

# LH52256C/CH

CMOS 256K (32K × 8) Static RAM

## FEATURES

- 32,768 × 8 bit organization
- Access time: 70 ns (MAX.)
- Supply current:
  - Operating: 45 mA (MAX.)
  - 10 mA (MAX.) ( $t_{RC}$ ,  $t_{WC} = 1 \mu s$ )
  - Standby: 40  $\mu A$  (MAX.)
- Data retention current: 1.0  $\mu A$  (MAX.)
  - ( $V_{CCDR} = 3 V$ ,  $T_A = 25^\circ C$ )
- Wide operating voltage range:
  - 4.5 V  $\pm$  5.5 V
- Operating temperature:
  - Commerical temperature 0°C to +70°C
  - Industrial temperature -40° to +85°C
- Fully-static operation
- Three-state outputs
- Not designed or rated as radiation hardened
- Package:
  - 28-pin, 600-mil DIP
  - 28-pin, 450-mil SOP
  - 28-pin, 300-mil SK-DIP
  - 28-pin, 8 × 3 mm<sup>2</sup> TSOP (Type I)
- N-type bulk silicon

## DESCRIPTION

The LH52256C is a Static RAM organized as 32,768 × 8 bits which provides low-power standby mode. It is fabricated using silicon-gate CMOS process technology.

