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**PART NUMBER****54AC138B2A-ROC**

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**Rochester Electronics  
Manufactured Components**

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer. (OCM)

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

**Quality Overview**

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
  - Class Q Military
  - Class V Space Level

**Qualified Suppliers List of Distributors (QSLD)**

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

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*The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.*

## 54AC138 • 54ACT138

### 1-of-8 Decoder/Demultiplexer

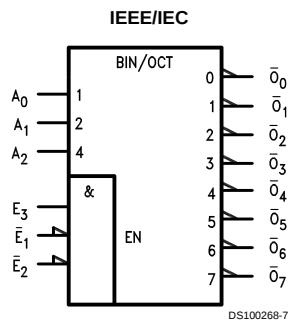
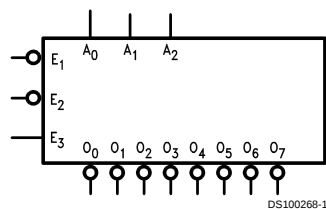
#### General Description

The 'AC/ACT138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three 'AC/ACT138 devices or a 1-of-32 decoder using four 'AC/ACT138 devices and one inverter.

#### Features

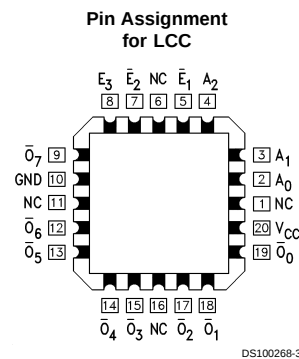
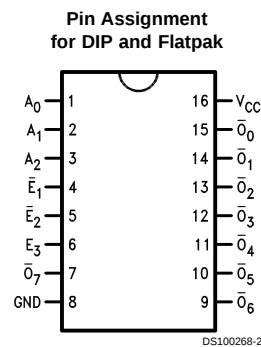
- $I_{CC}$  reduced by 50%
- Demultiplexing capability
- Multiple input enable for easy expansion
- Active LOW mutually exclusive outputs
- Outputs source/sink 24 mA
- 'ACT138 has TTL-compatible inputs
- Standard Microcircuit Drawing (SMD)
  - 'AC138: 5962-87622
  - 'ACT138: 5962-87554

#### Logic Symbols



| Pin Names                 | Description    |
|---------------------------|----------------|
| $A_0$ – $A_2$             | Address Inputs |
| $\bar{E}_1$ – $\bar{E}_2$ | Enable Inputs  |
| $E_3$                     | Enable Input   |
| $\bar{O}_0$ – $\bar{O}_7$ | Outputs        |

#### Connection Diagrams



## Functional Description

The 'AC/ACT138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs ( $A_0$ ,  $A_1$ ,  $A_2$ ) and, when enabled, provides eight mutually exclusive active-LOW outputs ( $\overline{O}_0$ – $\overline{O}_7$ ). The 'AC/ACT138 features three Enable inputs, two active-LOW ( $\overline{E}_1$ ,  $\overline{E}_2$ ) and one active-HIGH ( $E_3$ ). All outputs will be HIGH unless  $\overline{E}_1$  and  $\overline{E}_2$  are LOW and  $E_3$  is HIGH. This multiple enable function allows easy parallel ex-

pansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four 'AC/ACT138 devices and one inverter (see *Figure 1*). The 'AC/ACT138 can be used as an 8-output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

