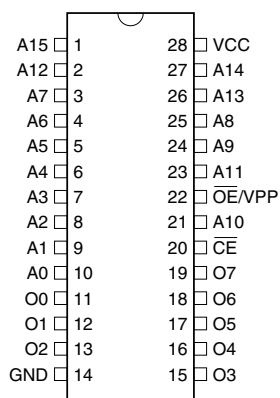


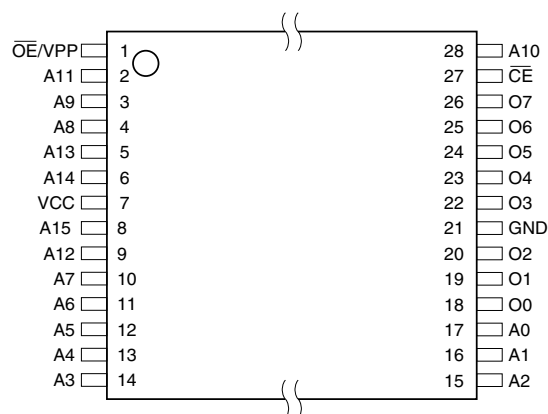
## 2. Pin Configurations

| Pin Name            | Function                      |
|---------------------|-------------------------------|
| A0 - A15            | Addresses                     |
| O0 - O7             | Outputs                       |
| $\overline{CE}$     | Chip Enable                   |
| $\overline{OE}/VPP$ | Output Enable/ Program Supply |
| NC                  | No Connect                    |

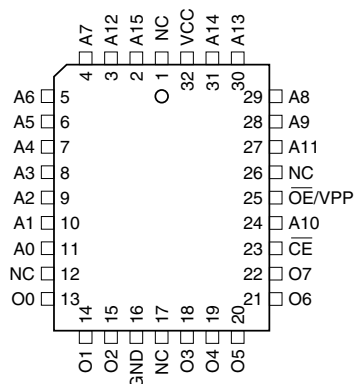
### 2.1 28-lead PDIP/SOIC Top View



### 2.3 28-lead TSOP Top View – Type 1



### 2.2 32-lead PLCC Top View

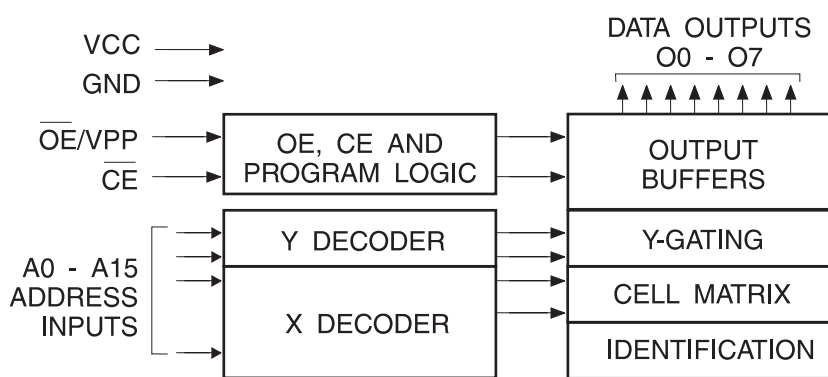


Note: PLCC Package Pins 1 and 17 are Don't Connect.

### 3. System Considerations

Switching between active and standby conditions via the Chip Enable pin may produce transient voltage excursions. Unless accommodated by the system design, these transients may exceed datasheet limits, resulting in device non-conformance. At a minimum, a 0.1  $\mu\text{F}$  high frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the  $V_{\text{CC}}$  and Ground terminals of the device, as close to the device as possible. Additionally, to stabilize the supply voltage level on printed circuit boards with large EPROM arrays, a 4.7  $\mu\text{F}$  bulk electrolytic capacitor should be utilized, again connected between the  $V_{\text{CC}}$  and Ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.

### 4. Block Diagram



### 5. Absolute Maximum Ratings\*

|                                                                |                                 |
|----------------------------------------------------------------|---------------------------------|
| Temperature Under Bias.....                                    | -55°C to + 125°C                |
| Storage Temperature .....                                      | -65°C to + 150°C                |
| Voltage on Any Pin with<br>Respect to Ground .....             | -2.0V to + 7.0V <sup>(1)</sup>  |
| Voltage on A9 with<br>Respect to Ground .....                  | -2.0V to + 14.0V <sup>(1)</sup> |
| $V_{\text{PP}}$ Supply Voltage with<br>Respect to Ground ..... | -2.0V to + 14.0V <sup>(1)</sup> |

**\*NOTICE:** Stresses beyond 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 beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note: 1. Minimum voltage is -0.6V DC which may undershoot to -2.0V for pulses of less than 20 ns. Maximum output pin voltage is  $V_{\text{CC}} + 0.75\text{V}$  DC which may overshoot to +7.0 volts for pulses of less than 20 ns.

