

**SANYO**

SANYO Semiconductors

**DATA SHEET****LC36256ALL,  
AMLL-70/85/10/12****Overview**

The LC36256ALL, AMLL-70/85/10/12 are fully asynchronous silicon gate CMOS static RAMs with an 32768 words × 8 bits.

This series has  $\overline{CE}$  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.

Current dissipation is notably reduced during stand-by and data retention. For these reasons, this series is most suited for use in systems requiring high speed, low power consumption and long-term battery backup. Simple memory capacity expansion is also supported.

**Features**

## • Access time

70 ns (max.)	: LC36256ALL-70, LC36256AMLL-70
85 ns (max.)	: LC36256ALL-85, LC36256AMLL-85
100 ns (max.)	: LC36256ALL-10, LC36256AMLL-10
120 ns (max.)	: LC36256ALL-12, LC36256AMLL-12

## • Low current dissipation

## During standby

0.5 $\mu$ A (max.)	/ $T_a = 25^\circ\text{C}$
1 $\mu$ A (max.)	/ $T_a = 0$ to $40^\circ\text{C}$
5 $\mu$ A (max.)	/ $T_a = 0$ to $70^\circ\text{C}$

## During data retention

0.3 $\mu$ A (max.)	/ $T_a = 25^\circ\text{C}$
0.6 $\mu$ A (max.)	/ $T_a = 0$ to $40^\circ\text{C}$
3 $\mu$ A (max.)	/ $T_a = 0$ to $70^\circ\text{C}$

## During operation (DC)

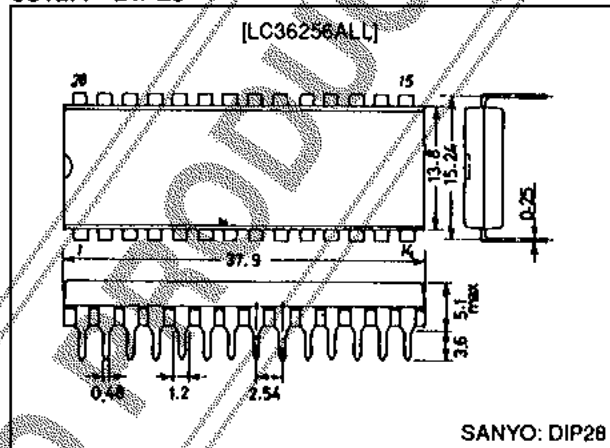
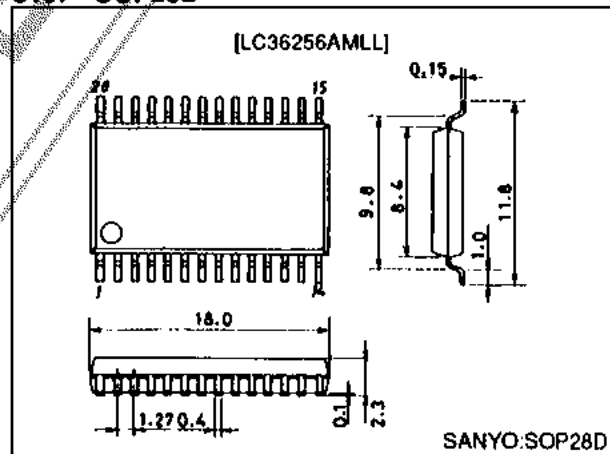
10 mA (max.)

- 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) : LC36256ALL
  - SOP 28-pin plastic package (450 mil) : LC36256AMLL