## Truth Table

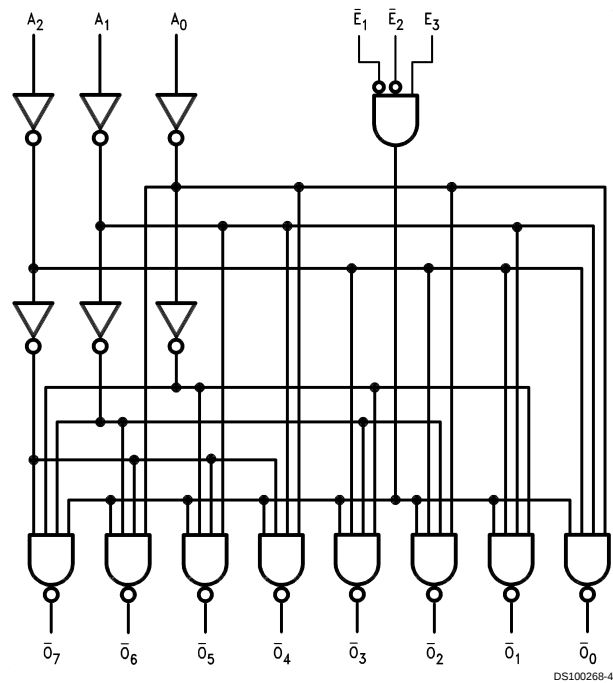
| Inputs           |                  |       |       |       |       | Outputs          |                  |                  |                  |                  |                  |                  |                  |
|------------------|------------------|-------|-------|-------|-------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| $\overline{E}_1$ | $\overline{E}_2$ | $E_3$ | $A_0$ | $A_1$ | $A_2$ | $\overline{O}_0$ | $\overline{O}_1$ | $\overline{O}_2$ | $\overline{O}_3$ | $\overline{O}_4$ | $\overline{O}_5$ | $\overline{O}_6$ | $\overline{O}_7$ |
| H                | X                | X     | X     | X     | X     | H                | H                | H                | H                | H                | H                | H                | H                |
| X                | H                | X     | X     | X     | X     | H                | H                | H                | H                | H                | H                | H                | H                |
| X                | X                | L     | X     | X     | X     | H                | H                | H                | H                | H                | H                | H                | H                |
| L                | L                | H     | L     | L     | L     | L                | H                | H                | H                | H                | H                | H                | H                |
| L                | L                | H     | H     | L     | L     | H                | L                | H                | H                | H                | H                | H                | H                |
| L                | L                | H     | L     | H     | L     | H                | H                | L                | H                | H                | H                | H                | H                |
| L                | L                | H     | H     | H     | L     | H                | H                | H                | L                | H                | H                | H                | H                |
| L                | L                | H     | L     | L     | H     | H                | H                | H                | H                | L                | H                | H                | H                |
| L                | L                | H     | H     | L     | H     | H                | H                | H                | H                | H                | L                | H                | H                |
| L                | L                | H     | L     | H     | H     | H                | H                | H                | H                | H                | H                | L                | H                |
| L                | L                | H     | H     | H     | H     | H                | H                | H                | H                | H                | H                | H                | L                |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

### Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

# Logic Diagram (Continued)

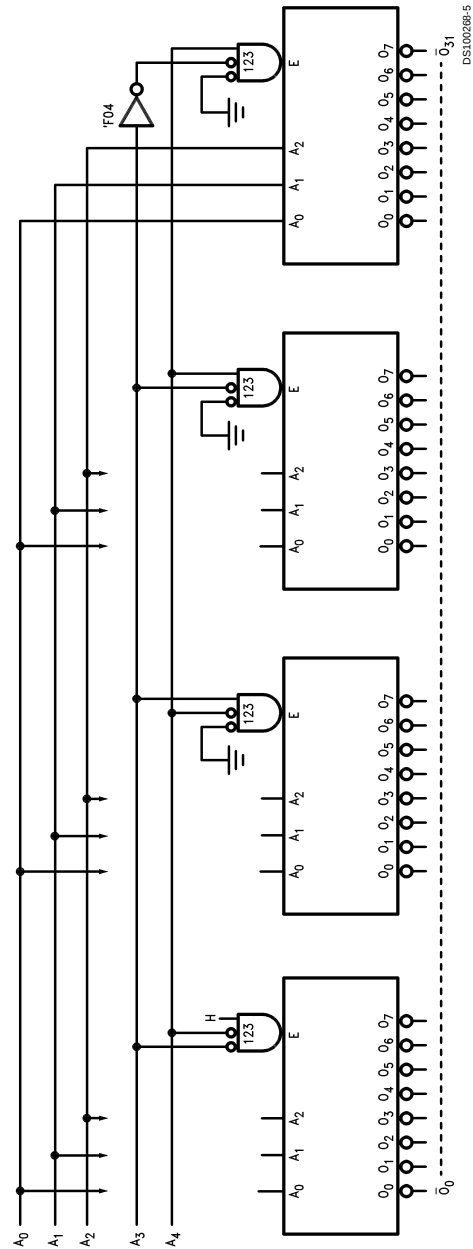


FIGURE 1. Expansion to 1-of-32 Decoding

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

|                                                                        |                          |
|------------------------------------------------------------------------|--------------------------|
| Supply Voltage ( $V_{CC}$ )                                            | -0.5V to +7.0V           |
| DC Input Diode Current ( $I_{IK}$ )                                    |                          |
| $V_I = -0.5V$                                                          | -20 mA                   |
| $V_I = V_{CC} + 0.5V$                                                  | +20 mA                   |
| DC Input Voltage ( $V_I$ )                                             | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Diode Current ( $I_{OK}$ )                                   |                          |
| $V_O = -0.5V$                                                          | -20 mA                   |
| $V_O = V_{CC} + 0.5V$                                                  | +20 mA                   |
| DC Output Voltage ( $V_O$ )                                            | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Source or Sink Current ( $I_O$ )                             | $\pm 50$ mA              |
| DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ ) | $\pm 50$ mA              |
| Storage Temperature ( $T_{STG}$ )                                      | -65°C to +150°C          |
| Junction Temperature ( $T_J$ )                                         |                          |
| CDIP                                                                   | 175°C                    |

## Recommended Operating Conditions

|                                                 |                 |
|-------------------------------------------------|-----------------|
| Supply Voltage ( $V_{CC}$ )                     |                 |
| 'AC                                             | 2.0V to 6.0V    |
| 'ACT                                            | 4.5V to 5.5V    |
| Input Voltage ( $V_I$ )                         | 0V to $V_{CC}$  |
| Output Voltage ( $V_O$ )                        | 0V to $V_{CC}$  |
| Operating Temperature ( $T_A$ )                 |                 |
| 54AC/ACT                                        | -55°C to +125°C |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                 |
| 'AC Devices                                     |                 |
| $V_{IN}$ from 30% to 70% of $V_{CC}$            |                 |
| $V_{CC}$ @ 3.3V, 4.5V, 5.5V                     | 125 mV/ns       |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                 |
| 'ACT Devices                                    |                 |
| $V_{IN}$ from 0.8V to 2.0V                      |                 |
| $V_{CC}$ @ 4.5V, 5.5V                           | 125 mV/ns       |

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT® circuits outside databook specifications.