## PIN CONNECTIONS

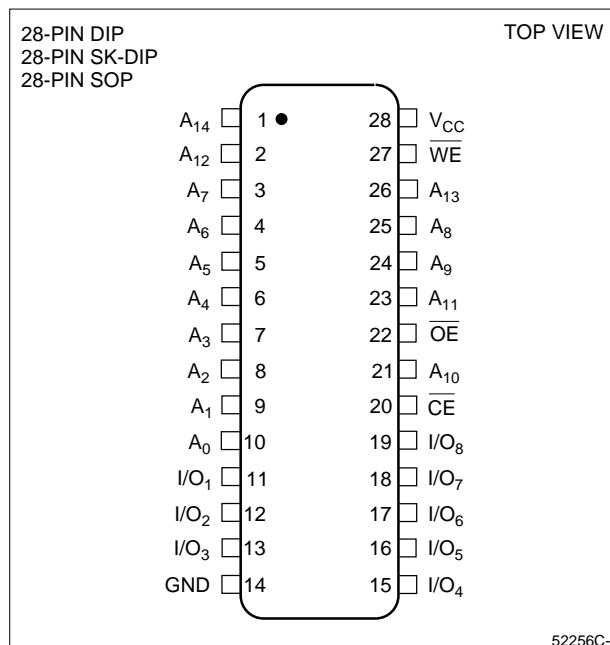


Figure 1. Pin Connections

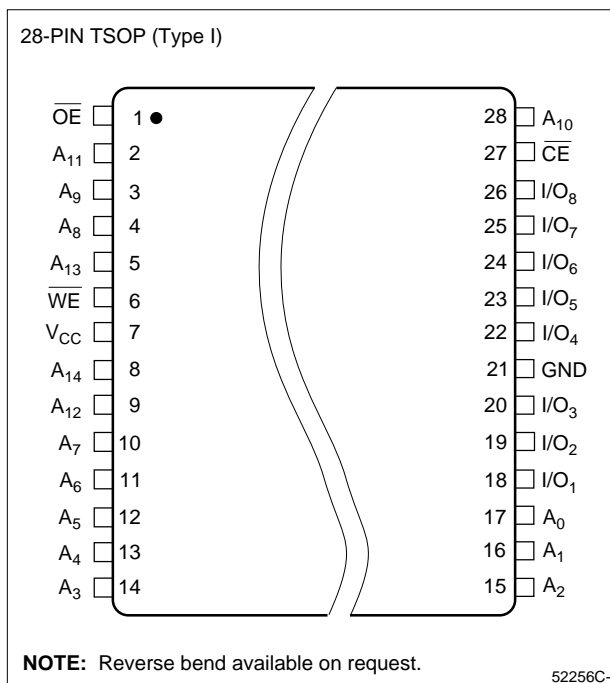


Figure 2. TSOP (Type I) Pin Connections

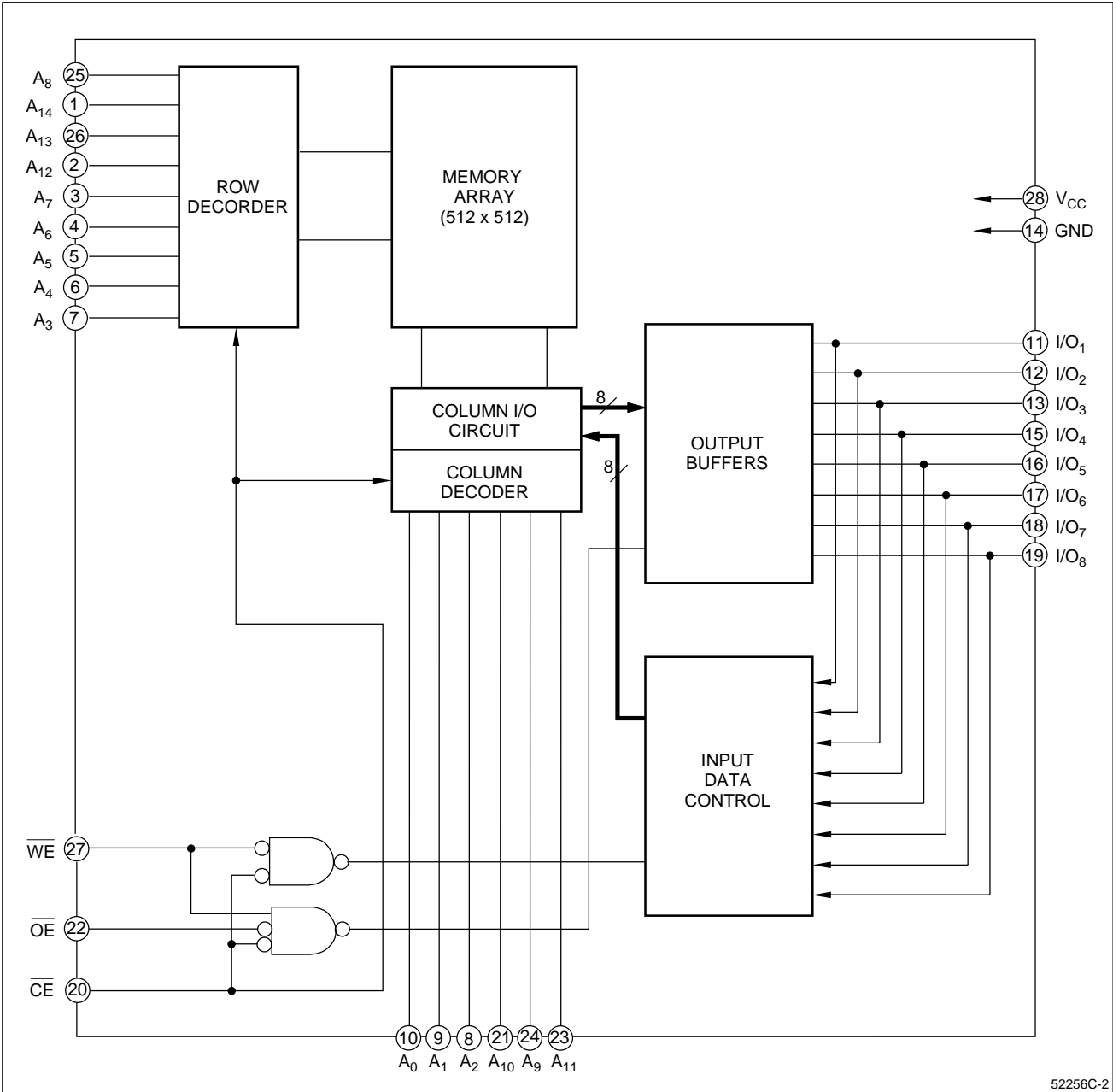


Figure 3. LH52256C Block Diagram

# PIN DESCRIPTION

SIGNAL	PIN NAME
A <sub>0</sub> - A <sub>14</sub>	Address inputs
CE	Chip enable
WE	Write enable
OE	Output enable

SIGNAL	PIN NAME
I/O <sub>1</sub> - I/O <sub>8</sub>	Data inputs and outputs
V <sub>CC</sub>	Power supply
GND	Ground

## TRUTH TABLE

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	MODE	I/O <sub>1</sub> - I/O <sub>8</sub>	SUPPLY CURRENT	NOTE
H	X	X	Standby	High impedance	Standby (I <sub>SB</sub> )	1
L	H	L	Read	Data output	Active (I <sub>CC</sub> )	1
L	H	H	Output disable	High impedance	Active (I <sub>CC</sub> )	1
L	L	X	Write	Data input	Active (I <sub>CC</sub> )	1

## NOTE:

1. X = Don't care, L = Low, H = High

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT	NOTE
Supply voltage	V <sub>CC</sub>	-0.5 to +7.0	V	1
Input voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> + 0.5	V	1, 2
Operating temperature	T <sub>OPR</sub>	0 to +70	°C	—
Storage temperature	T <sub>STG</sub>	-65 to +150	°C	—

## NOTES:

1. The maximum applicable voltage on any pin with respect to GND.  
 2. Undershoot of -3.0 V is allowed width of pulse below 50 ns.

