Asynchronous Silicon Gate CMOS LSI

SANYO No. ※5399

LC361000AMLL, ATLL, ARLL-70X/10X

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 CE2) for controlling the device selected/unselected state and one output enable pin ($\overline{OE}$) for output control and feature high speed, low power, and wide temperature range. 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.

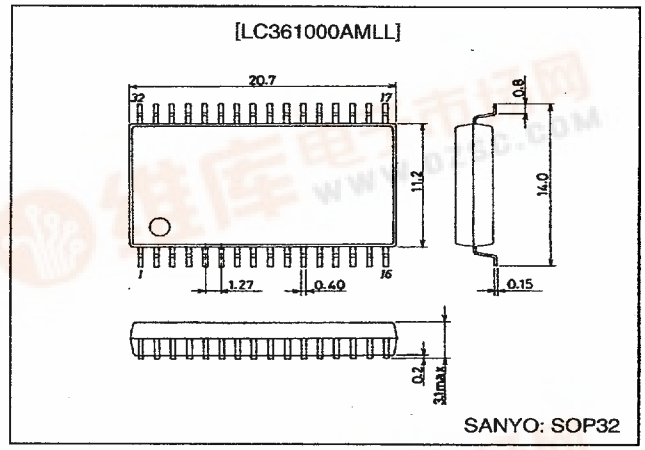
Features

- Access time
  70 ns (max.): LC361000AMLL, ATLL, ARLL-70X
  100 ns (max.): LC361000AMLL, ATLL, ARLL-10X
- Low current drain
  During standby
  2.0 µA (max.)/Ta = 25°C
  4.0 µA (max.)/Ta = –20 to +40°C
  20.0 µA (max.)/Ta = –20 to +70°C
  40.0 µA (max.)/Ta = –20 to +85°C
  During data retention
  1.2 µA (max.)/Ta = 25 °C
  2.4 µA (max.)/Ta = –20 to +40 °C
  12.0 µA (max.)/Ta = –20 to +70°C
  24.0 µA (max.)/Ta = –20 to +85°C
  During operation (DC)
  15 mA (max.)
- Single 5 V power supply: 5 V ±10%
- Wide range of operating temperature: –20 to 85°C
- 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, with 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

