



## Description

The GM76C8128CL/CLL is a 1,048,576 bits static random access memory organized as 131,072 words by 8 bits. Using a 0.6 $\mu$ m advanced CMOS technology and it provides high speed operation with minimum cycle time of 55/70/85ns. The device is placed in a low power standby mode with /CS1 high or CS2 low and the output enable (/OE) allows fast memory access. Thus it is suitable for high speed and low power applications, especially where battery back-up is required.

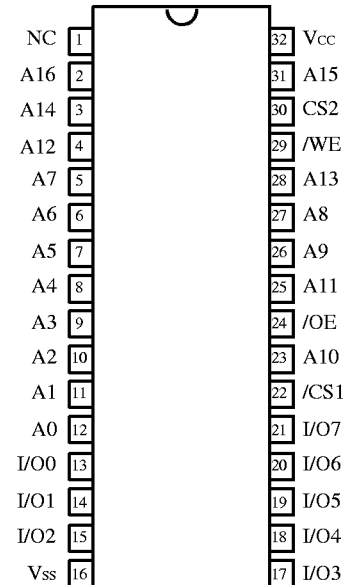
## Features

- \* Fast Speed : 55/70/85ns
- \* Low Power Standby and Low Power Operation
  - Standby : 0.275mW Max. at TA = - 40 ~ 85C(LLE/LLI)
  - 0.55mW Max. at TA = - 40 ~ 85C(LE/LI)
  - 0.11mW Max. at TA = 0 ~ 70C(LL)
  - 0.55mW Max. at TA = 0 ~ 70C(L)
- \* Operation : 385mW (Max)
- \* Completely Static RAM : No Clock or Timing Strobe Required
- \* Equal Access and Cycle Time
- \* TTL compatible inputs and outputs
- \* Capability of Battery Back-up Operation
- \* Single + 5V+/-10% Operation
- \* Standard 32 DIP, SOP and TSOP-I,STSOP-I
- \* Temperature Range
  - Commercial(0; > 70C) : GM76C8128C
  - Extended (-25 ~ 85C) : GM76C8128C-E
  - Industrial (-40 ~ 85C) : GM76C8128C-I

## Pin Description

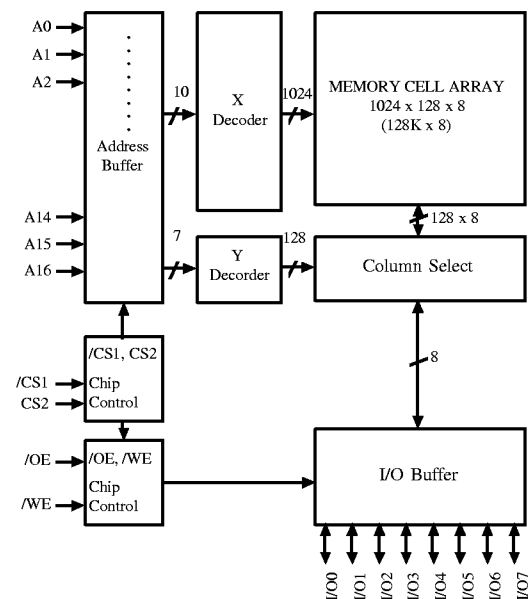
| Pin       | Function                  |
|-----------|---------------------------|
| A0-A16    | Address Inputs            |
| /WE       | Write Enable Input        |
| /CS1, CS2 | Chip Select Input         |
| /OE       | Output Enable Input       |
| I/O0-I/O7 | Data Inputs/Outputs       |
| Vcc       | Power Supply (4.5V ~5.5V) |
| Vss       | Ground                    |
| NC        | No Connection             |

## Pin Configuration



(Top View)

## Block Diagram



## Absolute Maximum Ratings\*

| Symbol           | Parameter                      |              | Rating                       | Unit |
|------------------|--------------------------------|--------------|------------------------------|------|
| T <sub>A</sub>   | Ambient Temperature under Bias | GM76C8128C   | 0 ~ 70                       | C    |
|                  |                                | GM76C8128C-E | -25 ~ 85                     | C    |
|                  |                                | GM76C8128C-I | -40 ~ 85                     | C    |
| T <sub>STG</sub> | Storage Temperature            |              | -55 ~ 150                    | C    |
| T <sub>SOL</sub> | Soldering Temperature and Time |              | 260, 10 (at lead)            | C, S |
| V <sub>CC</sub>  | Supply Voltage                 |              | -0.3 ~ 7.0                   | V    |
| V <sub>IN</sub>  | Input Voltage                  |              | -0.3 ~ 7.0                   | V    |
| V <sub>IO</sub>  | Input and Output Voltage       |              | -0.5 ~ V <sub>CC</sub> + 0.5 | V    |
| P <sub>D</sub>   | Power Dissipation              |              | 1.0                          | W    |

