

**SANYO**

No. 4163

**LC36256AL, AML-70/85/10/12****256 K (32768 words × 8 bits) SRAM**

## Overview

The LC36256AL, AML-70/85/10/12 are fully asynchronous silicon gate CMOS static RAMs with an 32768 words × 8 bits.

This series have  $\overline{CE}$  chip enable pin for device select/nonselect control and an  $\overline{OE}$  output enable pin for output control, and features high speed as well as low power dissipation.

For these reasons, the series is especially suited for use in systems requiring high speed, low power, and battery backup, and it is easy to expand memory capacity.

## Features

### • Access time

70 ns (max.) : LC36256AL-70, LC36256AML-70

85 ns (max.) : LC36256AL-85, LC36256AML-85

100 ns (max.) : LC36256AL-10, LC36256AML-10

120 ns (max.) : LC36256AL-12, LC36256AML-12

### • Low current dissipation

#### During standby

2  $\mu$ A (max.) /  $T_a = 25^\circ\text{C}$

5  $\mu$ A (max.) /  $T_a = 0$  to  $40^\circ\text{C}$

25  $\mu$ A (max.) /  $T_a = 0$  to  $70^\circ\text{C}$

#### During data retention

1  $\mu$ A (max.) /  $T_a = 25^\circ\text{C}$

2  $\mu$ A (max.) /  $T_a = 0$  to  $40^\circ\text{C}$

10  $\mu$ A (max.) /  $T_a = 0$  to  $70^\circ\text{C}$

#### During operation (DC)

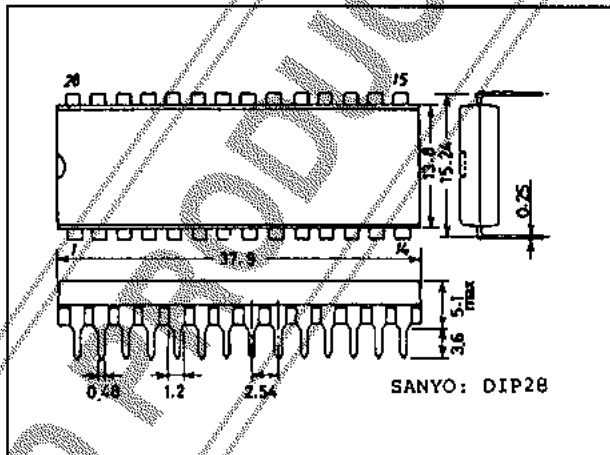
10 mA (max.)

- Single 5 V power supply:  $5\text{ V} \pm 10\%$
- Data retention power 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
- Packages
  - DIP 28-pin plastic package (600 mil) : LC36256AL
  - SOP 28-pin plastic package (450 mil) : LC36256AML