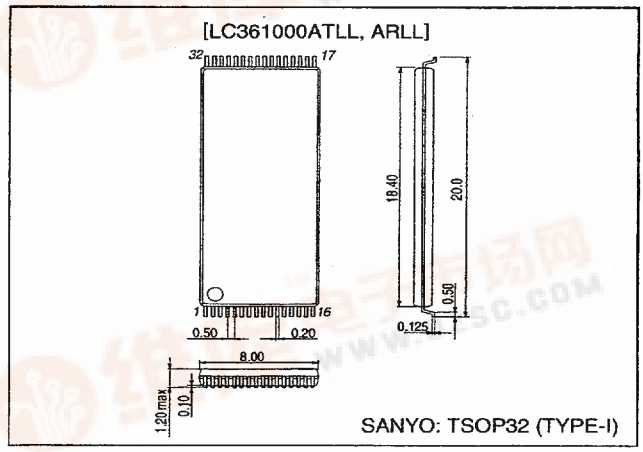
unit: mm

3205-SOP32

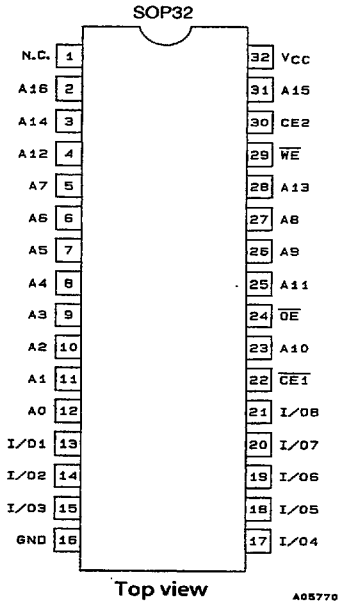


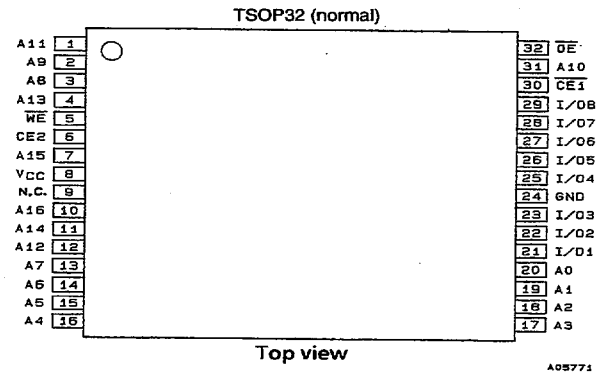
unit: mm

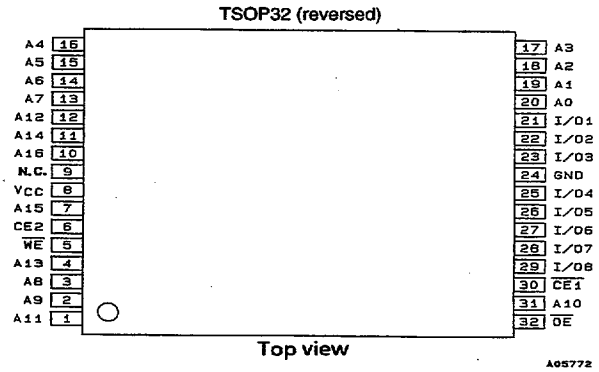
3224-TSOP32



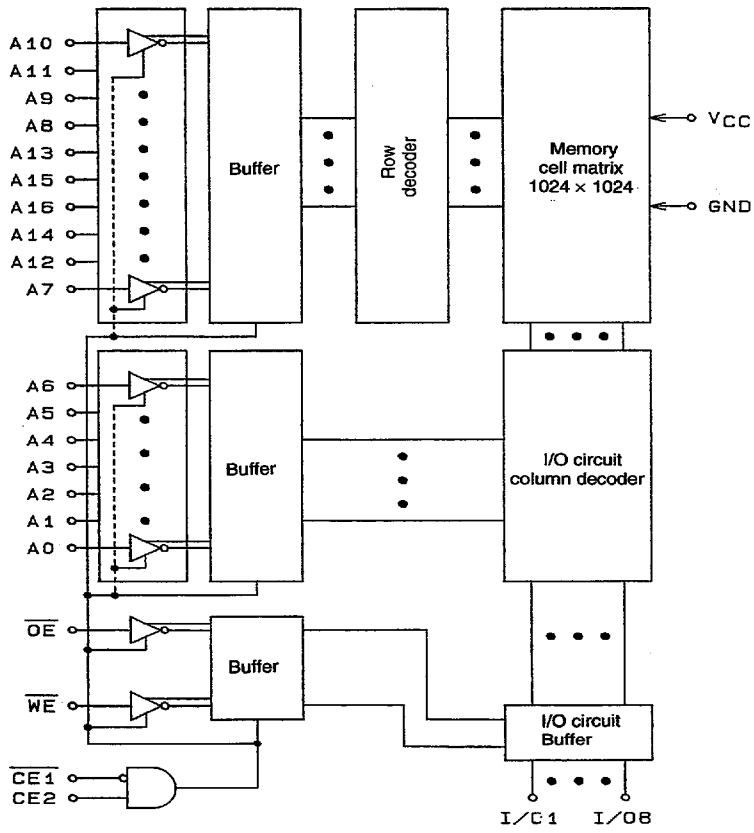
Pin Assignments







Block Diagram



Pin Functions

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

Function Logic

Mode	$\overline{CE1}$	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 Ta = 25°C

Parameter	Symbol	Ratings	Unit
Maximum supply voltage	V_{CC} 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	Pd max	0.7	W
Operating temperature	Topr	−20 to +85	°C
Storage temperature	Tstg	−55 to +150	°C

Note: * −3.0 V when pulse width is less than 50 ns.
Stresses greater than the above listed maximum values may result in damage to the device.