## 6. Operating Modes

| Mode/Pin                              | $\overline{CE}$ | $\overline{OE}/V_{PP}$ | Ai                                                                   | Outputs             |
|---------------------------------------|-----------------|------------------------|----------------------------------------------------------------------|---------------------|
| Read                                  | $V_{IL}$        | $V_{IL}$               | Ai                                                                   | $D_{OUT}$           |
| Output Disable                        | $V_{IL}$        | $V_{IH}$               | $X^{(1)}$                                                            | High Z              |
| Standby                               | $V_{IH}$        | $X^{(1)}$              | X                                                                    | High Z              |
| Rapid Program <sup>(2)</sup>          | $V_{IL}$        | $V_{PP}$               | Ai                                                                   | $D_{IN}$            |
| PGM Inhibit                           | $V_{IH}$        | $V_{PP}$               | $X^{(1)}$                                                            | High Z              |
| Product Identification <sup>(4)</sup> | $V_{IL}$        | $V_{IL}$               | A9 = $V_H^{(3)}$<br>A0 = $V_{IH}$ or $V_{IL}$<br>A1 - A15 = $V_{IL}$ | Identification Code |

- Notes:
1. X can be  $V_{IL}$  or  $V_{IH}$ .
  2. Refer to Programming Characteristics.
  3.  $V_H = 12.0 \pm 0.5V$ .
  4. Two identifier bytes may be selected. All Ai inputs are held low ( $V_{IL}$ ), except A9 which is set to  $V_H$  and A0 which is toggled low ( $V_{IL}$ ) to select the Manufacturer's Identification byte and high ( $V_{IH}$ ) to select the Device Code byte.

## 7. DC and AC Operating Conditions for Read Operation

|                       |       | AT27C512R    |               |
|-----------------------|-------|--------------|---------------|
|                       |       | -45          | -70           |
| Operating Temp.(Case) | Ind.  | -40°C - 85°C | -40°C - 85°C  |
|                       | Auto. |              | -40°C - 125°C |
| $V_{CC}$ Supply       |       | 5V $\pm$ 10% | 5V $\pm$ 10%  |

## 8. DC and Operating Characteristics for Read Operation

| Symbol   | Parameter                      | Condition                                                 | Min   | Max            | Units   |
|----------|--------------------------------|-----------------------------------------------------------|-------|----------------|---------|
| $I_{LI}$ | Input Load Current             | $V_{IN} = 0V$ to $V_{CC}$                                 | Ind.  | $\pm 1$        | $\mu A$ |
|          |                                |                                                           | Auto. | $\pm 5$        | $\mu A$ |
| $I_{LO}$ | Output Leakage Current         | $V_{OUT} = 0V$ to $V_{CC}$                                | Ind.  | $\pm 5$        | $\mu A$ |
|          |                                |                                                           | Auto. | $\pm 10$       | $\mu A$ |
| $I_{SB}$ | $V_{CC}^{(1)}$ Standby Current | $I_{SB1}$ (CMOS), $\overline{CE} = V_{CC} \pm 0.3V$       |       | 100            | $\mu A$ |
|          |                                | $I_{SB2}$ (TTL), $\overline{CE} = 2.0$ to $V_{CC} + 0.5V$ |       | 1              | mA      |
| $I_{CC}$ | $V_{CC}$ Active Current        | $f = 5$ MHz, $I_{OUT} = 0$ mA, $\overline{CE} = V_{IL}$   |       | 20             | mA      |
| $V_{IL}$ | Input Low Voltage              |                                                           | -0.6  | 0.8            | V       |
| $V_{IH}$ | Input High Voltage             |                                                           | 2.0   | $V_{CC} + 0.5$ | V       |
| $V_{OL}$ | Output Low Voltage             | $I_{OL} = 2.1$ mA                                         |       | 0.4            | V       |
| $V_{OH}$ | Output High Voltage            | $I_{OH} = -400$ $\mu A$                                   | 2.4   |                | V       |

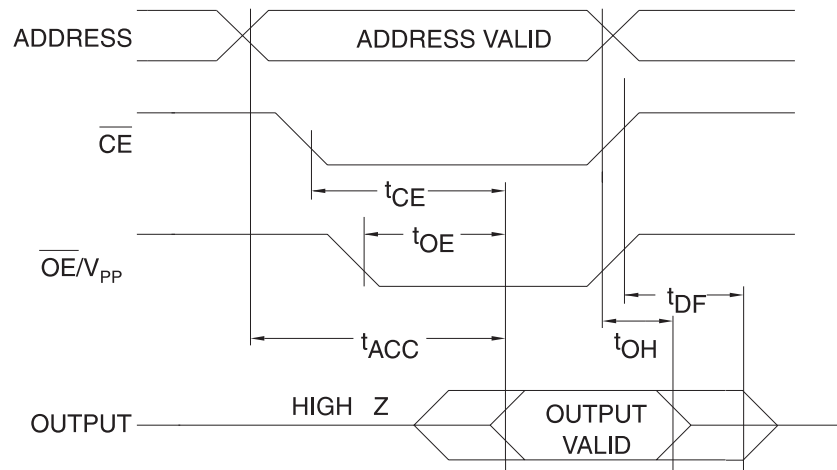
- Note:
1.  $V_{CC}$  must be applied simultaneously with or before  $\overline{OE}/V_{PP}$  and removed simultaneously with or after  $\overline{OE}/V_{PP}$ .