\*: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended DC Operating Conditions (T<sub>A</sub> = - 40 ~ 85°C)

| Symbol          | Parameter          | Min   | Typ | Max                   | Unit |
|-----------------|--------------------|-------|-----|-----------------------|------|
| V <sub>CC</sub> | Supply Voltage     | 4.5   | 5.0 | 5.5                   | V    |
| V <sub>IH</sub> | Input High Voltage | 2.2   | -   | V <sub>CC</sub> + 0.3 | V    |
| V <sub>IL</sub> | Input Low Voltage  | -0.3* | -   | 0.8                   | V    |

\*Note :V<sub>IL</sub>(min) = -3.0V for ≤ 10ns pulse

## Truth Table

| /CS1 | CS2 | /OE | /WE | A0 to A16 | DATA I/O    | MODE           |
|------|-----|-----|-----|-----------|-------------|----------------|
| L    | H   | L   | H   | Stable    | Output Data | Read           |
| L    | H   | X   | L   | Stable    | Input Data  | Write          |
| L    | H   | H   | H   | Stable    | Hi-Z        | Output Disable |
| H    | X   | X   | X   | -         | Hi-Z        | Standby        |
| X    | L   | X   | X   | -         | Hi-Z        |                |

\*Note: X means don't care

Capacitance (f = 1MHz, T<sub>A</sub> = 25°C)

| Symbol          | Parameter          | Test Conditions     | Min | Max | Unit |
|-----------------|--------------------|---------------------|-----|-----|------|
| C <sub>IN</sub> | Input Capacitance  | V <sub>I</sub> = 0V | -   | 6   | pF   |
| C <sub>IO</sub> | Output Capacitance | V <sub>O</sub> = 0V | -   | 8   | pF   |

\*Note: This parameter is sampled and not 100% tested.

DC Operating Characteristics ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = -40 \sim 85^\circ C$ )

| Symbol            | Parameter                 |              | Conditions                                                                                                                                              |              | Min | *Typ | Max | Unit |
|-------------------|---------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----|------|-----|------|
| I <sub>I(L)</sub> | Input Leakage Current     |              | V <sub>IN</sub> = 0 to V <sub>CC</sub>                                                                                                                  |              | -1  | -    | 1   | uA   |
| I <sub>O(L)</sub> | Output Leakage Current    |              | /CS1 = V <sub>IH</sub> or CS2 = V <sub>IL</sub><br>/OE = V <sub>IH</sub> , V <sub>SS</sub> <=V <sub>OUT</sub> <=V <sub>CC</sub>                         |              | -1  | -    | 1   | uA   |
| V <sub>OH</sub>   | High Level Output Voltage |              | I <sub>OH</sub> = -1.0mA                                                                                                                                |              | 2.4 | -    | -   | V    |
| V <sub>OL</sub>   | Low Level Output Voltage  |              | I <sub>OL</sub> = 2.1mA                                                                                                                                 |              | -   | -    | 0.4 | V    |
| I <sub>CC</sub>   | Operating Supply Current  |              | /CS1 = V <sub>IL</sub> and CS2 = V <sub>IH</sub><br>V <sub>IN</sub> = V <sub>IH</sub> /V <sub>IL</sub> , I <sub>OUT</sub> = 0mA                         |              | -   | -    | 15  | mA   |
| I <sub>CC1</sub>  | Average Operating Current |              | /CS1 = V <sub>IL</sub> and CS2 = V <sub>IH</sub><br>V <sub>IN</sub> = V <sub>IH</sub> /V <sub>IL</sub><br>I <sub>OUT</sub> = 0mA<br>tcycle = Min, cycle |              | -   | -    | 70  | mA   |
| I <sub>CC2</sub>  |                           |              | /CS1 = 0.2V, CS2 = V <sub>CC</sub> -0.2V<br>V <sub>IN</sub> = V <sub>CC</sub> - 0.2V/0.2V<br>I <sub>OUT</sub> = 0mA<br>tcycle = 1us                     |              | -   | -    | 10  | mA   |
| I <sub>CCS1</sub> | Standby Current(TTL)      |              | /CS1 = V <sub>IH</sub> , CS2 = V <sub>IL</sub>                                                                                                          |              | -   | -    | 2   | mA   |
| I <sub>CCS2</sub> | Standby Current(CMOS)     | GM76C8128C   | /CS1 = V <sub>CC</sub> -0.2V<br>CS2 = 0.2V                                                                                                              | L - Version  | -   | -    | 100 | uA   |
|                   |                           |              |                                                                                                                                                         | LL - Version | -   | -    | 20  |      |
|                   |                           | GM76C8128C-E |                                                                                                                                                         | L - Version  | -   | -    | 100 | uA   |
|                   |                           | GM76C8128C-I |                                                                                                                                                         | LL - Version | -   | -    | 50  |      |

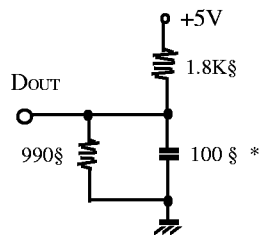
\*Typ. Values are measured at  $25^\circ C$ 