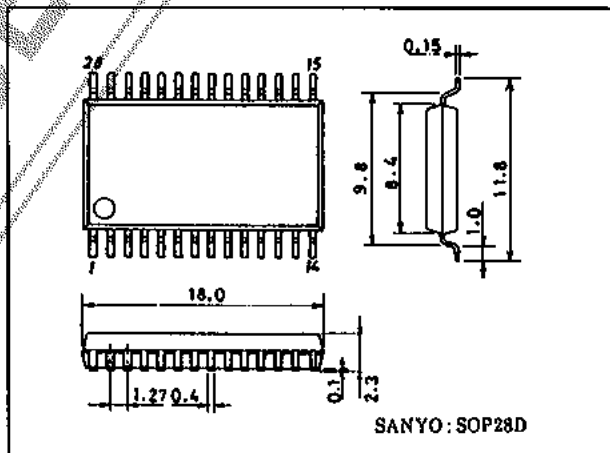
## Package Dimensions

unit : mm

3012A - DIP28



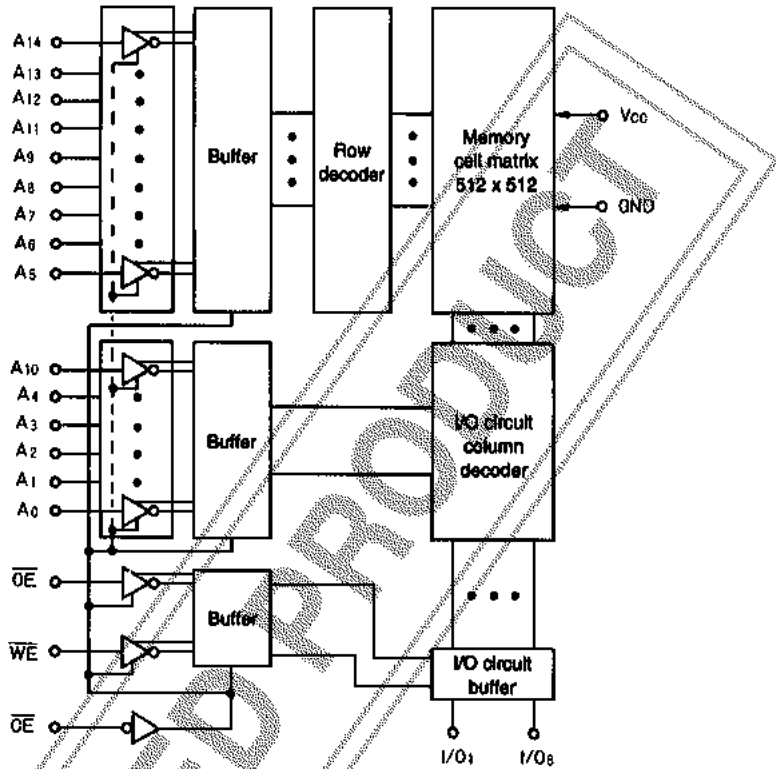
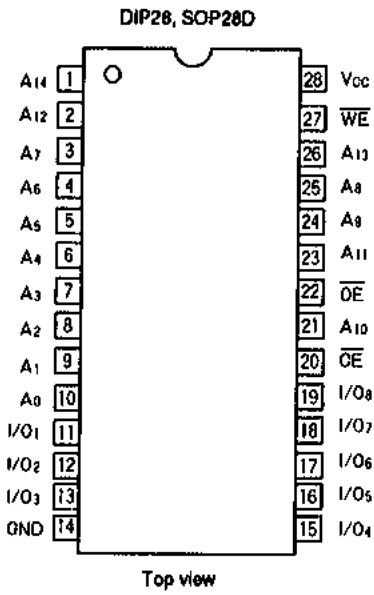
3187 - SOP28D

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Pin Assignment

Block Diagram



- A0 to A14 : Address input
- WE : Read/write control input
- OE : Output enable input
- CE : Chip enable input
- I/O1 to I/O8 : Data input/output
- Vcc, GND : Power supply pins

Functions

Mode	CE	OE	WE	I/O	Supply current
Read cycle	L	L	H	Data output	I <sub>CCA</sub>
Write cycle	L	X	L	Data input	I <sub>CCA</sub>
Output disable	L	H	H	High impedance	I <sub>CCA</sub>
Nonselect	H	X	X	High impedance	I <sub>CCS</sub>

X : H or L

## Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	VCC max		7.0	V
Input pin voltage	V <sub>IN</sub>		-0.5* to VCC+0.5	V
I/O pin voltage	V <sub>IO</sub>		-0.5* to VCC+0.5	V
Allowable power dissipation	Pd max	LC36256AL	1.0	W
		LC36256AML	0.7	W
Operating temperature range	T <sub>opr</sub>		0 to +70	°C
Storage temperature range	T <sub>stg</sub>		-55 to +150	°C

\* -3.0 V when pulse width is less than 50 ns

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

Parameter	Symbol	min	typ	max	Unit
Power supply voltage	VCC	4.5	5.0	5.5	V
Input high level voltage	V <sub>IH</sub>	2.2		VCC+0.3	V
Input low level voltage	V <sub>IL</sub>	-0.3*		+0.8	V