## DC Characteristics for 'AC Family Devices

| Symbol    | Parameter                               | $V_{CC}$<br>(V) | 54AC                       | Units   | Conditions                                                                    |
|-----------|-----------------------------------------|-----------------|----------------------------|---------|-------------------------------------------------------------------------------|
|           |                                         |                 | $T_A =$<br>-55°C to +125°C |         |                                                                               |
|           |                                         |                 | Guaranteed Limits          |         |                                                                               |
| $V_{IH}$  | Minimum High Level Input Voltage        | 3.0             | 2.1                        | V       | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$                                        |
|           |                                         | 4.5             | 3.15                       |         |                                                                               |
|           |                                         | 5.5             | 3.85                       |         |                                                                               |
| $V_{IL}$  | Maximum Low Level Input Voltage         | 3.0             | 0.9                        | V       | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$                                        |
|           |                                         | 4.5             | 1.35                       |         |                                                                               |
|           |                                         | 5.5             | 1.65                       |         |                                                                               |
| $V_{OH}$  | Minimum High Level Output Voltage       | 3.0             | 2.9                        | V       | $I_{OUT} = -50 \mu A$                                                         |
|           |                                         | 4.5             | 4.4                        |         |                                                                               |
|           |                                         | 5.5             | 5.4                        |         |                                                                               |
|           |                                         | 3.0             | 2.4                        | V       | (Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$<br>-12 mA<br>$I_{OH}$ -24 mA<br>-24 mA |
|           |                                         | 4.5             | 3.7                        |         |                                                                               |
|           |                                         | 5.5             | 4.7                        |         |                                                                               |
| $V_{OL}$  | Maximum Low Level Output Voltage        | 3.0             | 0.1                        | V       | $I_{OUT} = 50 \mu A$                                                          |
|           |                                         | 4.5             | 0.1                        |         |                                                                               |
|           |                                         | 5.5             | 0.1                        |         |                                                                               |
|           |                                         | 3.0             | 0.50                       | V       | (Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$<br>12 mA<br>$I_{OL}$ 24 mA<br>24 mA    |
|           |                                         | 4.5             | 0.50                       |         |                                                                               |
|           |                                         | 5.5             | 0.50                       |         |                                                                               |
| $I_{IN}$  | Maximum Input Leakage Current           | 5.5             | $\pm 1.0$                  | $\mu A$ | $V_I = V_{CC}, GND$                                                           |
| $I_{OLD}$ | (Note 3) Minimum Dynamic Output Current | 5.5             | 50                         | mA      | $V_{OLD} = 1.65V$ Max                                                         |
| $I_{OHD}$ |                                         | 5.5             | -50                        | mA      | $V_{OHD} = 3.85V$ Min                                                         |

## DC Characteristics for 'AC Family Devices (Continued)

| Symbol          | Parameter                        | V <sub>CC</sub><br>(V) | 54AC                                | Units | Conditions                               |
|-----------------|----------------------------------|------------------------|-------------------------------------|-------|------------------------------------------|
|                 |                                  |                        | T <sub>A</sub> =<br>–55°C to +125°C |       |                                          |
|                 |                                  |                        | Guaranteed Limits                   |       |                                          |
| I <sub>CC</sub> | Maximum Quiescent Supply Current | 5.5                    | 80.0                                | μA    | V <sub>IN</sub> = V <sub>CC</sub> or GND |

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 4:** I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>. I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## DC Characteristics for 'ACT Family Devices

| Symbol           | Parameter                               | V <sub>CC</sub><br>(V) | 54ACT                               | Units | Conditions                                                                                        |
|------------------|-----------------------------------------|------------------------|-------------------------------------|-------|---------------------------------------------------------------------------------------------------|
|                  |                                         |                        | T <sub>A</sub> =<br>–55°C to +125°C |       |                                                                                                   |
|                  |                                         |                        | Guaranteed Limits                   |       |                                                                                                   |
| V <sub>IH</sub>  | Minimum High Level Input Voltage        | 4.5<br>5.5             | 2.0<br>2.0                          | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> – 0.1V                                              |
| V <sub>IL</sub>  | Maximum Low Level Input Voltage         | 4.5<br>5.5             | 0.8<br>0.8                          | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> – 0.1V                                              |
| V <sub>OH</sub>  | Minimum High Level Output Voltage       | 4.5<br>5.5             | 4.4<br>5.4                          | V     | I <sub>OUT</sub> = –50 μA                                                                         |
|                  |                                         | 4.5<br>5.5             | 3.70<br>4.70                        | V     | (Note 5) V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> –24 mA<br>–24 mA |
|                  |                                         |                        |                                     |       |                                                                                                   |
| V <sub>OL</sub>  | Maximum Low Level Output Voltage        | 4.5<br>5.5             | 0.1<br>0.1                          | V     | I <sub>OUT</sub> = 50 μA                                                                          |
|                  |                                         | 4.5<br>5.5             | 0.50<br>0.50                        | V     | (Note 5) V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> 24 mA<br>24 mA   |
|                  |                                         |                        |                                     |       |                                                                                                   |
| I <sub>IN</sub>  | Maximum Input Leakage Current           | 5.5                    | ±1.0                                | μA    | V <sub>I</sub> = V <sub>CC</sub> , GND                                                            |
| I <sub>CCT</sub> | Maximum I <sub>CC</sub> /Input          | 5.5                    | 1.6                                 | mA    | V <sub>I</sub> = V <sub>CC</sub> – 2.1V                                                           |
| I <sub>OLD</sub> | (Note 6) Minimum Dynamic Output Current | 5.5                    | 50                                  | mA    | V <sub>OLD</sub> = 1.65V Max                                                                      |
| I <sub>OHD</sub> |                                         | 5.5                    | –50                                 | mA    | V <sub>OHD</sub> = 3.85V Min                                                                      |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current        | 5.5                    | 80.0                                | μA    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                          |