RECOMMENDED DC OPERATING CONDITIONS (T<sub>A</sub> = 0°C to +70°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V	—
Input voltage	V <sub>IH</sub>	2.2	—	V <sub>CC</sub> + 0.5	V	—
	V <sub>IL</sub>	-0.5	—	0.8	V	1

## NOTE:

1. Undershoot of -3.0 V is allowed width of pulse below 50 ns.

**DC ELECTRICAL CHARACTERISTICS ( $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )**

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input leakage current	$I_{LI}$	$V_{IN} = 0\text{ V}$ to $V_{CC}$	-1.0	—	1.0	$\mu\text{A}$
Output leakage current	$I_{LO}$	$CE = V_{IH}$ or $OE = V_{IH}$ $V_{IO} = 0\text{ V}$ to $V_{CC}$	-1.0	—	1.0	$\mu\text{A}$
Operating supply current	$I_{CC}$	Minimum cycle, $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{IO} = 0\text{ mA}$ , $CE = V_{IL}$	—	25	45.0	mA
	$I_{CC1}$	$t_{RC}, t_{WC} = 1\text{ }\mu\text{s}$ , $V_{IN} = V_{IL}$ or $V_{IH}$ , $I_{IO} = 0\text{ mA}$ , $CE = V_{IL}$	—	—	10.0	
Standby current	$I_{SB}$	$CE \geq V_{CC} - 0.2\text{ V}$	—	0.6	40.0	$\mu\text{A}$
	$I_{SB1}$	$CE = V_{IH}$	—	—	3.0	mA
Output voltage	$V_{OL}$	$I_{OL} = 2.1\text{ mA}$	—	—	0.4	V
	$V_{OH}$	$I_{OH} = -1.0\text{ mA}$	2.4	—	—	

**NOTE:**

Typical values at  $V_{CC} = 5.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$

**AC ELECTRICAL CHARACTERISTICS****AC Test Conditions**

PARAMETER	MODE	NOTE
Input pulse level	0.6 V to 2.4 V	—
Input rise and fall time	10 ns	—
Input and output timing Ref. level	1.5 V	—
Output load	1 TTL + $C_L$ (100 pF)	1

**NOTE:**

1. Including scope and jig capacitance.

**READ CYCLE ( $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )**

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Read cycle time	$t_{RC}$	70	—	ns	—
Address access time	$t_{AA}$	—	70	ns	—
$CE$ access time	$t_{ACE}$	—	70	ns	—
Output enable to output valid	$t_{OE}$	—	35	ns	—
Output hold from address change	$t_{OH}$	10	—	ns	—
$CE$ Low to output active	$t_{LZ}$	10	—	ns	1
$OE$ Low to output active	$t_{OLZ}$	5	—	ns	1
$CE$ High to output in High impedance	$t_{HZ}$	0	30	ns	1
$OE$ High to output in High impedance	$t_{OHZ}$	0	30	ns	1

**NOTES:**

1. Active output to high-impedance and high-impedance to output active tests specified for a  $\pm 200\text{ mV}$  transition from steady state levels into the test load.

**WRITE CYCLE ( $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )**

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Write cycle time	$t_{WC}$	70	—	ns	—
CE Low to end of write	$t_{CW}$	45	—	ns	—
Address valid to end of write	$t_{AW}$	45	—	ns	—
Address setup time	$t_{AS}$	0	—	ns	—
Write pulse width	$t_{WP}$	35	—	ns	—
Write recovery time	$t_{WR}$	0	—	ns	—
Input data setup time	$t_{DW}$	30	—	ns	—
Input data hold time	$t_{DH}$	0	—	ns	—
$\overline{WE}$ High to output active	$t_{OW}$	5	—	ns	1
$\overline{WE}$ Low to output in High impedance	$t_{WZ}$	0	30	ns	1
OE High to output in High impedance	$t_{OHZ}$	0	30	ns	1

**NOTE:**

- Active output to high-impedance and high-impedance to output active tests specified for a  $\pm 200\text{ mV}$  transition from steady state levels into the test load.