Asynchronous Silicon Gate CMOS LSI

**256K (32768 words × 8 bits)  
SRAM****Package Dimensions**

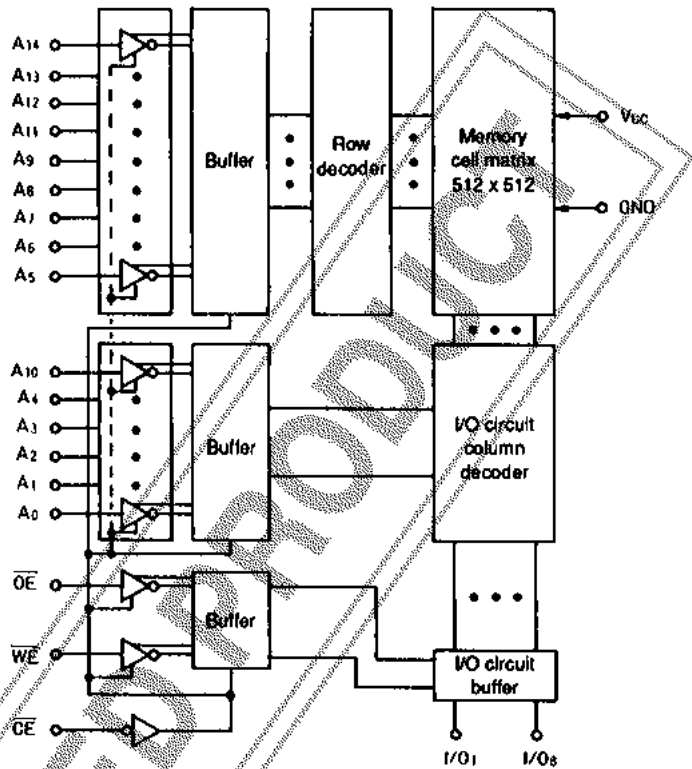
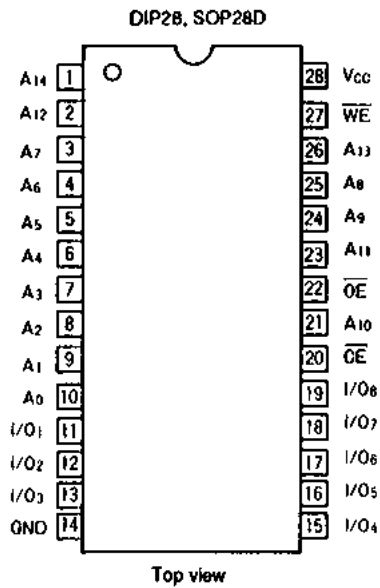
unit : mm

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Pin Assignment

Block Diagram



- A<sub>0</sub> to A<sub>14</sub> : Address input
- WE : Read/write control input
- OE : Output enable input
- CE : Chip enable input
- I/O<sub>1</sub> to I/O<sub>8</sub> : 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 Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		7.0	V
Input pin voltage	V <sub>IN</sub>		-0.5* to V <sub>CC</sub> +0.5	V
I/O pin voltage	V <sub>IO</sub>		-0.5* to V <sub>CC</sub> +0.5	V
Allowable power dissipation	P <sub>d</sub> max	LC36256ALL	1.0	W
		LC36256AMLL	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 Ta = 0 to 70°C

Parameter	Symbol	min	typ	max	Unit
Power supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
Input high level voltage	V <sub>IH</sub>	2.2		V <sub>CC</sub> +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 Ta = 0 to 70°C, V<sub>CC</sub> = 5 V ±10%

Parameter	Symbol	Conditions		min	typ*	max	Unit
Input leakage current	I <sub>LI</sub>	V <sub>IN</sub> = 0 to V <sub>CC</sub>		-0.5		+0.5	μA
I/O leakage current	I <sub>LO</sub>	V <sub>CE</sub> = V <sub>IH</sub> or V <sub>CE</sub> = V <sub>IH</sub> , V <sub>IO</sub> = 0 to V <sub>CC</sub>		-0.5		+0.5	μA
Output high level voltage	V <sub>OIH</sub>	I <sub>OIH</sub> = -1.0mA		2.4			V
Output low level voltage	V <sub>OIL</sub>	I <sub>OIL</sub> = 2.1mA				0.4	V
Operating supply current (DC)	I <sub>CCA1</sub>	V <sub>CE</sub> ≤ 0.2V, V <sub>IN</sub> ≤ 0.2V or V <sub>IN</sub> ≥ V <sub>CC</sub> -0.2V			1	5	mA
	I <sub>CCA2</sub>	V <sub>CE</sub> = V <sub>IL</sub> , 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>	V <sub>CE</sub> ≥ V <sub>CC</sub> -0.2V	LC36256ALL/ AMLL	0 to 70°C		5	μA
				0 to 40°C		1	
				25°C	0.2	0.5	
	I <sub>CCS2</sub>	V <sub>CE</sub> = V <sub>IH</sub>			0.4	2	mA

