS}	30		40		ns
Data hold time	t _{DH}	0		0		ns
CE1 data hold time	t _{DH1}	0		0		ns
CE2 data hold time	t _{DH2}	0		0		ns
WE output enable time	t _{WOE}	10		10		ns
WE output disable time	t _{WOD}		25		30	ns

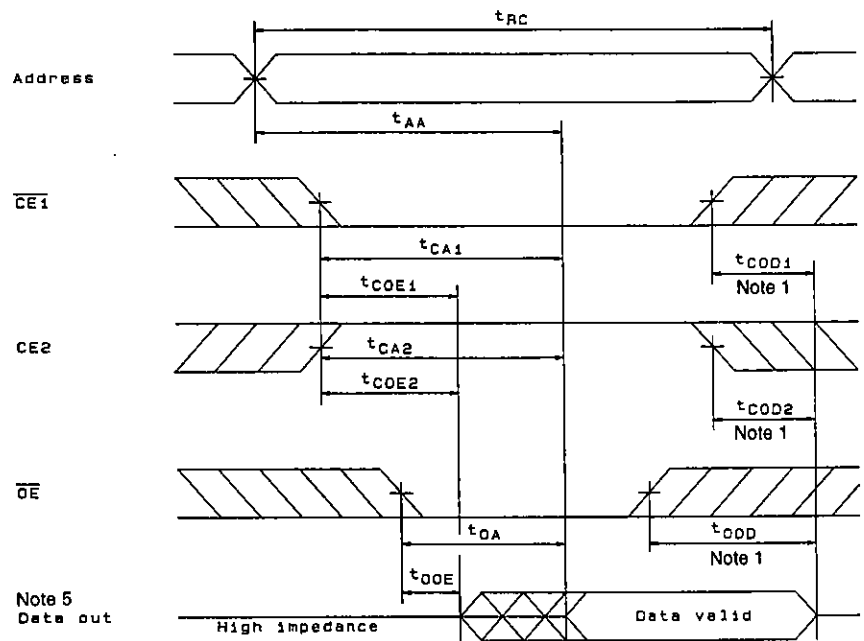
Timing Chart

Read Cycle (1): $\overline{CE1} = \overline{OE} = V_{IL}$, $CE2 = V_{IH}$, $\overline{WE} = V_{IH}$



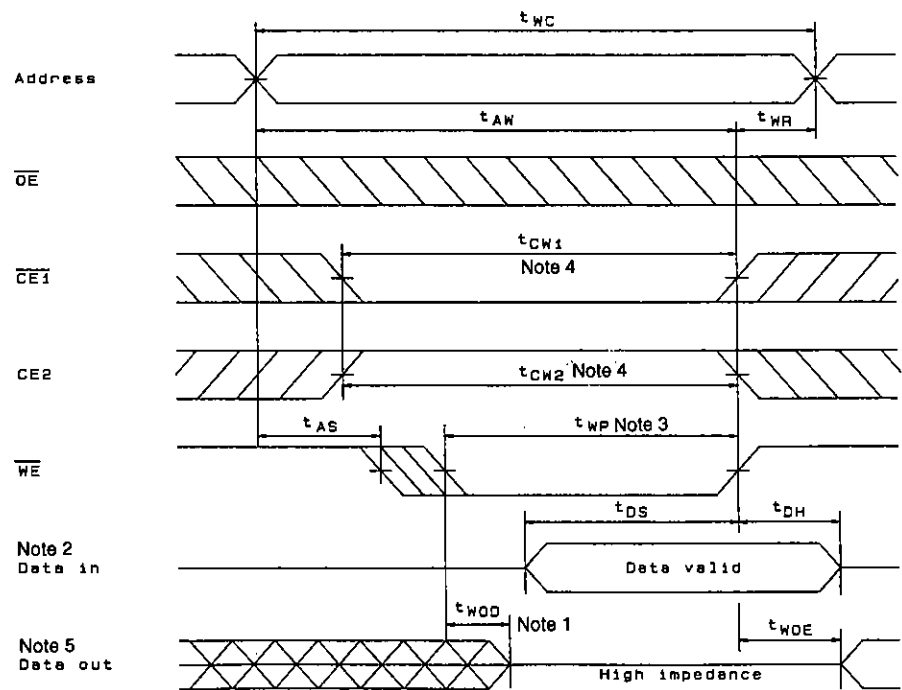
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Read Cycle (2): $\overline{WE} = V_{IH}$