DC Recommended Operating Ranges at Ta = −20 to +85°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 = –20 to +85°C

Parameter	Symbol	Conditions		min	typ*	max	Unit
Operating supply current (DC)	I_{CCA1}	$V_{\overline{CE1}} \le 0.2$ V, $V_{CE2} \ge V_{CC} - 0.2$ V, $V_{IN} \le 0.2$ V or $V_{IN} \ge V_{CC} - 0.2$ V, $I_{I/O} = 0$ mA				10	mA
	I_{CCA2}	$V_{\overline{CE1}} = V_{IL}$, $V_{CE2} = V_{IH}$, $V_{IN} = V_{IH}$ or V_{IL}, $I_{I/O} = 0$ mA			7	15	mA
Average operating supply current	I_{CCA3}	$V_{\overline{CE1}} = V_{IL}$, $V_{CE2} = V_{IH}$, $I_{I/O} = 0$ mA, min cycle	70 ns		40	80	mA
			100 ns		35	60	
Standby supply current	I_{CCS1}	$\{V_{CE2} \le 0.2$ V$\}$ or $\{V_{\overline{CE1}} \ge V_{CC} - 0.2$ V, $(V_{CE2} \ge V_{CC} - 0.2$ V or $V_{CE2} \le 0.2$ V$)\}$	–20 to +85°C			40	µA
			–20 to +70°C			20	
			–20 to +40°C			4	
			25°C		0.7	2	
	I_{CCS2}	$V_{CE2} = V_{IL}$ or $V_{\overline{CE1}} = V_{IH}$			0.6	3	mA
Input leakage current	I_{LI}	$V_{IN} = 0$ to V_{CC}		–1		+1	µA
I/O leakage current	I_{LO}	$V_{\overline{CE1}} = V_{IH}$ or $V_{CE2} = V_{IL}$, or $V_{\overline{OE}} = V_{IH}$ or $V_{\overline{WE}} = V_{IL}$, $I_{I/O} = 0$ to V_{CC}		–1		+1	µA
Output high evel 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 = –20 to +85°C, V_{CC} = 5 V ±10%

AC Test Conditions

Parameter	Conditions
Input pulse voltage level	0.6 V, 2.4 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

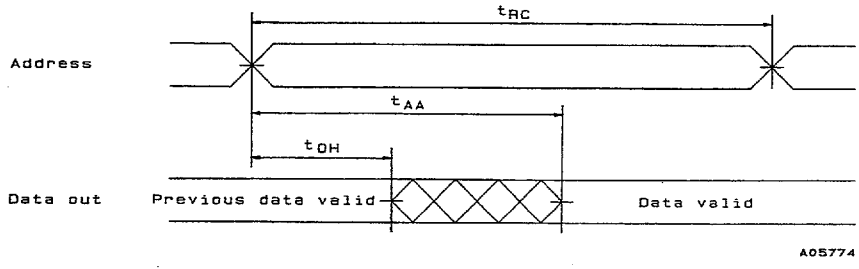
Parameter	Symbol	LC361000AMLL, ATLL, ARLL				Unit
		-70X		-10X		
		min	max	min	max	
Read cycle time	t_{RC}	70		100		ns
Address access time	t_{AA}		70		100	ns
$\overline{CE1}$ access time	t_{CA1}		70		100	ns
CE2 access time	t_{CA2}		70		100	ns
$\overline{OE}$ access time	t_{OA}		40		50	ns
Output hold time	t_{OH}	10		10		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