## 9. AC Characteristics for Read Operation

| Symbol                          | Parameter                                                                                    | Condition                                       | AT27C512R |     |     |     | Units |
|---------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------|-----------|-----|-----|-----|-------|
|                                 |                                                                                              |                                                 | -45       |     | -70 |     |       |
|                                 |                                                                                              |                                                 | Min       | Max | Min | Max |       |
| t <sub>ACC</sub> <sup>(1)</sup> | Address to Output Delay                                                                      | $\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$ |           | 45  |     | 70  | ns    |
| t <sub>CE</sub> <sup>(1)</sup>  | $\overline{CE}$ to Output Delay                                                              | $\overline{OE}/V_{PP} = V_{IL}$                 |           | 45  |     | 70  | ns    |
| t <sub>OE</sub> <sup>(1)</sup>  | $\overline{OE}/V_{PP}$ to Output Delay                                                       | $\overline{CE} = V_{IL}$                        |           | 20  |     | 30  | ns    |
| t <sub>DF</sub> <sup>(1)</sup>  | $\overline{OE}/V_{PP}$ or $\overline{CE}$ High to Output Float, Whichever Occurred First     |                                                 |           | 20  |     | 25  | ns    |
| t <sub>OH</sub>                 | Output Hold from Address, $\overline{CE}$ or $\overline{OE}/V_{PP}$ Whichever Occurred First |                                                 | 7         |     | 7   |     | ns    |

Note: 1. See AC Waveforms for Read Operation.

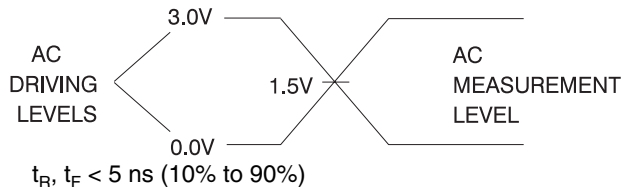
## 10. AC Waveforms for Read Operation<sup>(1)</sup>



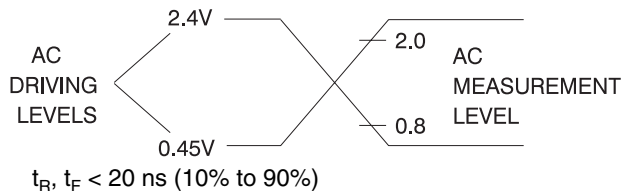
- Notes:
1. Timing measurement reference level is 1.5V for -45 devices. Input AC drive levels are  $V_{IL} = 0.0V$  and  $V_{IH} = 3.0V$ . Timing measurement reference levels for all other speed grades are  $V_{OL} = 0.8V$  and  $V_{OH} = 2.0V$ . Input AC drive levels are  $V_{IL} = 0.45V$  and  $V_{IH} = 2.4V$ .
  2.  $\overline{OE}/V_{PP}$  may be delayed up to  $t_{CE} - t_{OE}$  after the falling edge of  $\overline{CE}$  without impact on  $t_{CE}$ .
  3.  $\overline{OE}/V_{PP}$  may be delayed up to  $t_{ACC} - t_{OE}$  after the address is valid without impact on  $t_{ACC}$ .
  4. This parameter is only sampled and is not 100% tested.
  5. Output float is defined as the point when data is no longer driven.

## 11. Input Test Waveforms and Measurement Levels

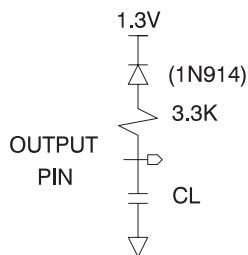
For -45 devices only:



For -70 devices:



## 12. Output Test Load



Note: 1.  $C_L = 100 \text{ pF}$  including jig capacitance, except for the -45 devices, where  $C_L = 30 \text{ pF}$ .