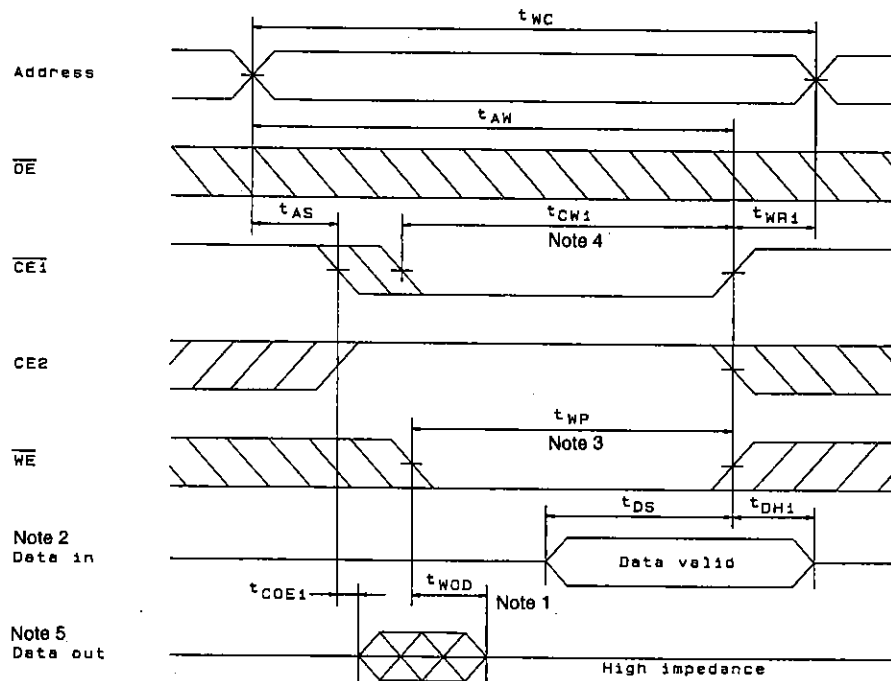
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Write Cycle (1): \overline{WE} control (Note 6)



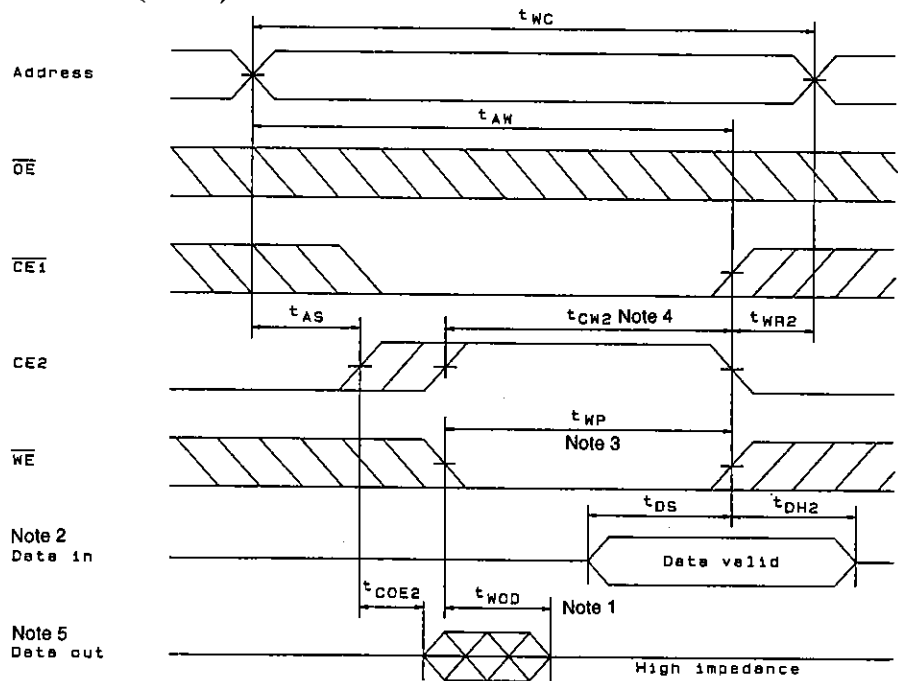
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Write Cycle (2): $\overline{CE1}$ control (Note 6)



Write Cycle (3): CE2 control (Note 6)