**CAPACITANCE ( $T_A = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$ )**

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Input capacitance	$C_{IN}$	$V_{IN} = 0\text{ V}$	—	—	7	pF	1
I/O capacitance	$C_{I/O}$	$V_{I/O} = 0\text{ V}$	—	—	10	pF	1

**NOTE:**

- This parameter is sampled and not production tested.

**DATA RETENTION CHARACTERISTICS ( $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ )**

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNIT	NOTE
Data retention supply voltage	$V_{CCDR}$	$\overline{CE} \geq V_{CCDR} - 0.2\text{ V}$		2.0	—	5.5	V	—
Data retention supply current	$I_{CCDR}$	$V_{CCDR} = 3.0\text{ V}$	$T_A = 25^\circ\text{C}$	—	0.3	1.0	$\mu\text{A}$	—
			$T_A = 40^\circ\text{C}$	—	—	3.0		—
		$\overline{CE} \geq V_{CCDR} - 0.2\text{ V}$				15		
Chip enable setup time	$t_{CDR}$	—		0	—	—	ns	—
Chip enable hold time	$t_R$	—		$t_{RC}$	—	—	ns	1

**NOTE:**

- $t_{RC}$  = Read cycle time.
- Typical values at  $T_A = 25^\circ\text{C}$

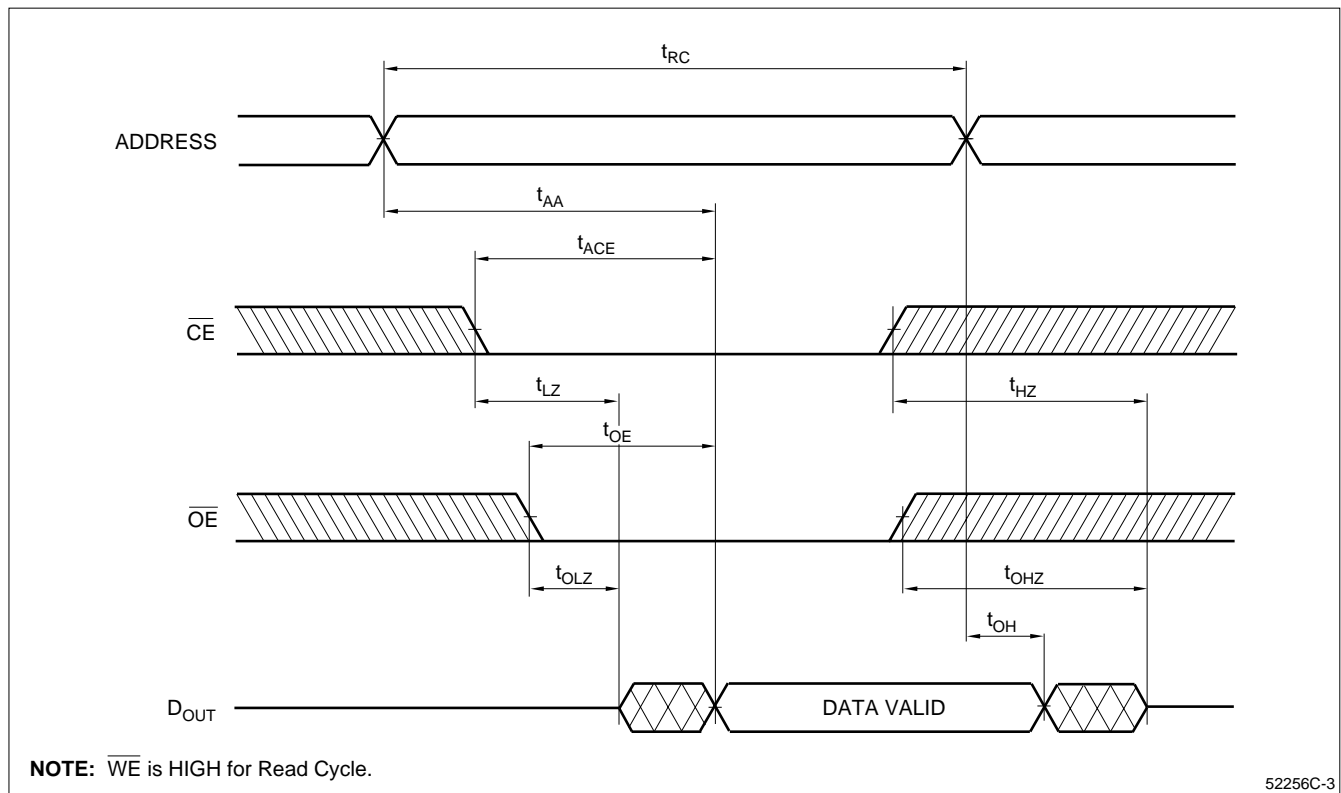
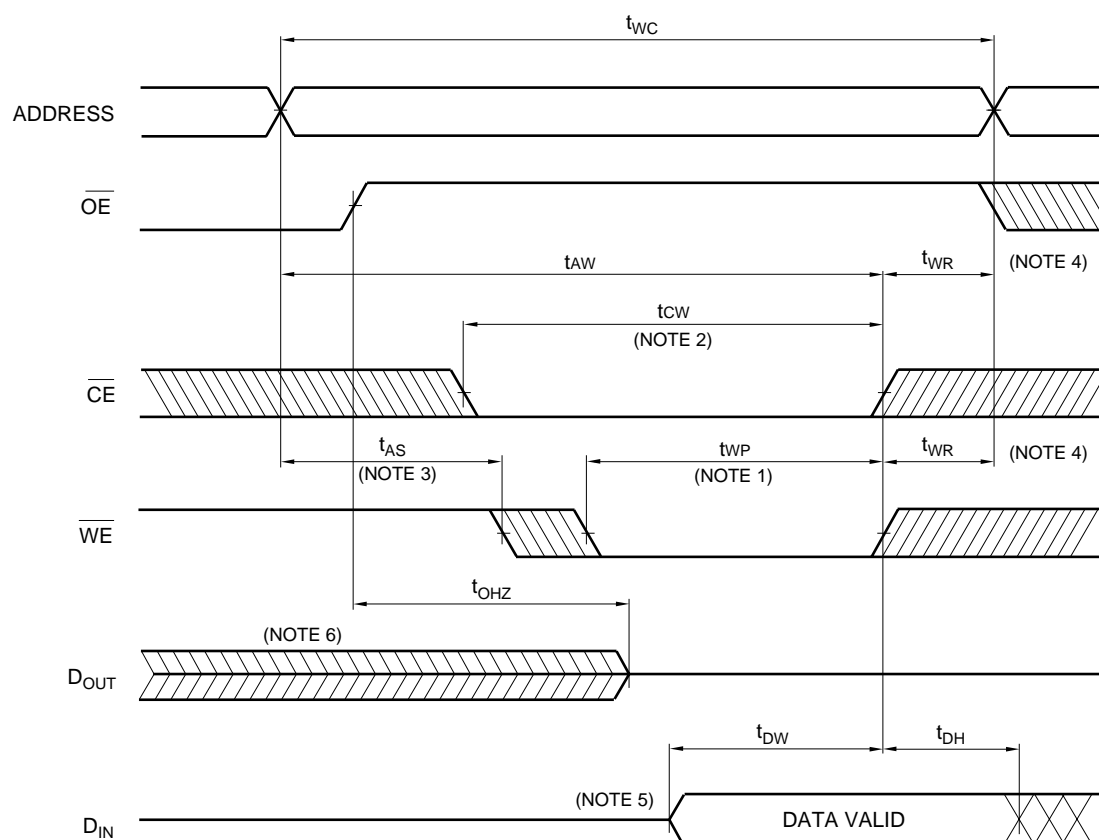