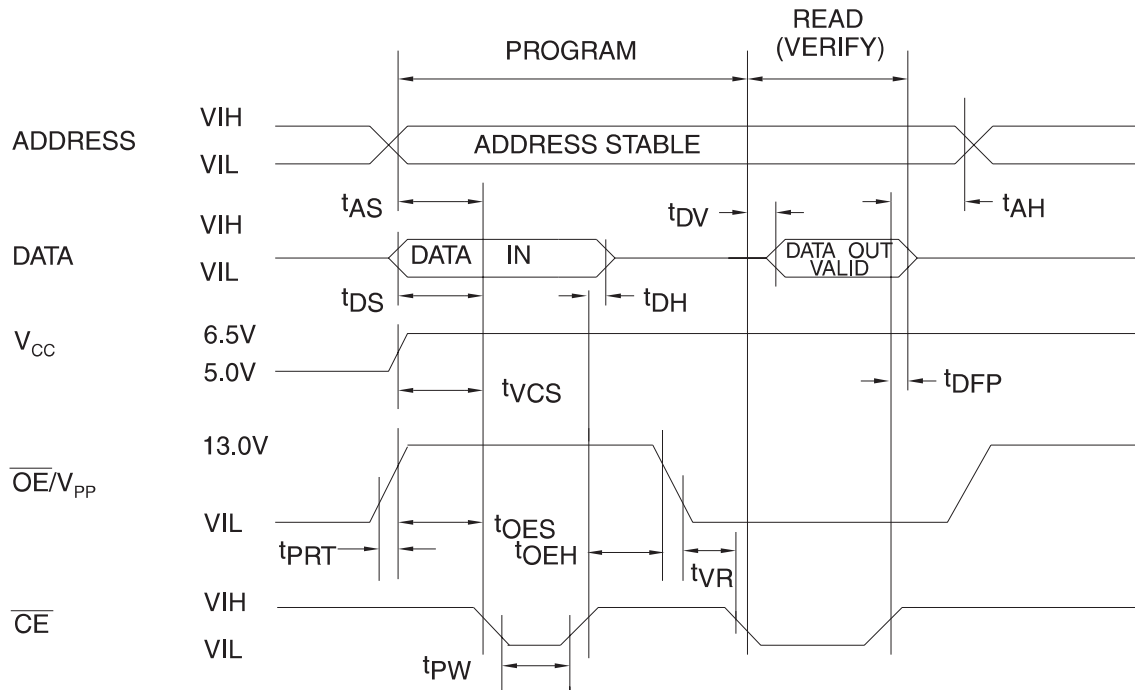
## 13. Pin Capacitance

$f = 1 \text{ MHz}$ ,  $T = 25^\circ\text{C}$  <sup>(1)</sup>

| Symbol    | Typ | Max | Units | Conditions     |
|-----------|-----|-----|-------|----------------|
| $C_{IN}$  | 4   | 6   | pF    | $V_{IN} = 0V$  |
| $C_{OUT}$ | 8   | 12  | pF    | $V_{OUT} = 0V$ |

Note: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

## 14. Programming Waveforms<sup>(1)</sup>



- Notes:
1. The Input Timing Reference is 0.8V for  $V_{IL}$  and 2.0V for  $V_{IH}$ .
  2.  $t_{OE}$  and  $t_{DFP}$  are characteristics of the device but must be accommodated by the programmer.

## 15. DC Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.5 \pm 0.25\text{V}$ ,  $\overline{OE}/V_{PP} = 13.0 \pm 0.25\text{V}$

| Symbol    | Parameter                                    | Test Conditions             | Limits |              | Units         |
|-----------|----------------------------------------------|-----------------------------|--------|--------------|---------------|
|           |                                              |                             | Min    | Max          |               |
| $I_{LI}$  | Input Load Current                           | $V_{IN} = V_{IL}, V_{IH}$   |        | $\pm 10$     | $\mu\text{A}$ |
| $V_{IL}$  | Input Low Level                              |                             | -0.6   | 0.8          | V             |
| $V_{IH}$  | Input High Level                             |                             | 2.0    | $V_{CC} + 1$ | V             |
| $V_{OL}$  | Output Low Voltage                           | $I_{OL} = 2.1 \text{ mA}$   |        | 0.4          | V             |
| $V_{OH}$  | Output High Voltage                          | $I_{OH} = -400 \mu\text{A}$ | 2.4    |              | V             |
| $I_{CC2}$ | $V_{CC}$ Supply Current (Program and Verify) |                             |        | 25           | mA            |
| $I_{PP2}$ | $\overline{OE}/V_{PP}$ Current               | $\overline{CE} = V_{IL}$    |        | 25           | mA            |
| $V_{ID}$  | A9 Product Identification Voltage            |                             | 11.5   | 12.5         | V             |

## 16. AC Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.5 \pm 0.25\text{V}$ ,  $\overline{OE}/V_{PP} = 13.0 \pm 0.25\text{V}$

| Symbol    | Parameter                                                 | Test Conditions <sup>(1)</sup>                  | Limits |     | Units         |
|-----------|-----------------------------------------------------------|-------------------------------------------------|--------|-----|---------------|
|           |                                                           |                                                 | Min    | Max |               |
| $t_{AS}$  | Address Setup Time                                        | Input Rise and Fall Times<br>(10% to 90%) 20 ns | 2      |     | $\mu\text{s}$ |
| $t_{OES}$ | $\overline{OE}/V_{PP}$ Setup Time                         |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{OEH}$ | $\overline{OE}/V_{PP}$ Hold Time                          |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{DS}$  | Data Setup Time                                           |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{AH}$  | Address Hold Time                                         | Input Pulse Levels<br>0.45V to 2.4V             | 0      |     | $\mu\text{s}$ |
| $t_{DH}$  | Data Hold Time                                            |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{DFP}$ | $\overline{CE}$ High to Output Float Delay <sup>(2)</sup> | Input Timing Reference Level<br>0.8V to 2.0V    | 0      | 130 | ns            |
| $t_{VCS}$ | $V_{CC}$ Setup Time                                       |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{PW}$  | $\overline{CE}$ Program Pulse Width <sup>(3)</sup>        |                                                 | 95     | 105 | $\mu\text{s}$ |
| $t_{DV}$  | Data Valid from $\overline{CE}$ <sup>(2)</sup>            | Output Timing Reference Level<br>0.8V to 2.0V   |        | 1   | $\mu\text{s}$ |
| $t_{VR}$  | $\overline{OE}/V_{PP}$ Recovery Time                      |                                                 | 2      |     | $\mu\text{s}$ |
| $t_{PRT}$ | $\overline{OE}/V_{PP}$ Pulse Rise Time During Programming |                                                 | 50     |     | ns            |