\* Reference values at V<sub>CC</sub> = 5 V, Ta = 25°C

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Input/output capacitance	C <sub>IO</sub>	V <sub>IO</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, V<sub>CC</sub> = 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**

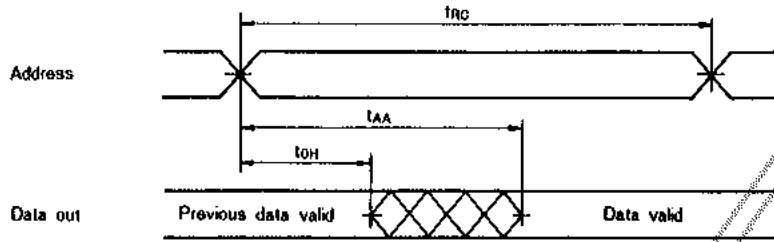
Parameter	Symbol	LC36256ALL-70 LC36256AMLL-70		LC36256ALL-85 LC36256AMLL-85		LC36256ALL-10 LC36256AMLL-10		LC36256ALL-12 LC36256AMLL-12		Unit
		min	max	min	max	min	max	min	max	
Read cycle time	t <sub>RC</sub>	70		85		100		120		ns
Address access time	t <sub>AA</sub>		70		85		100		120	ns
CE access time	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**

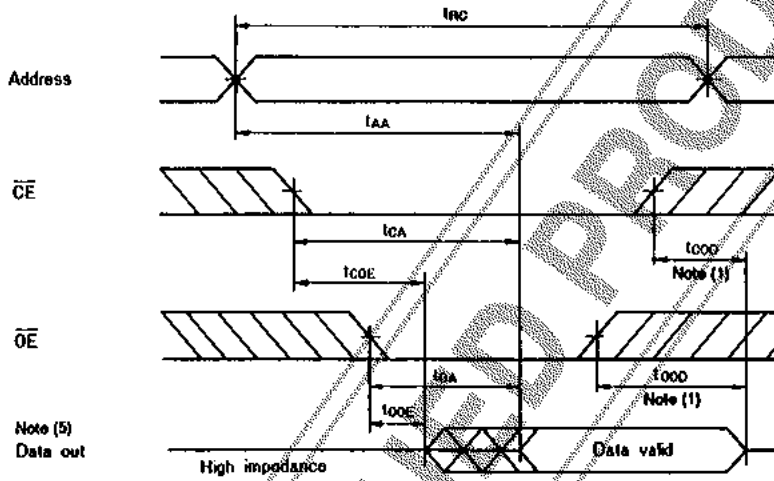
Parameter	Symbol	LC36256ALL-70 LC36256AMLL-70		LC36256ALL-85 LC36256AMLL-85		LC36256ALL-10 LC36256AMLL-10		LC36256ALL-12 LC36256AMLL-12		Unit
		min	max	min	max	min	max	min	max	
Write cycle time	t <sub>WC</sub>	70		85		100		120		ns
Address valid to end of write	t <sub>AW</sub>	65		75		80		100		ns
Address 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**