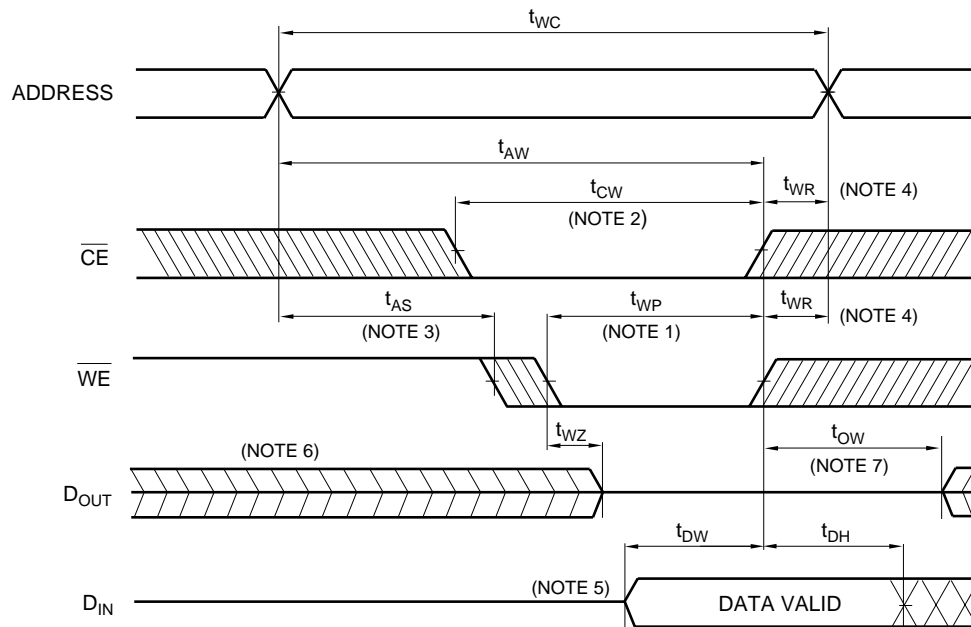
Figure 4. Read Cycle

**NOTES:**

1. A write occurs during the overlap of a LOW  $\overline{CE}$  and a LOW  $\overline{WE}$ . A write begins at the latest transition among  $\overline{CE}$  going LOW, and  $\overline{WE}$  going LOW. A write ends at the earliest transition among  $\overline{CE}$  going HIGH, and  $\overline{WE}$  going HIGH.  $t_{WP}$  is measured from the beginning of write to the end of write.
2.  $t_{CW}$  is measured from the later of  $\overline{CE}$  going LOW to the end of write.
3.  $t_{AS}$  is measured from the address valid to the beginning of write.
4.  $t_{WR}$  is measured from the end of write to the address change.
5. During this period, I/O pins are in the output state, therefore the input signals of opposite phase to the outputs must not be applied.
6. If  $\overline{CE}$  goes LOW simultaneously with  $\overline{WE}$  going LOW or after  $\overline{WE}$  going LOW, the outputs remain in high impedance state.
7. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  going HIGH or before  $\overline{WE}$  going HIGH, the outputs remain in high impedance state.

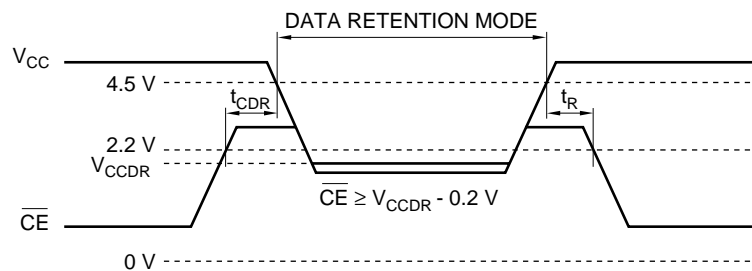
52256C-4

**Figure 5. Write Cycle (OE Controlled)**

**NOTES:**

1. A write occurs during the overlap of a LOW  $\overline{CE}$ , and a LOW  $\overline{WE}$ . A write begins at the latest transition among  $\overline{CE}$  going LOW, and  $\overline{WE}$  going LOW. A write ends at the earliest transition among  $\overline{CE}$  going HIGH, and  $\overline{WE}$  going HIGH.  $t_{WP}$  is measured from the beginning of write to the end of write.
2.  $t_{CW}$  is measured from the later of  $\overline{CE}$  going LOW to the end of write.
3.  $t_{AS}$  is measured from the address valid to the beginning of write.
4.  $t_{WR}$  is measured from the end of write to the address change.
5. During this period, I/O pins are in the output state, therefore the input signals of opposite phase to the outputs must not be applied.
6. If  $\overline{CE}$  goes LOW simultaneously with  $\overline{WE}$  going LOW or after  $\overline{WE}$  going LOW, the outputs remain in high impedance state.
7. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  going HIGH or before  $\overline{WE}$  going HIGH, the outputs remain in high impedance state.

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**Figure 6. Write Cycle ( $\overline{OE}$  Low Fixed)** **$\overline{CE}$  CONTROL**