## AC Operating Characteristics

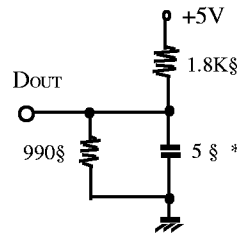
Test Conditions ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = -40 \sim 85^\circ C$ , unless otherwise noted.)

| Parameter                                | Value        |
|------------------------------------------|--------------|
| Input Pulse Level                        | 0.6V to 2.4V |
| Input Rise and Fall Time                 | 5ns          |
| Input and Output Timing Reference Levels | 1.5V         |
| Output Load                              | See below    |

Output Load (A)



Output Load (B) (for tCHZ, tCLZ, tWHZ, tOW, tOLZ &amp; tOHZ)



AC Operating Characteristics ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = -40 \sim 85^\circ C$ )

## Read Cycle

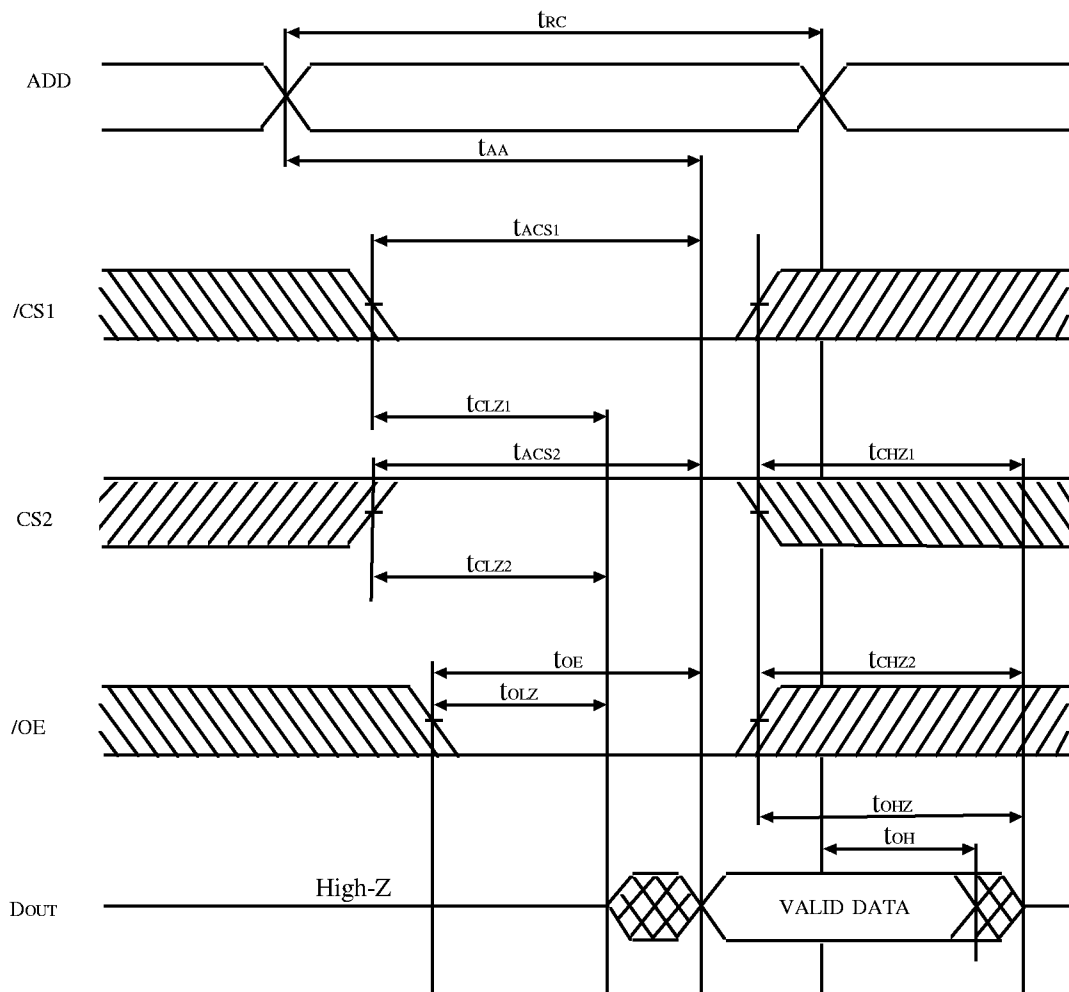
| Symbol     | Parameter                       | GM76C8128C-55 |     | GM76C8128C-70 |     | GM76C8128C-85 |     | Unit |
|------------|---------------------------------|---------------|-----|---------------|-----|---------------|-----|------|
|            |                                 | Min           | Max | Min           | Max | Min           | Max |      |
| $t_{RC}$   | Read Cycle Time                 | 55            | -   | 70            | -   | 85            | -   | ns   |
| $t_{AA}$   | Address Access Time             | -             | 55  | -             | 70  | -             | 85  | ns   |
| $t_{ACS1}$ | Chip Select 1 Access Time       | -             | 55  | -             | 70  | -             | 85  | ns   |
| $t_{ACS2}$ | Chip Select 2 Access Time       | -             | 55  | -             | 70  | -             | 85  | ns   |
| $t_{OE}$   | Output Enable Access Time       | -             | 30  | -             | 35  | -             | 45  | ns   |
| $t_{CLZ1}$ | Chip Select 1 Output Setup Time | 5             | -   | 5             | -   | 10            | -   | ns   |
| $t_{CHZ1}$ | Chip Select 1 Output Floating   | -             | 20  | -             | 25  | -             | 30  | ns   |
| $t_{CLZ2}$ | Chip Select 2 Output Setup Time | 5             | -   | 5             | -   | 10            | -   | ns   |
| $t_{CHZ2}$ | Chip Select 2 Output Floating   | -             | 20  | -             | 25  | -             | 30  | ns   |
| $t_{OLZ}$  | Output Enable Output Setup Time | 0             | -   | 0             | -   | 0             | -   | ns   |
| $t_{OHZ}$  | Output Enable Output Floating   | -             | 20  | -             | 25  | -             | 30  | ns   |
| $t_{OH}$   | Output Hold Time                | 5             | -   | 10            | -   | 10            | -   | ns   |