\* -3.0 V when pulse width is less than 50 ns

### DC Electrical Characteristics at $T_a = 0$ to $70^\circ\text{C}$ , VCC = 5 V $\pm 10\%$

Parameter	Symbol	Conditions	min	typ*	max	Unit	
Input leakage current	I <sub>LI</sub>	V <sub>IN</sub> = 0 to VCC	-0.5		+0.5	$\mu\text{A}$	
I/O leakage current	I <sub>LO</sub>	$\overline{V_{CE}} = V_{IH}$ or $\overline{V_{CE}} = V_{IH}$ , V <sub>IO</sub> = 0 to VCC	-0.5		+0.5	$\mu\text{A}$	
Output high level voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1.0mA	2.4			V	
Output low level voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.1mA			0.4	V	
Operating supply current (DC)	I <sub>CCA1</sub>	$\overline{V_{CE}} \leq 0.2\text{V}$ , V <sub>IN</sub> $\leq 0.2\text{V}$ or V <sub>IN</sub> $\geq V_{CC}-0.2\text{V}$		1	5	mA	
	I <sub>CCA2</sub>	$\overline{V_{CE}} = V_{IL}$ , I <sub>IO</sub> = 0mA		3	10	mA	
Average operating supply current	I <sub>CCA3</sub>	min cycle Duty = 100% I <sub>IO</sub> = 0mA	Access time	70ns	30	50	mA
				85ns	25	50	
				100ns	23	50	
				120ns	20	50	
Standby supply current	I <sub>CCS1</sub>	$\overline{V_{CE}} \geq V_{CC}-0.2\text{V}$	LC36256AL/ AML	0 to 70°C		25	$\mu\text{A}$
				0 to 40°C		5	
				25°C	0.5	2	
	I <sub>CCS2</sub>	$\overline{V_{CE}} = V_{IH}$			0.4	2	mA

\* Reference values at VCC = 5 V, T<sub>a</sub> = 25°C

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Input/output capacitance	C <sub>VO</sub>	V <sub>VO</sub> = 0V			8	pF
Input capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 0V			6	pF

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

**AC Electrical Characteristics at Ta = 0 to 70°C, Vcc = 5 V ±10%**

AC testing conditions

- Input pulse voltage level : 0.8 V, 2.2 V
- Input rise and fall time : 5 ns
- Input - output timing level : 1.5 V
- Output load : 1 TTL gate + C<sub>L</sub> = 100 pF (85 ns/100 ns/120 ns)  
1 TTL gate + C<sub>L</sub> = 30 pF (70 ns)  
(including scope and jig capacitance)

**Read Cycle**

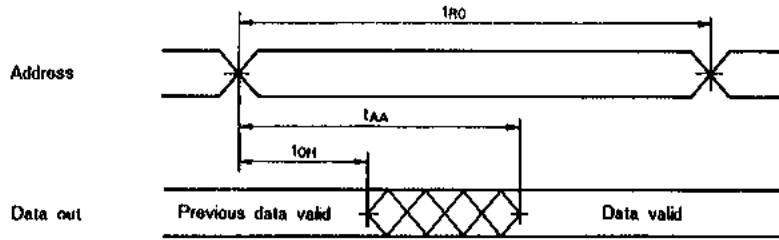
Parameter	Symbol	LC36256AL-70 LC36256AML-70		LC36256AL-85 LC36256AML-85		LC36256AL-10 LC36256AML-10		LC36256AL-12 LC36256AML-12		Unit
		min	max	min	max	min	max	min	max	
Read cycle time	t <sub>RC</sub>	70		85		100		120		ns
Address access time	t <sub>AA</sub>		70		85		100		120	ns
CE access time	t <sub>CA</sub>		70		85		100		120	ns
OE access time	t <sub>OA</sub>		35		45		50		60	ns
Output hold time	t <sub>OH</sub>	20		20		20		20		ns
CE output enable time	t <sub>COE</sub>	10		10		10		10		ns
OE output enable time	t <sub>OOE</sub>	5		5		5		5		ns
CE output disable time	t <sub>COD</sub>	0	30	0	30	0	30	0	30	ns
OE output disable time	t <sub>OOD</sub>	0	30	0	30	0	30	0	30	ns