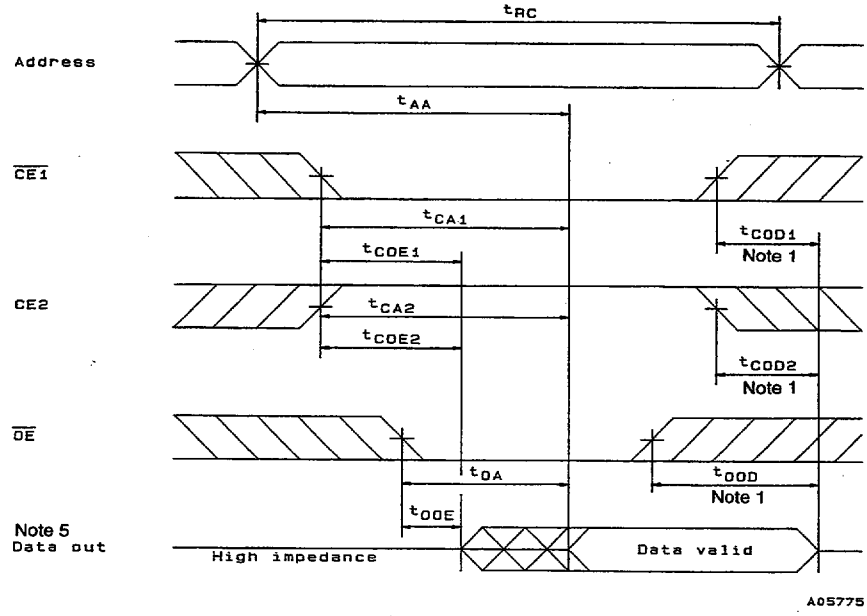
Parameter	Symbol	LC361000AMLL, ATLL, ARLL				Unit
		-70X		-10X		
		min	max	min	max	
Write cycle time	t_{WC}	70		100		ns
Address valid to end of write	t_{AW}	60		70		ns
Address setup time	t_{AS}	0		0		ns
Write pulse width	t_{WP}	50		70		ns
$\overline{CE1}$ setup time	t_{CW1}	60		70		ns
CE2 setup time	t_{CW2}	60		70		ns
Write recovery time	t_{WR}	5		5		ns
$\overline{CE1}$ 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
$\overline{CE1}$ data hold time	t_{DH1}	0		0		ns
CE2 data hold time	t_{DH2}	0		0		ns
$\overline{WE}$ output enable time	t_{WOE}	10		10		ns
$\overline{WE}$ output disable time	t_{WOD}		25		30	ns

Timing Chart

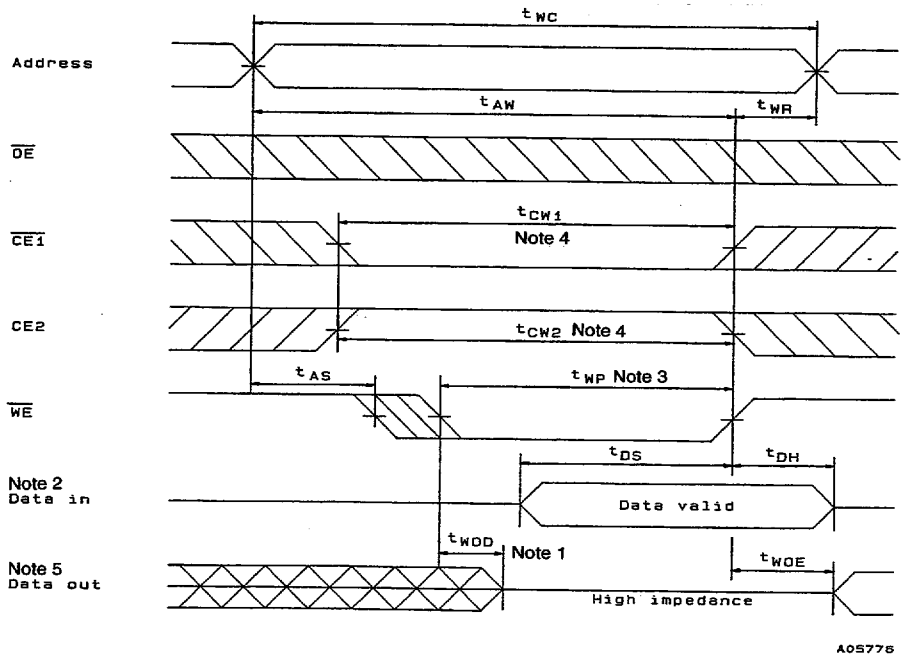
Read Cycle (1): $\overline{CE1} = \overline{OE} = V_{IL}$, $CE2 = V_{IH}$, $\overline{WE} = V_{IH}$