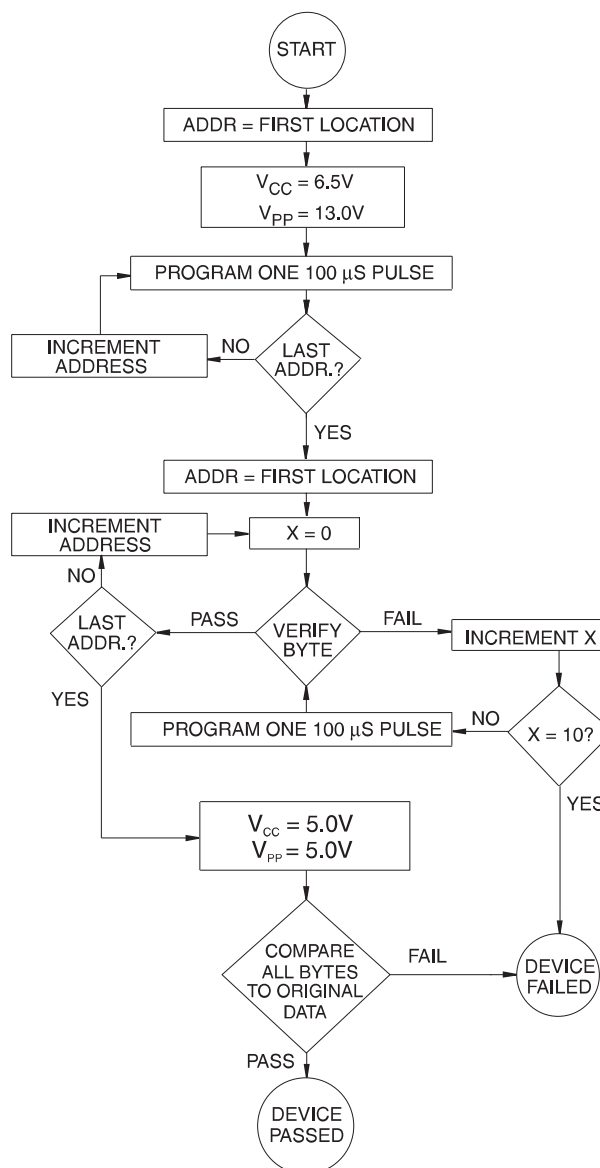
- Notes:
- $V_{CC}$  must be applied simultaneously or before  $\overline{OE}/V_{PP}$  and removed simultaneously or after  $\overline{OE}/V_{PP}$
  - This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven – see timing diagram.
  - Program Pulse width tolerance is 100  $\mu\text{sec} \pm 5\%$ .

## 17. Atmel's AT27C512R Integrated Product Identification Code

| Codes        | Pins |    |    |    |    |    |    |    |    | Hex Data |
|--------------|------|----|----|----|----|----|----|----|----|----------|
|              | A0   | O7 | O6 | O5 | O4 | O3 | O2 | O1 | O0 |          |
| Manufacturer | 0    | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1E       |
| Device Type  | 1    | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 1  | 0D       |

## 18. Rapid Programming Algorithm

A 100  $\mu\text{s}$   $\overline{\text{CE}}$  pulse width is used to program. The address is set to the first location.  $V_{\text{CC}}$  is raised to 6.5V and  $\overline{\text{OE}}/V_{\text{PP}}$  is raised to 13.0V. Each address is first programmed with one 100  $\mu\text{s}$   $\overline{\text{CE}}$  pulse without verification. Then a verification/reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 100  $\mu\text{s}$  pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked.  $\overline{\text{OE}}/V_{\text{PP}}$  is then lowered to  $V_{\text{IL}}$  and  $V_{\text{CC}}$  to 5.0V. All bytes are read again and compared with the original data to determine if the device passes or fails.



## 19. Ordering Information

### 19.1 Standard Package

| t <sub>ACC</sub><br>(ns) | I <sub>CC</sub> (mA) |         | Ordering Code  | Package            | Operation Range                  |
|--------------------------|----------------------|---------|----------------|--------------------|----------------------------------|
|                          | Active               | Standby |                |                    |                                  |
| 45                       | 20                   | 0.1     | AT27C512R-45JI | 32J                | Industrial<br>(-40° C to 85° C)  |
|                          |                      |         | AT27C512R-45PI | 28P6               |                                  |
|                          |                      |         | AT27C512R-45RI | 28R <sup>(1)</sup> |                                  |
|                          |                      |         | AT27C512R-45TI | 28T                |                                  |
| 70                       | 20                   | 0.1     | AT27C512R-70JI | 32J                | Industrial<br>(-40° C to 85° C)  |
|                          |                      |         | AT27C512R-70PI | 28P6               |                                  |
|                          |                      |         | AT27C512R-70RI | 28R <sup>(1)</sup> |                                  |
|                          |                      |         | AT27C512R-70TI | 28T                |                                  |
|                          | 20                   | 0.1     | AT27C512R-70JA | 32J                | Automotive<br>(-40° C to 125° C) |
|                          |                      |         | AT27C512R-70PA | 28P6               |                                  |
|                          |                      |         | AT27C512R-70RA | 28R <sup>(1)</sup> |                                  |
|                          |                      |         |                |                    |                                  |

Note:  Not recommended for new designs. Use Green package option.