**Write Cycle**

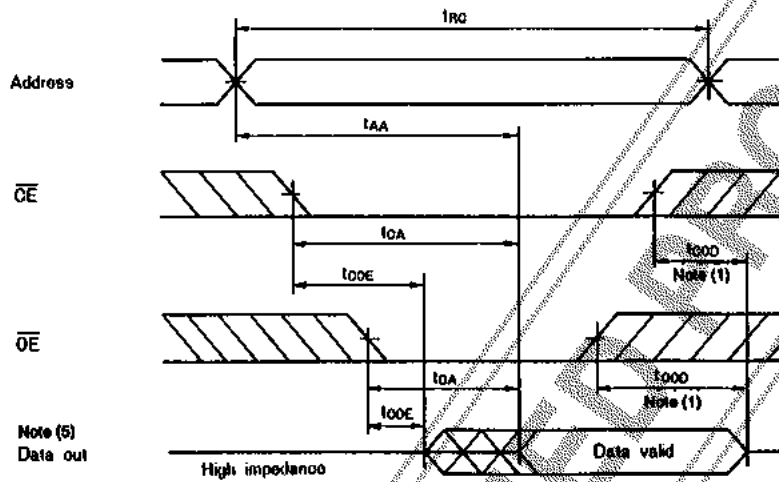
Parameter	Symbol	LC36256AL-70 LC36256AML-70		LC36256AL-85 LC36256AML-85		LC36256AL-10 LC36256AML-10		LC36256AL-12 LC36256AML-12		Unit
		min	max	min	max	min	max	min	max	
Write cycle time	t <sub>WC</sub>	70		85		100		120		ns
Address valid to end of write	t <sub>AW</sub>	65		75		80		100		ns
Address setup time	t <sub>AS</sub>	0		0		0		0		ns
Write pulse width	t <sub>WP</sub>	50		50		60		70		ns
CE setup time	t <sub>CW</sub>	65		75		80		100		ns
Write recovery time (WE)	t <sub>WR</sub>	0		0		0		0		ns
Write recovery time (CE)	t <sub>WR1</sub>	0		0		0		0		ns
Data setup time	t <sub>DS</sub>	30		30		35		40		ns
Data hold time	t <sub>DH</sub>	0		0		0		0		ns
WE output enable time	t <sub>WOE</sub>	10		10		10		10		ns
WE output disable time	t <sub>WOD</sub>	0	25	0	25	0	25	0	25	ns

**Timing Chart**

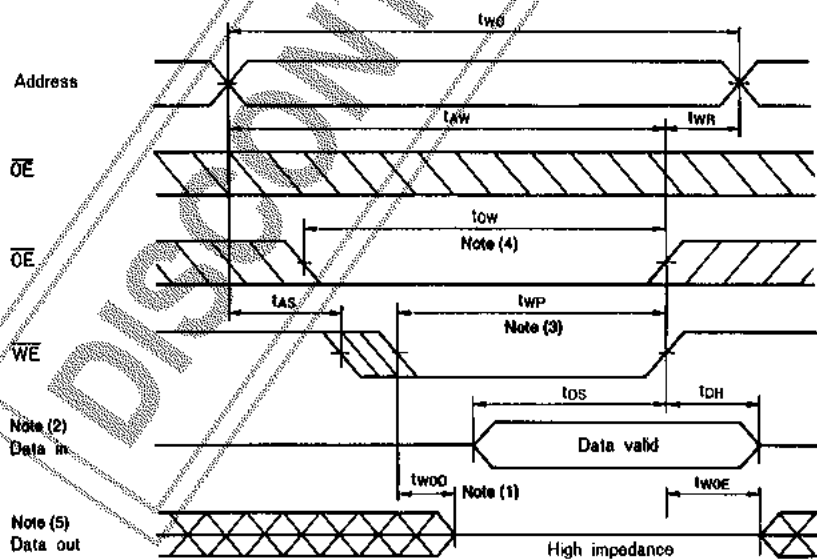
- Read Cycle (1):  $\overline{CE} = \overline{OE} = V_{IL}, \overline{WE} = V_{IH}$