## Write Cycle

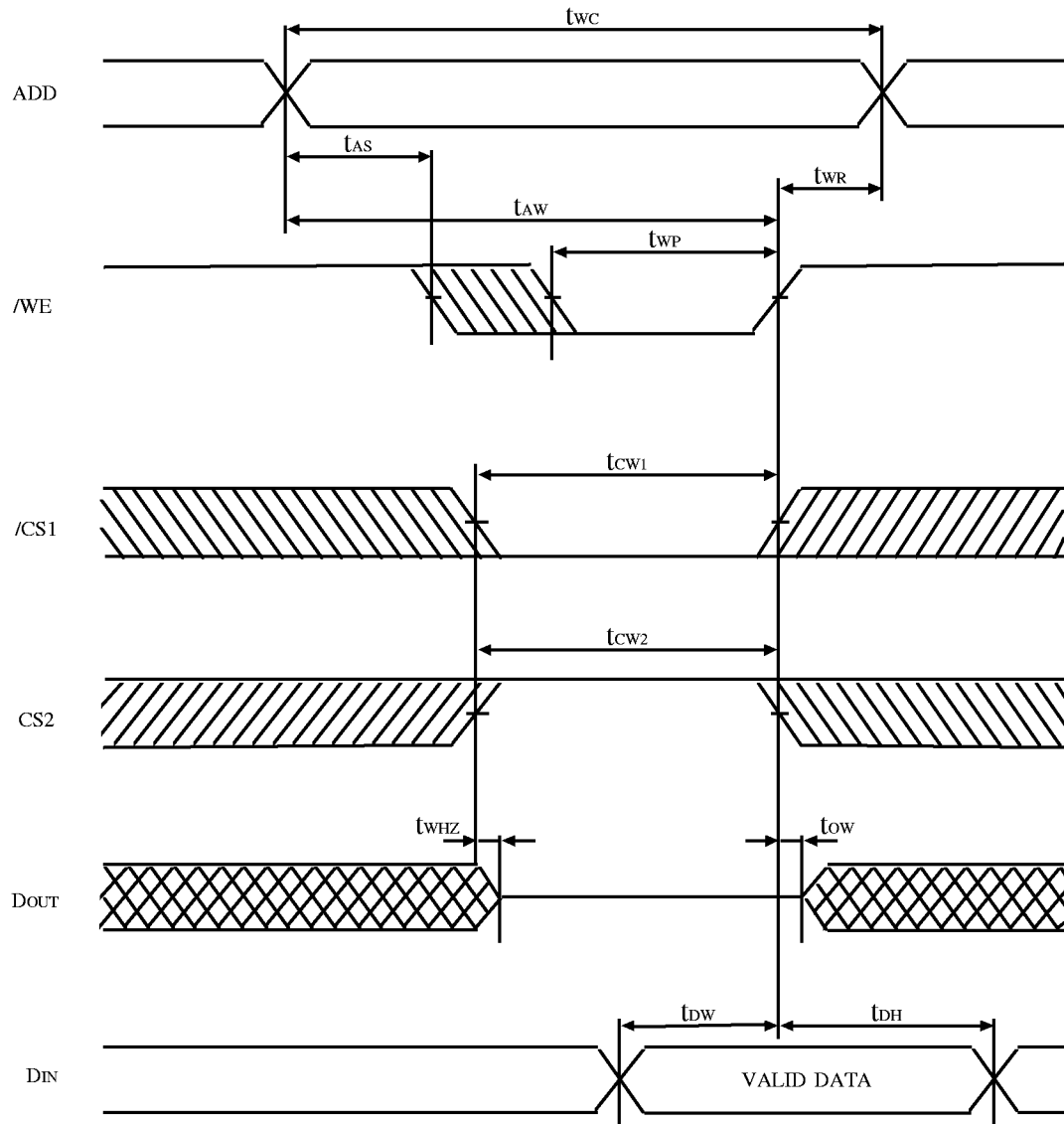
| Symbol    | Parameter                       | GM76C8128C-55 |     | GM76C8128C-70 |     | GM76C8128C-85 |     | Unit |
|-----------|---------------------------------|---------------|-----|---------------|-----|---------------|-----|------|
|           |                                 | Min           | Max | Min           | Max | Min           | Max |      |
| $t_{WC}$  | Write Cycle Time                | 55            | -   | 70            | -   | 85            | -   | ns   |
| $t_{CW1}$ | Chip Select Time 1              | 50            | -   | 65            | -   | 75            | -   | ns   |
| $t_{CW2}$ | Chip Select Time 2              | 50            | -   | 65            | -   | 75            | -   | ns   |
| $t_{AW}$  | Address Enable Time             | 50            | -   | 60            | -   | 70            | -   | ns   |
| $t_{AS}$  | Address Setup Time              | 0             | -   | 0             | -   | 0             | -   | ns   |
| $t_{WP}$  | Write Pulse Width               | 45            | -   | 50            | -   | 60            | -   | ns   |
| $t_{WR}$  | Address Hold Time               | 0             | -   | 0             | -   | 0             | -   | ns   |
| $t_{DW}$  | Input Data Setup Time           | 25            | -   | 30            | -   | 35            | -   | ns   |
| $t_{DH}$  | Input Data Hold Time            | 0             | -   | 0             | -   | 0             | -   | ns   |
| $t_{WHZ}$ | Write to Output in High-Z       | -             | 20  | -             | 25  | -             | 30  | ns   |
| $t_{OW}$  | Output Active from End of Write | 0             | -   | 0             | -   | 0             | -   | ns   |