### 19.2 Green Package (Pb/Halide-free)

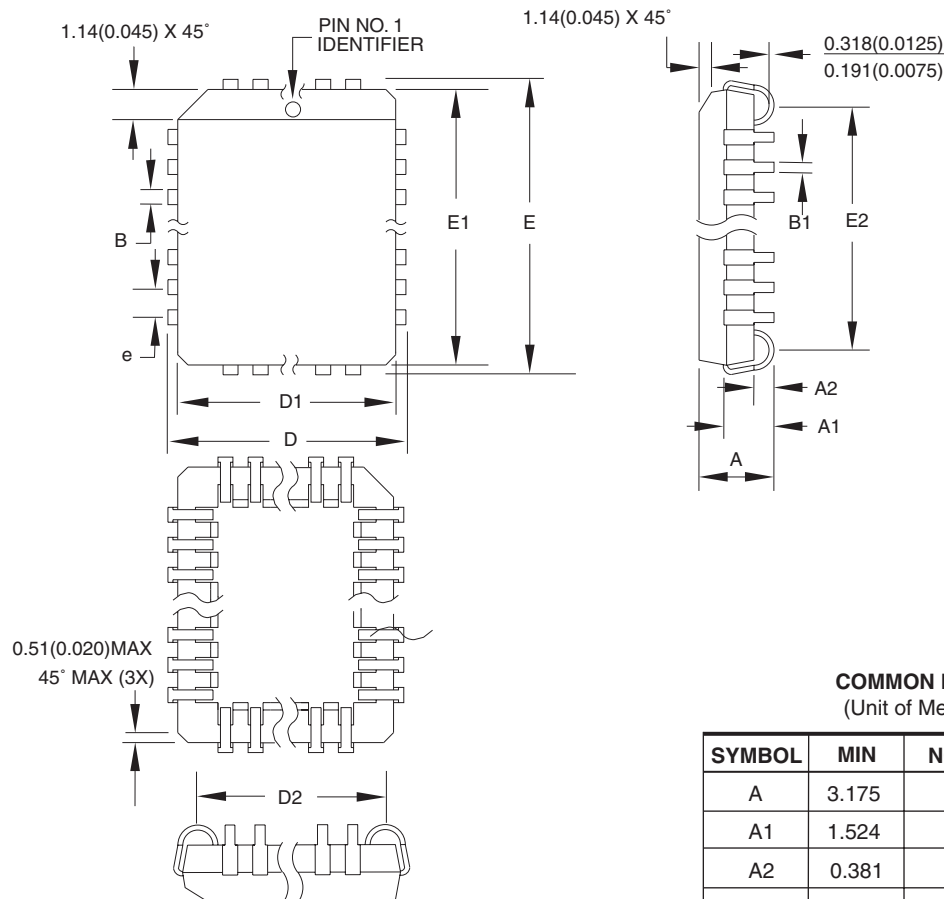
| t <sub>ACC</sub><br>(ns) | I <sub>CC</sub> (mA) |         | Ordering Code  | Package            | Operation Range                 |
|--------------------------|----------------------|---------|----------------|--------------------|---------------------------------|
|                          | Active               | Standby |                |                    |                                 |
| 45                       | 20                   | 0.1     | AT27C512R-45JU | 32J                | Industrial<br>(-40° C to 85° C) |
|                          |                      |         | AT27C512R-45PU | 28P6               |                                 |
|                          |                      |         | AT27C512R-45RU | 28R <sup>(1)</sup> |                                 |
|                          |                      |         | AT27C512R-45TU | 28T                |                                 |
| 70                       | 20                   | 0.1     | AT27C512R-70JU | 32J                | Industrial<br>(-40° C to 85° C) |
|                          |                      |         | AT27C512R-70PU | 28P6               |                                 |
|                          |                      |         | AT27C512R-70RU | 28R <sup>(1)</sup> |                                 |
|                          |                      |         | AT27C512R-70TU | 28T                |                                 |

Note: 1. The 28-pin SOIC package is not recommended for new designs.

| Package Type |                                                              |
|--------------|--------------------------------------------------------------|
| 32J          | 32-Lead, Plastic J-Leaded Chip Carrier (PLCC)                |
| 28P6         | 28-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)     |
| 28R          | 28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC) |
| 28T          | 28-Lead, Thin Small Outline Package (TSOP)                   |

# Packaging Information

## 19.3 32J – PLCC



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN       | NOM | MAX    | NOTE   |
|--------|-----------|-----|--------|--------|
| A      | 3.175     | –   | 3.556  |        |
| A1     | 1.524     | –   | 2.413  |        |
| A2     | 0.381     | –   | –      |        |
| D      | 12.319    | –   | 12.573 |        |
| D1     | 11.354    | –   | 11.506 | Note 2 |
| D2     | 9.906     | –   | 10.922 |        |
| E      | 14.859    | –   | 15.113 |        |
| E1     | 13.894    | –   | 14.046 | Note 2 |
| E2     | 12.471    | –   | 13.487 |        |
| B      | 0.660     | –   | 0.813  |        |
| B1     | 0.330     | –   | 0.533  |        |
| e      | 1.270 TYP |     |        |        |

- Notes:
1. This package conforms to JEDEC reference MS-016, Variation AE.
  2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is .010" (0.254 mm) per side. Dimension D1 and E1 include mold mismatch and are measured at the extreme material condition at the upper or lower parting line.
  3. Lead coplanarity is 0.004" (0.102 mm) maximum.