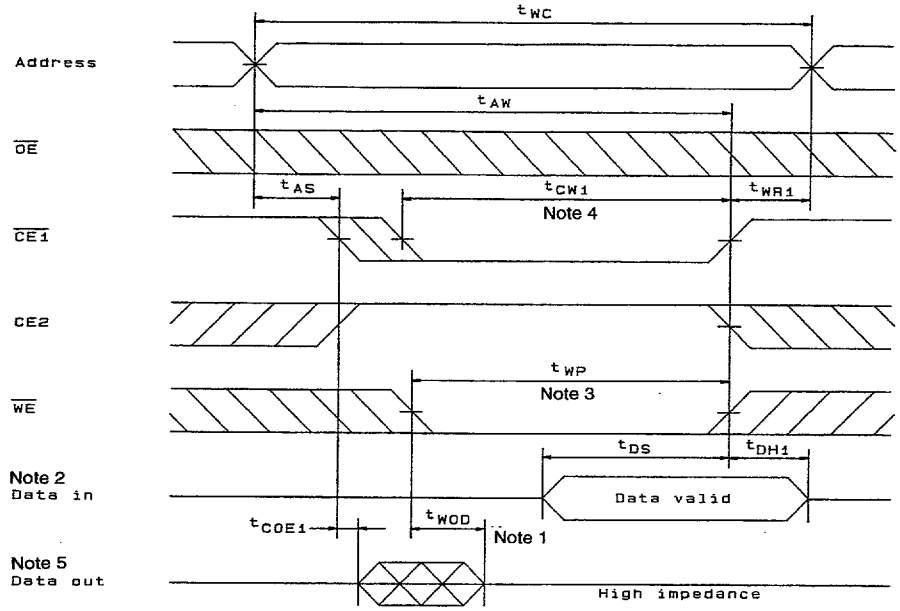
Read Cycle (2): $\overline{WE}$ = V_{IH}



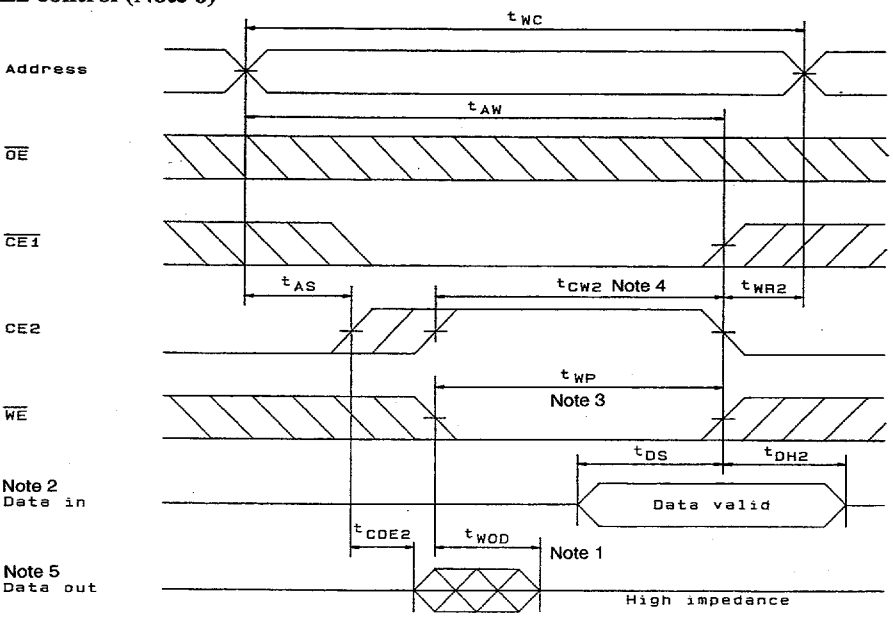
Write Cycle (1): $\overline{WE}$ control (Note 6)