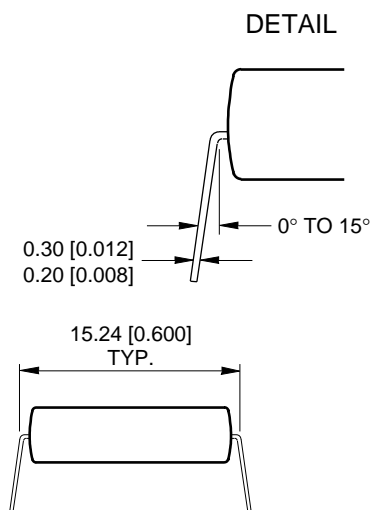
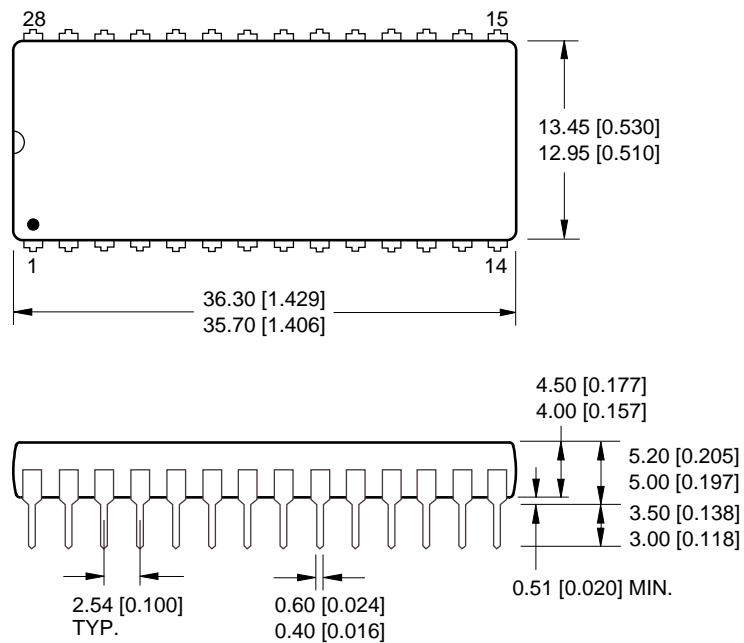
52256C-6

**Data Retention Timing Chart  
CE Controlled**



## PACKAGE DIAGRAMS

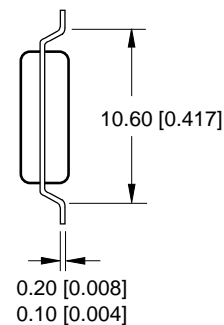
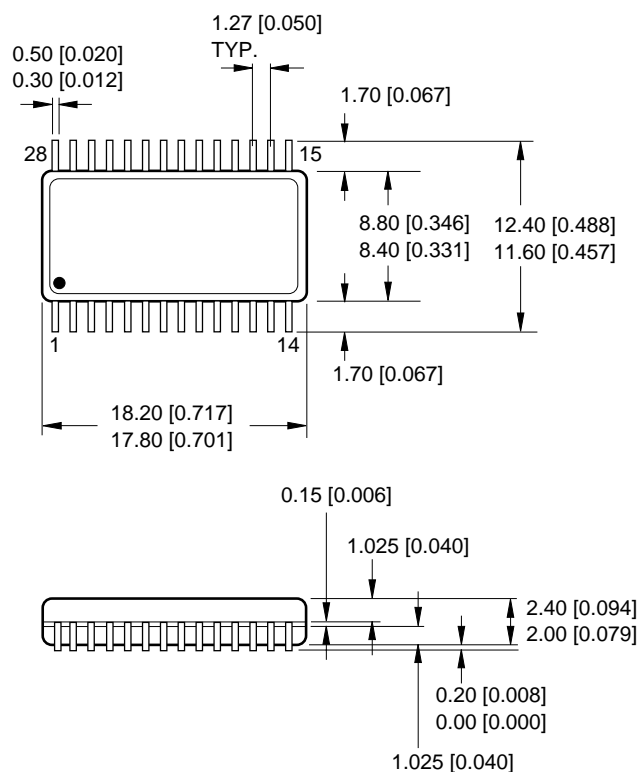
## 28DIP (DIP028-P-0600)



DIMENSIONS IN MM [INCHES]    MAXIMUM LIMIT  
MINIMUM LIMIT

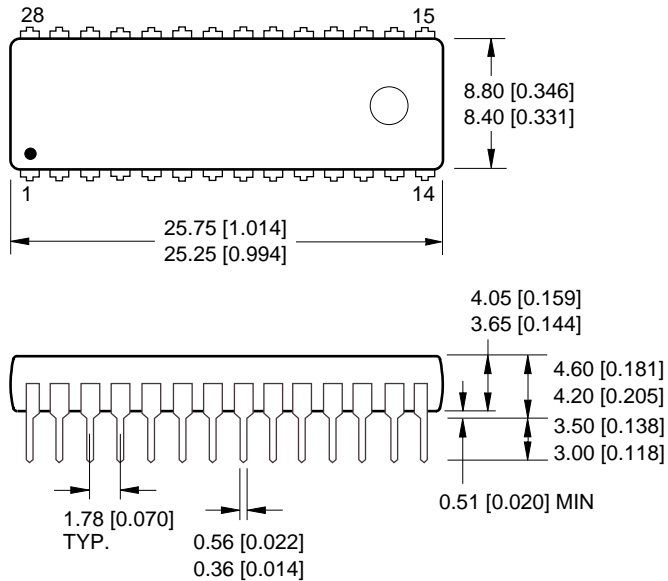
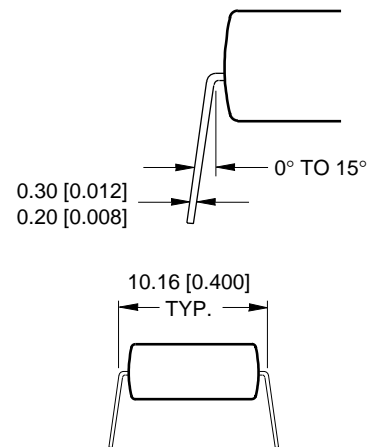
28DIP-2