10/04/01



2325 Orchard Parkway  
San Jose, CA 95131

### TITLE

**32J**, 32-lead, Plastic J-leaded Chip Carrier (PLCC)

### DRAWING NO.

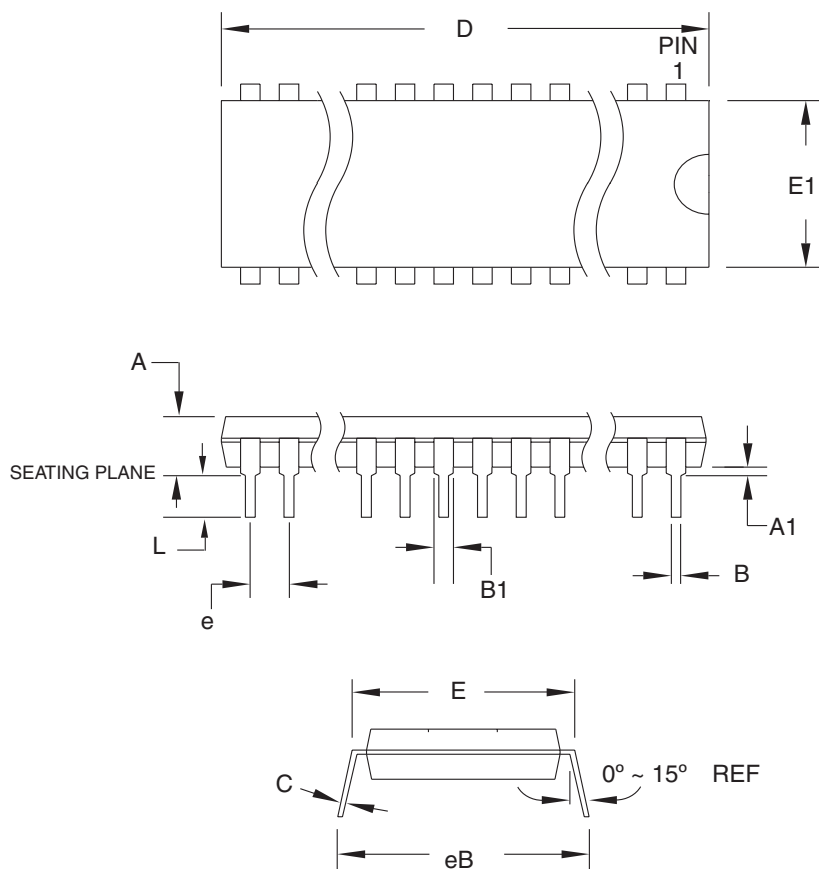
32J

### REV.

B



## 19.4 28P6 – PDIP



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN       | NOM | MAX    | NOTE   |
|--------|-----------|-----|--------|--------|
| A      | –         | –   | 4.826  |        |
| A1     | 0.381     | –   | –      |        |
| D      | 36.703    | –   | 37.338 | Note 2 |
| E      | 15.240    | –   | 15.875 |        |
| E1     | 13.462    | –   | 13.970 | Note 2 |
| B      | 0.356     | –   | 0.559  |        |
| B1     | 1.041     | –   | 1.651  |        |
| L      | 3.048     | –   | 3.556  |        |
| C      | 0.203     | –   | 0.381  |        |
| eB     | 15.494    | –   | 17.526 |        |
| e      | 2.540 TYP |     |        |        |

- Notes:
1. This package conforms to JEDEC reference MS-011, Variation AB.
  2. Dimensions D and E1 do not include mold Flash or Protrusion.  
Mold Flash or Protrusion shall not exceed 0.25 mm (0.010").

09/28/01



2325 Orchard Parkway  
San Jose, CA 95131

**TITLE**

**28P6**, 28-lead (0.600"/15.24 mm Wide) Plastic Dual  
Inline Package (PDIP)

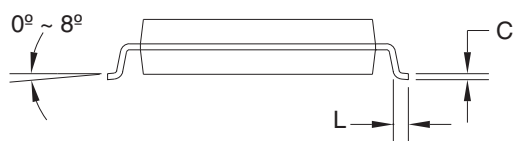
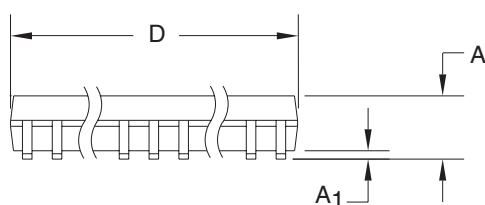
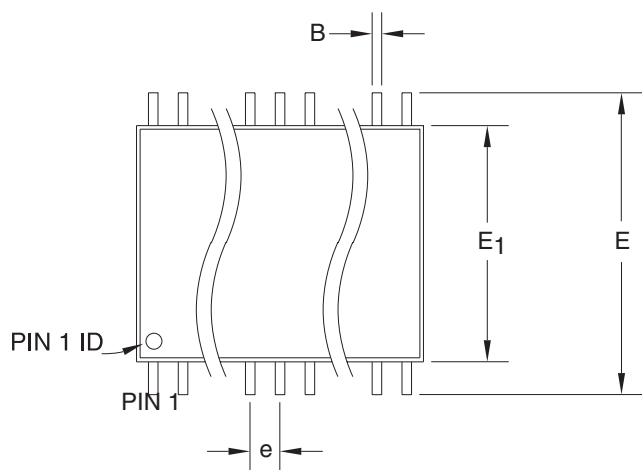
**DRAWING NO.**

28P6

**REV.**

B

19.5 28R – SOIC



Note: 1. Dimensions D and E1 do not include mold Flash or protrusion. Mold Flash or protrusion shall not exceed 0.25 mm (0.010").