## Timing Waveforms

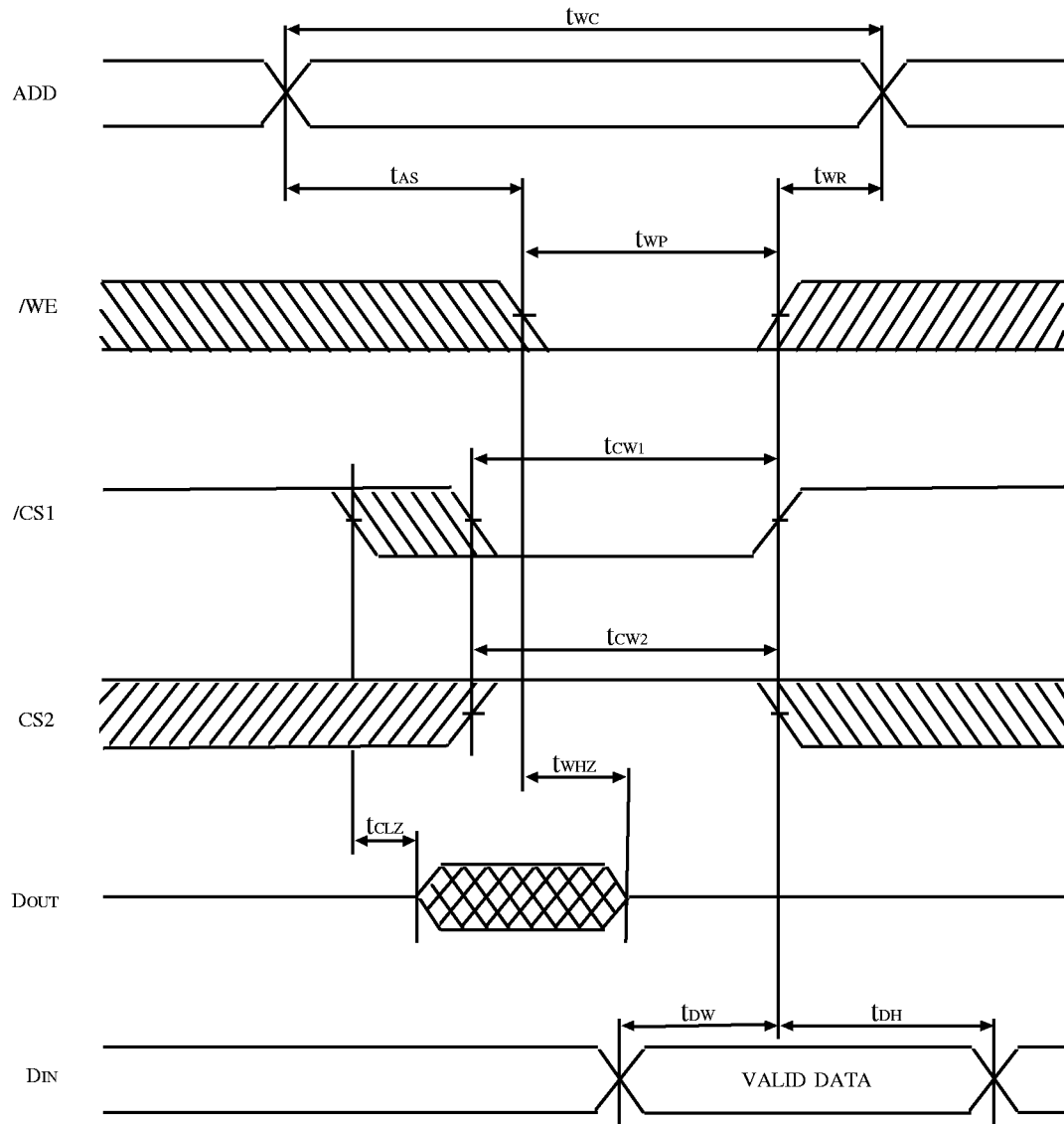
## Read Cycle (Note 1)