**Note 5:** All outputs loaded; thresholds on input associated with output under test.

**Note 6:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 7:** I<sub>CC</sub> for 54ACT @ 25°C is identical to 74ACT @ 25°C.

## AC Electrical Characteristics

| Symbol           | Parameter                                                                     | V <sub>CC</sub><br>(V)<br>(Note 8) | 54AC                                                          |      | Units | Fig.<br>No. |
|------------------|-------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------|------|-------|-------------|
|                  |                                                                               |                                    | T <sub>A</sub> = −55°C<br>to +125°C<br>C <sub>L</sub> = 50 pF |      |       |             |
|                  |                                                                               |                                    | Min                                                           | Max  |       |             |
| t <sub>PLH</sub> | Propagation Delay<br>A <sub>n</sub> to $\overline{O}_n$                       | 3.3                                | 1.0                                                           | 16.0 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 12.0 |       |             |
| t <sub>PHL</sub> | Propagation Delay<br>A <sub>n</sub> to $\overline{O}_n$                       | 3.3                                | 1.0                                                           | 15.0 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 11.5 |       |             |
| t <sub>PLH</sub> | Propagation Delay<br>$\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$ | 3.3                                | 1.0                                                           | 16.5 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 13.0 |       |             |
| t <sub>PHL</sub> | Propagation Delay<br>$\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$ | 3.3                                | 1.0                                                           | 15.5 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 12.0 |       |             |
| t <sub>PLH</sub> | Propagation Delay<br>E <sub>3</sub> to $\overline{O}_n$                       | 3.3                                | 1.0                                                           | 17.0 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 13.5 |       |             |
| t <sub>PHL</sub> | Propagation Delay<br>E <sub>3</sub> to $\overline{O}_n$                       | 3.3                                | 1.0                                                           | 15.0 | ns    |             |
|                  |                                                                               | 5.0                                | 1.5                                                           | 11.0 |       |             |