## 28SOP (SOP028-P-0450)



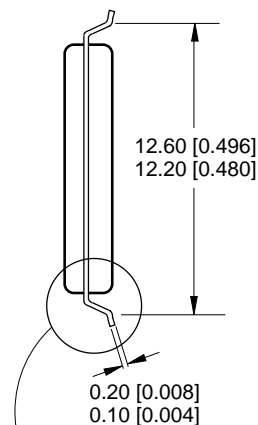
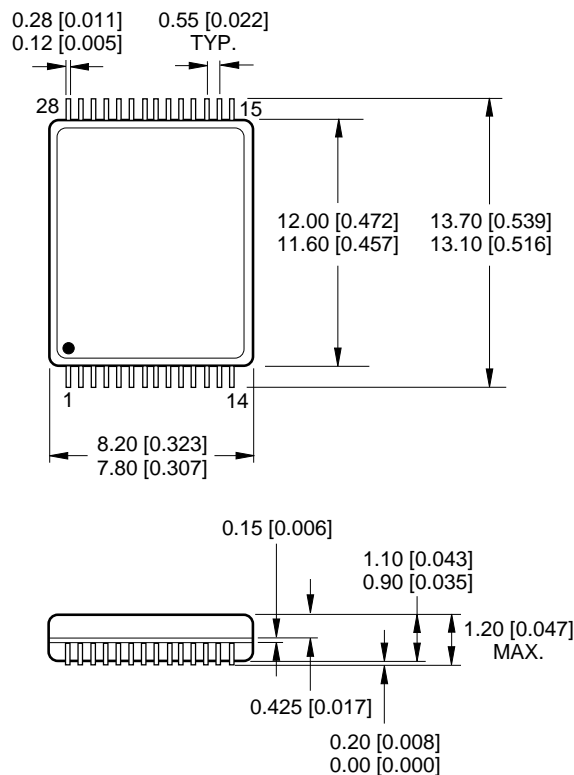
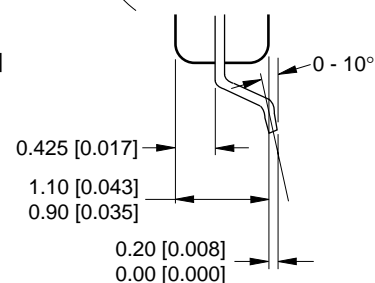
DIMENSIONS IN MM [INCHES]    MAXIMUM LIMIT  
MINIMUM LIMIT

28SOP

**28SDIP (SDIP28-P-400)****DETAIL**

DIMENSIONS IN MM [INCHES]    MAXIMUM LIMIT  
MINIMUM LIMIT

28SDIP

**28TSOP (TSOP028-P-0813)****DETAIL**

DIMENSIONS IN MM [INCHES]    MAXIMUM LIMIT  
MINIMUM LIMIT

28TSOP

ORDERING INFORMATION

LH52256C

Device Type

X

Operating Temp

X

Package

- ##

Speed

LL

Power

Low-Low-power standby

70 Access Time (ns)

Blank 28-pin, 600-mil DIP (DIP028-P-0600)

D 28-pin, 300-mil SK-DIP (DIP028-P-0300)

N 28-pin, 450-mil SOP (SOP028-P-0450)

T 28-pin, 8 x 13 mm<sup>2</sup> TSOP (Type I) (TSOP028-P-0813)

Blank 0° to +70°C

H -4° to +85°C

CMOS 32K x 8 Static RAM

Example: LH52256C-70LL (CMOS 32K x 8 Static RAM, Low-Low-power standby, 70 ns, 28-pin, 600-mil DIP)

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