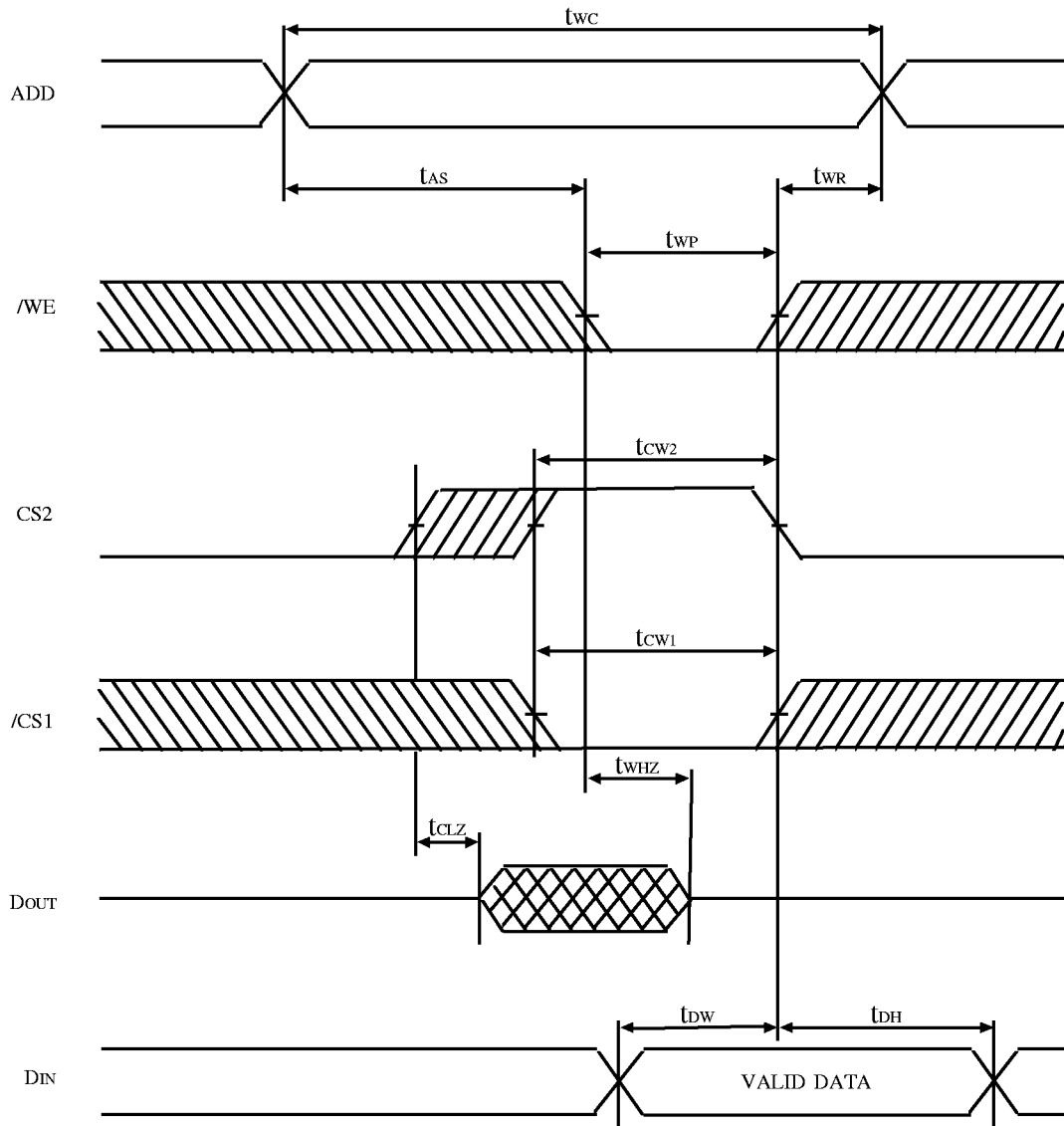
## Write Cycle (1) (/WE Controlled) (Notes 2, 3, 4)