**Note 8:** Voltage Range 3.3 is 3.3V ±0.3V

Voltage Range 5.0 is 5.0V ±0.5V

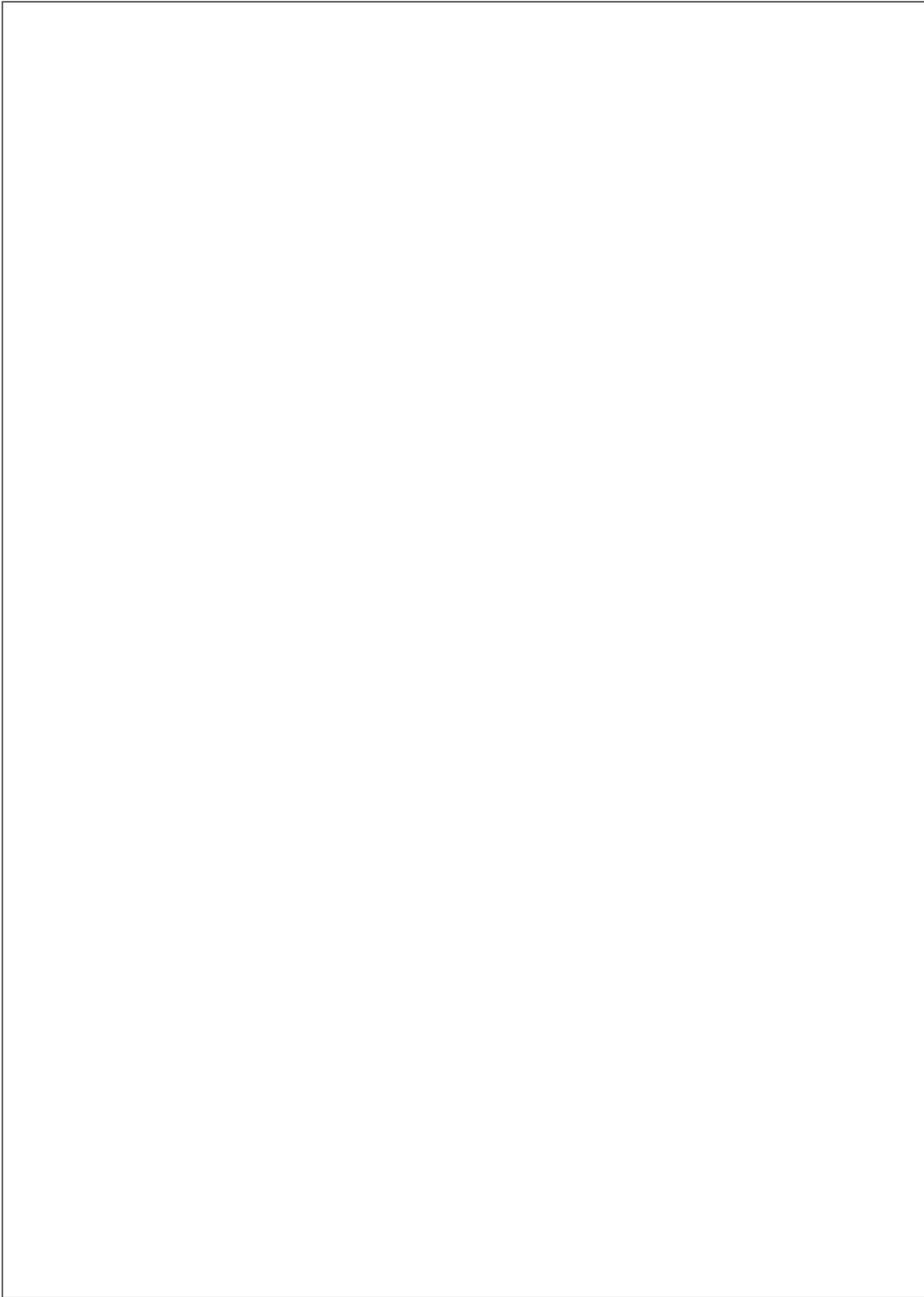
## AC Electrical Characteristics

| Symbol           | Parameter                                                                     | V <sub>CC</sub><br>(V)<br>(Note 9) | 54ACT                                                         |      | Units | Fig.<br>No. |
|------------------|-------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------|------|-------|-------------|
|                  |                                                                               |                                    | T <sub>A</sub> = −55°C<br>to +125°C<br>C <sub>L</sub> = 50 pF |      |       |             |
|                  |                                                                               |                                    | Min                                                           | Max  |       |             |
| t <sub>PLH</sub> | Propagation Delay<br>A <sub>n</sub> to $\overline{O}_n$                       | 5.0                                | 1.5                                                           | 12.5 | ns    |             |
| t <sub>PHL</sub> | Propagation Delay<br>A <sub>n</sub> to $\overline{O}_n$                       | 5.0                                | 1.5                                                           | 12.5 | ns    |             |
| t <sub>PLH</sub> | Propagation Delay<br>$\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$ | 5.0                                | 1.5                                                           | 13.5 | ns    |             |
| t <sub>PHL</sub> | Propagation Delay<br>$\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$ | 5.0                                | 1.5                                                           | 12.5 | ns    |             |
| t <sub>PLH</sub> | Propagation Delay<br>E <sub>3</sub> to $\overline{O}_n$                       | 5.0                                | 1.5                                                           | 14.0 | ns    |             |
| t <sub>PHL</sub> | Propagation Delay<br>E <sub>3</sub> to $\overline{O}_n$                       | 5.0                                | 1.5                                                           | 12.0 | ns    |             |