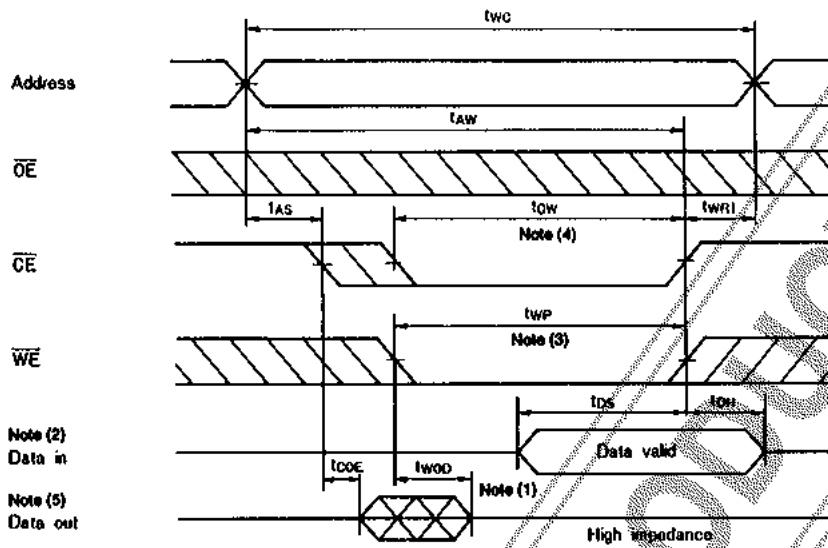
- Read Cycle (2):  $\overline{WE} = V_{IH}$



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



• Write Cycle (2):  $\overline{CE}$  Control Note (6)



- Notes
- (1)  $t_{COD}$ ,  $t_{OOD}$ , and  $t_{WOD}$  are defined as the time at which the outputs becomes the high impedance state and are not referred to output voltage levels.
  - (2) An external antiphase signal must not be applied when DOUT is in the output state.
  - (3)  $t_{WP}$  is the time interval that  $\overline{CE}$  and  $\overline{WE}$  are low-level and is defined as the interval from the falling of  $\overline{WE}$  to the rising of  $\overline{CE}$  or  $\overline{WE}$  whichever is earlier.
  - (4)  $t_{CW}$  is the time interval that  $\overline{CE}$  and  $\overline{WE}$  are low-level and is defined as the time from the falling of  $\overline{CE}$  to the rising of  $\overline{CE}$  or  $\overline{WE}$  whichever is earlier.
  - (5) DOUT goes to the high-impedance state when either  $\overline{OE}$  is high-level,  $\overline{CE}$  is high-level, or  $\overline{WE}$  is low-level.
  - (6) When  $\overline{OE}$  is high-level during the write cycle, DOUT goes to the high-impedance state.

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

Parameter	Symbol	Conditions	LC36256AL/AML			Unit
			min	typ*	max	
Data retention supply voltage	$V_{DR}$	$V_{\overline{CE}} \geq V_{CC} - 0.2\text{V}$	2.0		5.5	V
Data retention supply current	$I_{CCDR1}$	$V_{CC} = 3.0\text{V}$ $V_{\overline{CE}} \geq 2.8\text{V}$	0 to $70^\circ\text{C}$		10	$\mu\text{A}$
			0 to $40^\circ\text{C}$		2	
			$25^\circ\text{C}$		0.25	
	$I_{CCDR2}$	$V_{CC} = 2.0$ to $5.5\text{V}$ $V_{\overline{CE}} \geq V_{CC} - 0.2\text{V}$		0.5	25	$\mu\text{A}$
$\overline{CE}$ setup time	$t_{CDR}$		0			ns
$\overline{CE}$ hold time	$t_H$		$t_{RC}^{**}$			ns

\* Reference values at  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$

\*\* $t_{RC}$  = Read Cycle time

Data Retention Waveform