## Write Cycle (2) (/CS1 Controlled) (Notes 4)



## Write Cycle (3) (CS2 Controlled) (Notes 4)



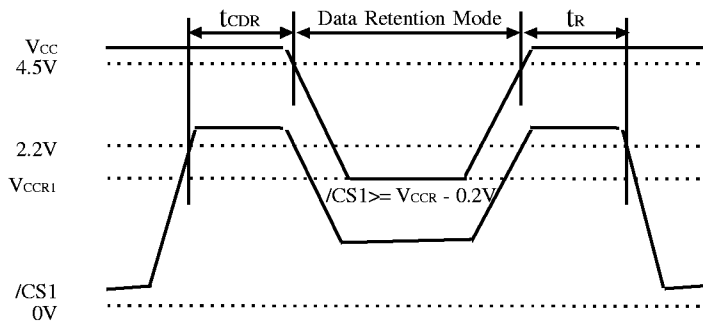
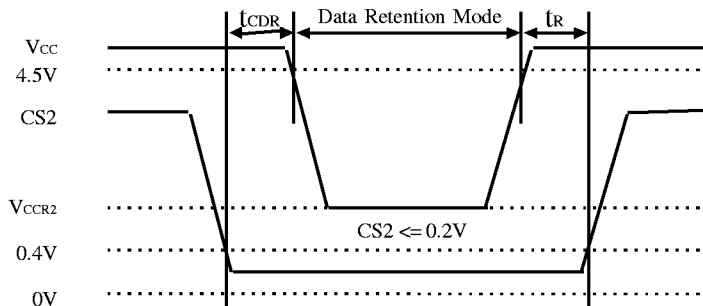
## Notes:

1. /WE is High for Read Cycle.
2. Assuming that /CS1 Low transition or CS2 High transition occurs coincident with or after /WE Low transition. Outputs remain in a high impedance state.
3. Assuming that /CS1 High transition or CS2 Low transition occurs coincident with or prior to /WE High transition. Outputs remain in a high impedance state.
4. Assuming that /OE is high for write cycle. Outputs are in a high impedance state during this period.



## Data Retention Characteristics

| Symbol           | Parameter                          |                              |          |              | Min                | Typ | Max | Unit |
|------------------|------------------------------------|------------------------------|----------|--------------|--------------------|-----|-----|------|
| V <sub>CCR</sub> | Data Retention Supply Voltage      |                              |          |              | 2.0                | -   | 5.5 | V    |
| I <sub>CCR</sub> | Data Retention Current             | GM76C8128C                   | VCC=3.0V | L - Version  | -                  | 1   | 50  | uA   |
|                  |                                    |                              |          | LL - Version | -                  | 0.5 | 15* |      |
|                  |                                    | GM76C8128C-E<br>GM76C8128C-I |          | L - Version  | -                  | -   | 50  |      |
|                  |                                    |                              |          | LL - Version | -                  | -   | 25* |      |
| t <sub>CDR</sub> | Chip Select to Data Retention Time |                              |          |              | 0                  | -   | -   | ns   |
| t <sub>r</sub>   | Operation Recovery Time            |                              |          |              | t <sub>rc</sub> ** | -   | -   | ns   |

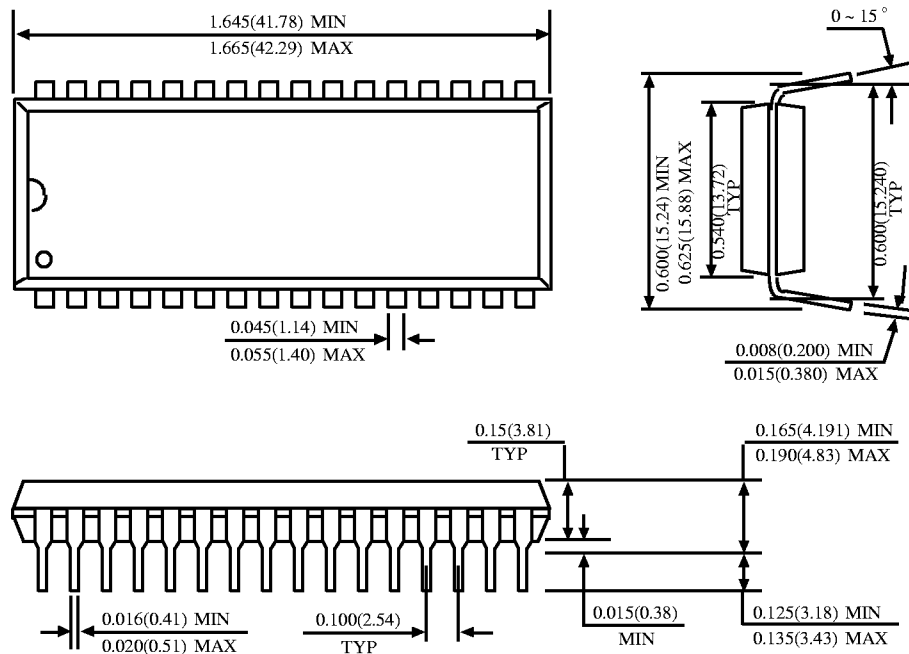
\* 3 $\mu A$  max at  $T_A = 0 \sim 40^\circ C$ \*\*  $t_{RC}$  = Read Cycle\* Low  $V_{CC}$  Data Retention Mode: (1) /CS1 Controlled\* Low  $V_{CC}$  Data Retention Mode: (2) CS2 Controlled