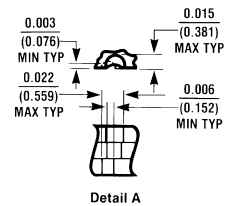
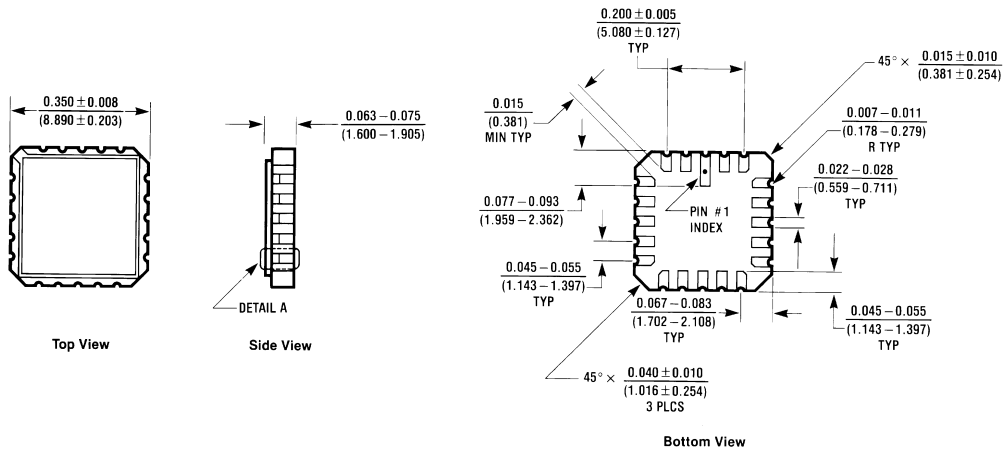
**Note 9:** Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

| Symbol          | Parameter                        | Typ  | Units | Conditions             |
|-----------------|----------------------------------|------|-------|------------------------|
| C <sub>IN</sub> | Input Capacitance                | 4.5  | pF    | V <sub>CC</sub> = OPEN |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance | 60.0 | pF    | V <sub>CC</sub> = 5.0V |

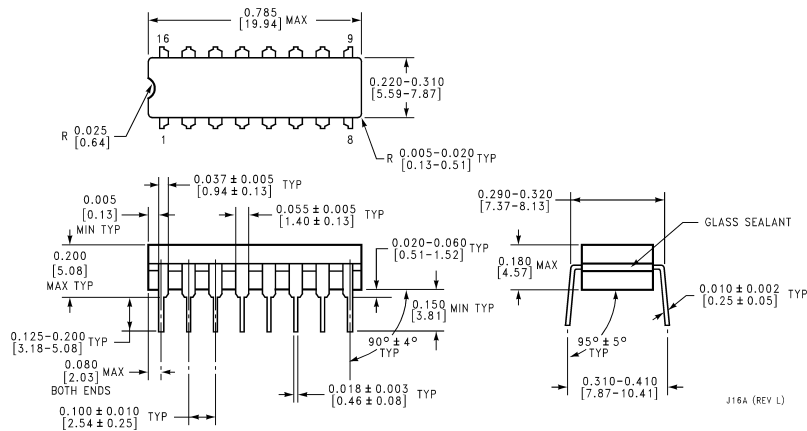


## Physical Dimensions inches (millimeters) unless otherwise noted



**20 Terminal Ceramic Leadless Chip Carrier (L)**  
 NS Package Number E20A

E20A (REV D)



**16 Lead Ceramic Dual-In-Line Package (D)**  
 NS Package Number J16A

J16A (REV L)