**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN      | NOM | MAX   | NOTE   |
|--------|----------|-----|-------|--------|
| A      | 2.39     | –   | 2.79  |        |
| A1     | 0.050    | –   | 0.356 |        |
| D      | 18.00    | –   | 18.50 | Note 1 |
| E      | 11.70    | –   | 12.50 |        |
| E1     | 8.59     | –   | 8.79  | Note 1 |
| B      | 0.356    | –   | 0.508 |        |
| C      | 0.203    | –   | 0.305 |        |
| L      | 0.94     | –   | 1.27  |        |
| e      | 1.27 TYP |     |       |        |

5/18/2004



2325 Orchard Parkway  
San Jose, CA 95131

**TITLE**

**28R**, 28-lead, 0.330" Body Width,  
Plastic Gull Wing Small Outline (SOIC)

**DRAWING NO.**

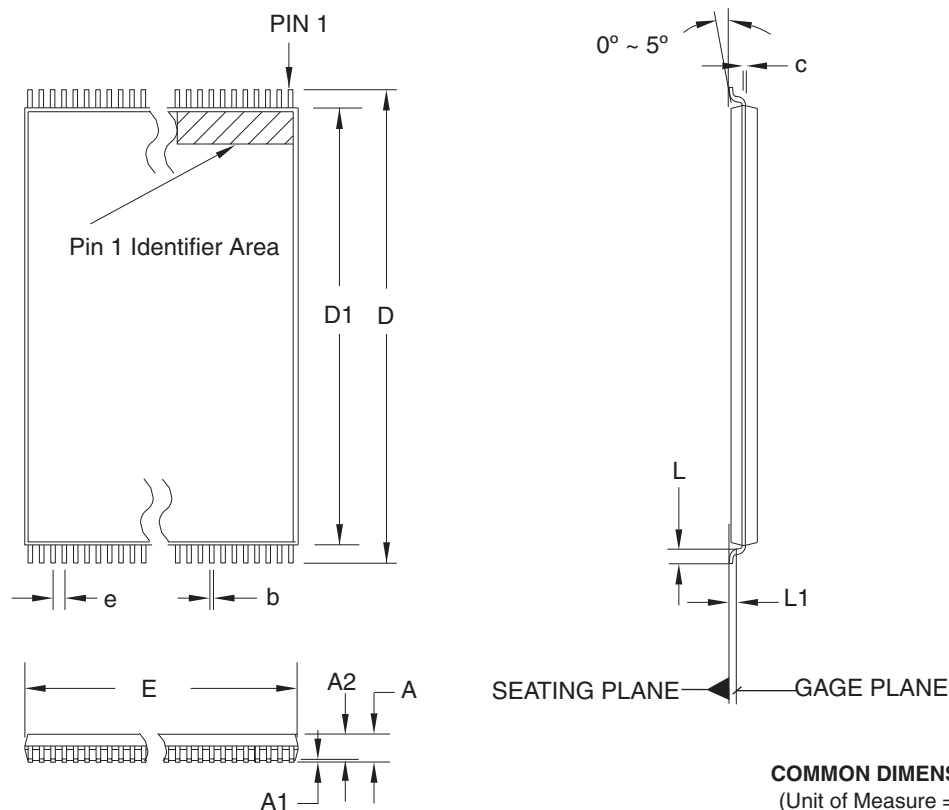
28R

**REV.**

C



## 19.6 28T – TSOP



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN        | NOM   | MAX   | NOTE   |
|--------|------------|-------|-------|--------|
| A      | —          | —     | 1.20  |        |
| A1     | 0.05       | —     | 0.15  |        |
| A2     | 0.90       | 1.00  | 1.05  |        |
| D      | 13.20      | 13.40 | 13.60 |        |
| D1     | 11.70      | 11.80 | 11.90 | Note 2 |
| E      | 7.90       | 8.00  | 8.10  | Note 2 |
| L      | 0.50       | 0.60  | 0.70  |        |
| L1     | 0.25 BASIC |       |       |        |
| b      | 0.17       | 0.22  | 0.27  |        |
| c      | 0.10       | —     | 0.21  |        |
| e      | 0.55 BASIC |       |       |        |

- Notes:
1. This package conforms to JEDEC reference MO-183.
  2. Dimensions D1 and E do not include mold protrusion. Allowable protrusion on E is 0.15 mm per side and on D1 is 0.25 mm per side.
  3. Lead coplanarity is 0.10 mm maximum.

12/06/02



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San Jose, CA 95131

### TITLE

**28T**, 28-lead (8 x 13.4 mm) Plastic Thin Small Outline  
Package, Type I (TSOP)

### DRAWING NO.

28T

### REV.

C



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