Notes: In Data Retention Mode, CS2 controls the Address, /WE, /CS1, /OE and  $D_{IN}$  buffer. If CS2 controls data retention mode,  $V_{IN}$  for these inputs can be in the high impedance state. If /CS1 controls the data retention mode, CS2 must satisfy either  $CS2 > V_{CCR} - 0.2V$  or  $CS2 \leq 0.2V$ . The other input levels (Address, /WE, /OE, I/O) can be in the high impedance state.

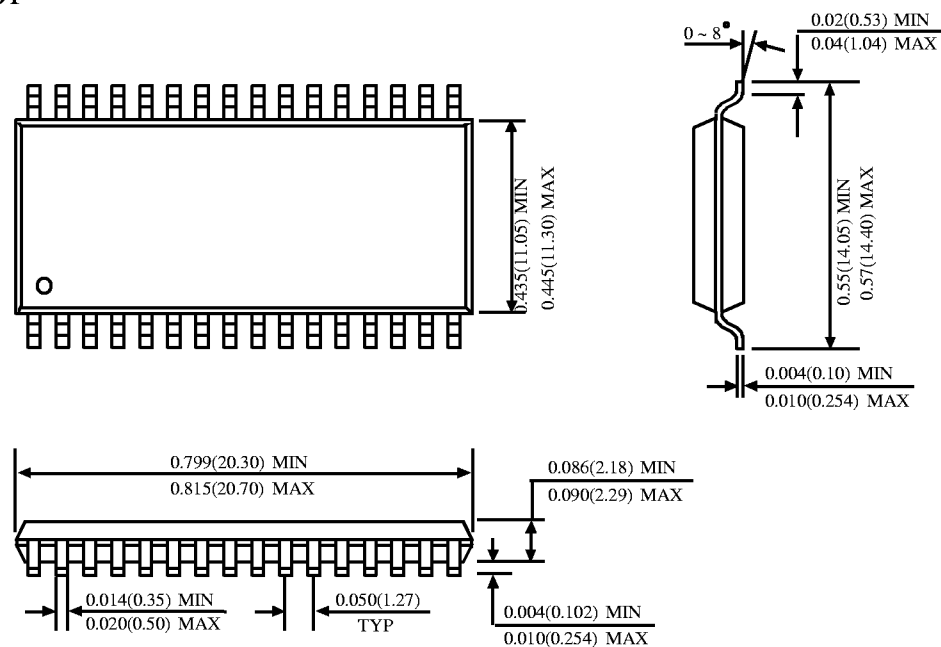
## Package Dimensions

Unit: Inches (mm)

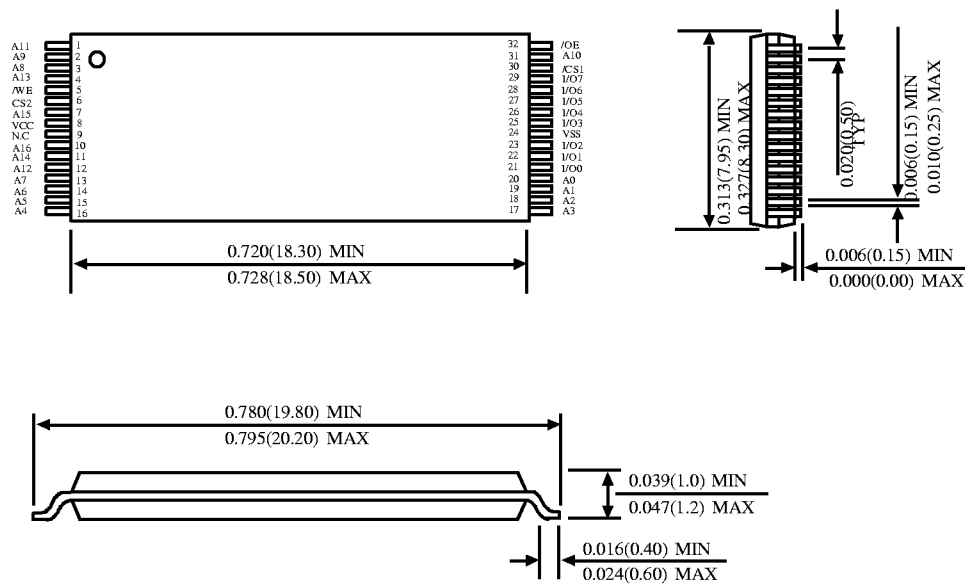
## 32 DIP



## 32 SOP



## 32 TSOP I (8x20mm)



## 32Small TSOP-I(8x13.4mm)