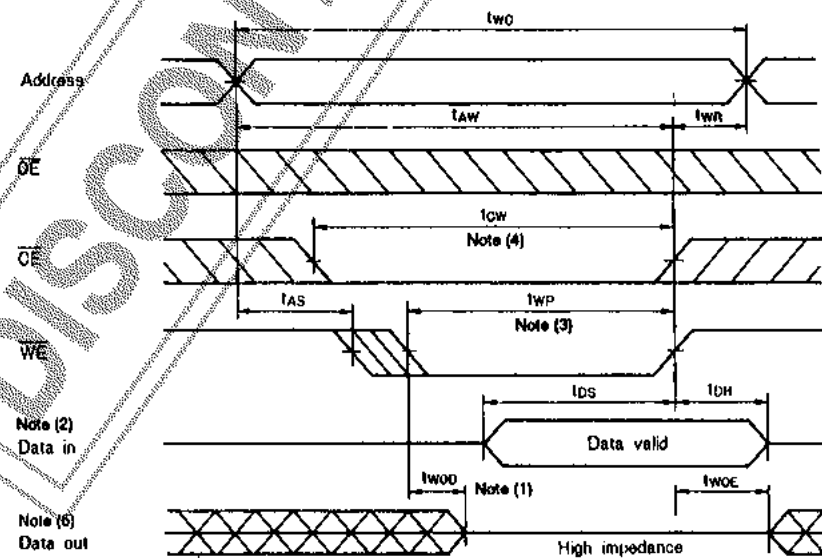
• Read Cycle (1):  $\overline{CE} = \overline{OE} = V_{IL}$ ,  $\overline{WE} = V_{IH}$



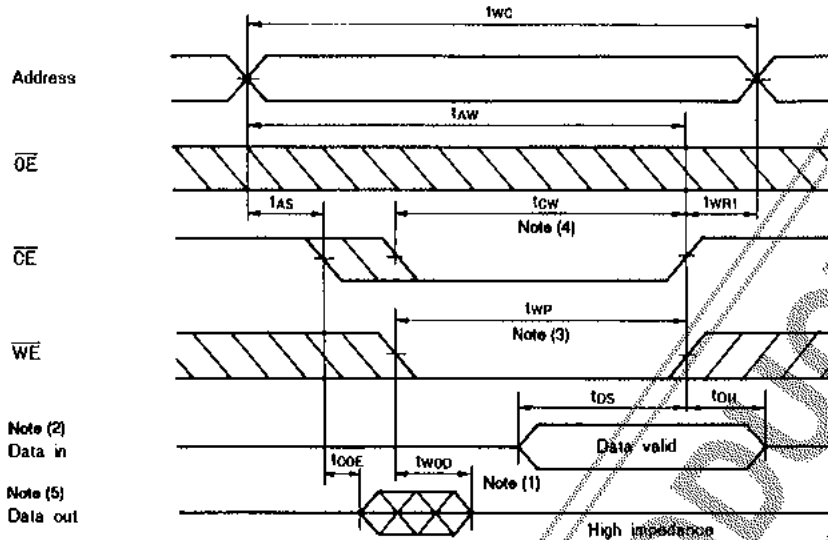
• Read Cycle (2):  $\overline{WE} = V_{IH}$



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



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



- Notes
- (1)  $t_{COE}$ ,  $t_{OD}$ , 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  $D_{OUT}$  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)  $D_{OUT}$  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,  $D_{OUT}$  goes to the high-impedance state.

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

Parameter	Symbol	Conditions	LC36256ALL/AMLL			Unit
			min	typ*	max	
Data retention supply voltage	$V_{DR}$	$V_{CE} \geq V_{CC} - 0.2V$	2.0		5.5	V
Data retention supply current	$I_{CCDR1}$	$V_{CC} = 3.0V$ , $V_{CE} \geq 2.8V$	0 to $70^\circ\text{C}$		3	$\mu\text{A}$
			0 to $40^\circ\text{C}$		0.6	
			$25^\circ\text{C}$	0.1	0.3	
	$I_{CCDR2}$	$V_{CC} = 2.0$ to $5.5V$ , $V_{CE} \geq V_{CC} - 0.2V$		0.2	5	$\mu\text{A}$
$\overline{CE}$ setup time	$t_{CDR}$		0			ns
$\overline{CE}$ hold time	$t_R$		$t_{RC}^{**}$			ns

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

Data Retention Waveform