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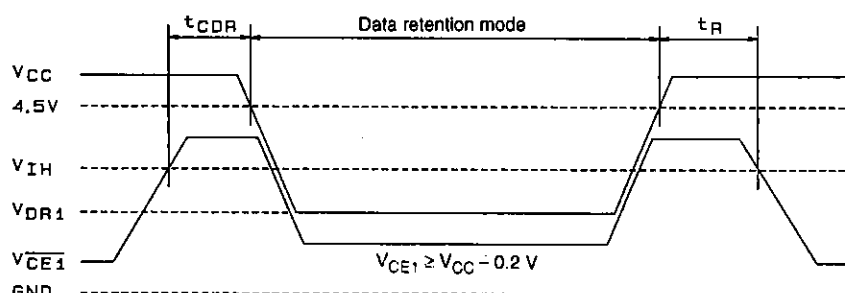


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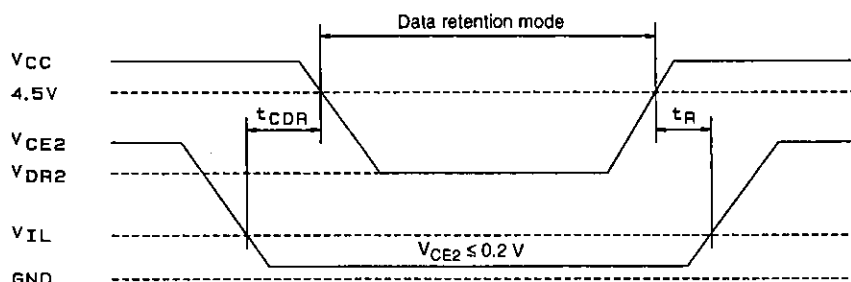
- Note: 1. t_{COD1} , t_{COD2} , t_{OOD} , and t_{WOD} are stipulated as the time until the outputs reach the high-impedance state, and are not determined by the output voltage levels.
2. Reverse phase signals must not be applied externally when the data outputs are in the output state.
3. t_{WP} is defined as the period when $\overline{CE1}$ and \overline{WE} are low and CE2 is high, from the falling edge of \overline{WE} until either a rising edge of $\overline{CE1}$ or \overline{WE} or a falling edge of CE2, whichever of these happens first.
4. t_{WC1} and t_{WC2} are defined as the periods when $\overline{CE1}$ and \overline{WE} are low and CE2 is high, from either a falling edge of $\overline{CE1}$ or a rising edge of CE2, until a rising edge of $\overline{CE1}$ or \overline{WE} , or a falling edge of CE2, whichever happens first.
5. The data outputs will be in the high-impedance state if either OE is high, CE1 is high, CE2 is low, or \overline{WE} is low.
6. If OE goes high during a write cycle, the data outputs will go to the high-impedance state.

Data Retention Characteristics at $T_a = 0$ to $+70^\circ\text{C}$

Parameter	Symbol	Conditions	min	typ*	max	Unit
Data retention supply voltage	V_{DR1}	$V_{CE1} \geq V_{CC} - 0.2\text{ V}$, $V_{CE2} \geq V_{CC} - 0.2\text{ V}$, or $V_{CE2} \leq 0.2\text{ V}$	2.0		5.5	V
	V_{DR2}	$V_{CE2} \leq 0.2\text{ V}$	2.0		5.5	V
Data retention supply current	I_{CCDR1}	$V_{CC} = 3.0\text{ V}$, $V_{CE1} \geq V_{CC} - 0.2\text{ V}$, $V_{CE2} \geq V_{CC} - 0.2\text{ V}$, or $V_{CE2} \leq 0.2\text{ V}$	0 to $+70^\circ\text{C}$		12	μA
			0 to $+40^\circ\text{C}$		2.4	
			25°C	0.4	1.2	
	I_{CCDR2}	$V_{CC} = 3.0\text{ V}$, $V_{CE2} \leq 0.2\text{ V}$	0 to $+70^\circ\text{C}$		12	μA
			0 to $+40^\circ\text{C}$		2.4	
			25°C	0.4	1.2	
Chip enable setup time	t_{CDR}		0			ns
Chip enable hold time	t_R		5			ms

Note: * Reference value at $T_a = 25^\circ\text{C}$.Data Retention Waveforms (1): ($\overline{\text{CE1}}$ control)

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Data Retention Waveforms (2): (CE2 control)

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