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



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



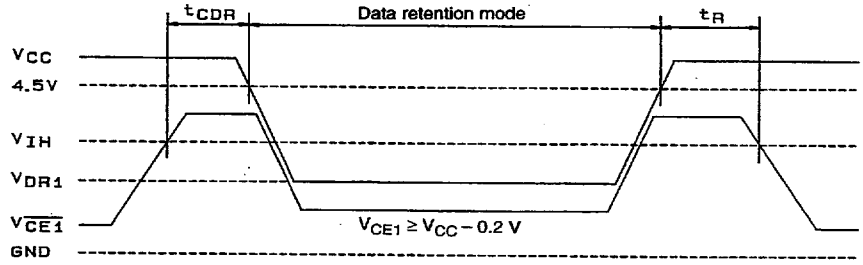
Note: 1. t_{COD1}, t_{COD2}, t_{OOD}, and t_{WOD} are stipulated as the times until the outputs reach the high-impedance state, and are not determined by the output voltage levels.
2. Reverse phase signals must not be applied externally when the data outputs are in the output state.
3. tWP is defined 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 $\overline{OE}$ is high, $\overline{CE1}$ is high, CE2 is low, or $\overline{WE}$ is low.
6. If $\overline{OE}$ goes high during a write cycle, the data outputs will go to the high-impedance state.

Data Retention Characteristics at Ta = –20 to +85°C

Parameter	Symbol	Conditions		min	typ*	max	Unit
Data retention supply voltage	V_{DR1}	$V_{\overline{CE1}} \geq V_{CC} - 0.2$ V, $V_{CE2} \geq V_{CC} - 0.2$ V, or $V_{CE2} \leq 0.2$ V		2.0		5.5	V
	V_{DR2}	$V_{CE2} \leq 0.2$ V		2.0		5.5	V
Data retention supply current	I_{CCDR1}	V_{CC} = 3.0 V, $V_{\overline{CE1}} \geq V_{CC} - 0.2$ V, $V_{CE2} \geq V_{CC} - 0.2$ V, or $V_{CE2} \leq 0.2$ V	–20 to +85°C			24	µA
			–20 to +70°C			12	
			–20 to +40°C			2.4	
			25°C		0.4	1.2	
	I_{CCDR2}	V_{CC} = 3.0 V, $V_{CE2} \leq 0.2$ V	–20 to +85°C			24	µA
			–20 to +70°C			12	
			–20 to +40°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 Ta = 25°C.

Data Retention Waveforms (1): (CE1 control)



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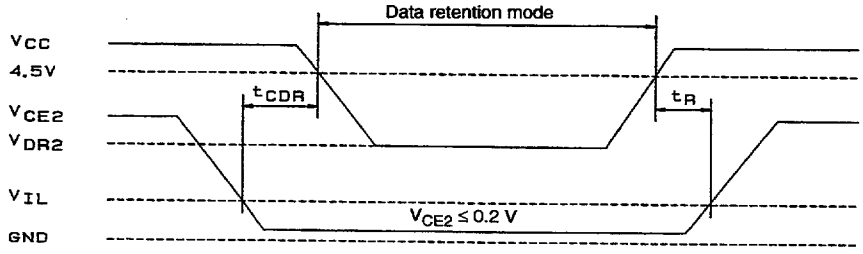
Data Retention Waveforms (2): (CE2 control)



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