

## 54AC240 • 54ACT240

### Octal Buffer/Line Driver with TRI-STATE® Outputs

#### General Description

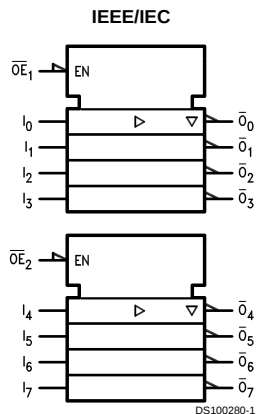
The 'AC/'ACT240 is an octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus oriented transmitter or receiver which provides improved PC board density.

#### Features

- $I_{CC}$  and  $I_{OZ}$  reduced by 50%

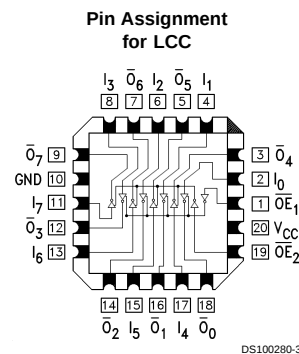
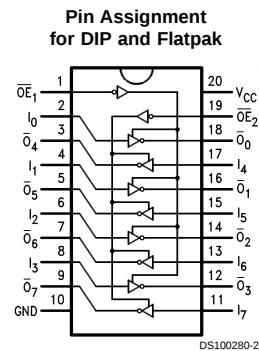
- Inverting TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs source/sink 24 mA
- 'ACT240 has TTL-compatible inputs
- Standard Microcircuit Drawing (SMD)
  - 'AC240: 5962-87550
  - 'ACT240: 5962-87759

#### Logic Symbol



| Pin Names                          | Description                    |
|------------------------------------|--------------------------------|
| $\overline{OE}_1, \overline{OE}_2$ | TRI-STATE Output Enable Inputs |
| $I_0-I_7$                          | Inputs                         |
| $\overline{O}_0-\overline{O}_7$    | Outputs                        |

#### Connection Diagrams



## Truth Tables

| Inputs            |       | Outputs<br>(Pins 12, 14, 16, 18) |
|-------------------|-------|----------------------------------|
| $\overline{OE}_1$ | $I_n$ |                                  |
| L                 | L     | H                                |
| L                 | H     | L                                |
| H                 | X     | Z                                |

| Inputs            |       | Outputs<br>(Pins 3, 5, 7, 9) |
|-------------------|-------|------------------------------|
| $\overline{OE}_2$ | $I_n$ |                              |
| L                 | L     | H                            |
| L                 | H     | L                            |
| H                 | X     | Z                            |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Z = High Impedance

## 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 <sub>CC</sub><br>(V) | 54AC                                | Units | Conditions                                           |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------|-------|------------------------------------------------------|
|                 |                                                                                                                                                      |                        | T <sub>A</sub> =<br>-55°C to +125°C |       |                                                      |
|                 |                                                                                                                                                      |                        | Guaranteed Limits                   |       |                                                      |
| V <sub>IH</sub> | Minimum High Level Input Voltage                                                                                                                     | 3.0                    | 2.1                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V |
|                 |                                                                                                                                                      | 4.5                    | 3.15                                |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 3.85                                |       |                                                      |
| V <sub>IL</sub> | Maximum Low Level Input Voltage                                                                                                                      | 3.0                    | 0.9                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V |
|                 |                                                                                                                                                      | 4.5                    | 1.35                                |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 1.65                                |       |                                                      |
| V <sub>OH</sub> | Minimum High Level Output Voltage                                                                                                                    | 3.0                    | 2.9                                 | V     | I <sub>OUT</sub> = -50 μA                            |
|                 |                                                                                                                                                      | 4.5                    | 4.4                                 |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 5.4                                 |       |                                                      |
|                 | (Note 2)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> = -12 mA<br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -24 mA | 3.0                    | 2.4                                 | V     |                                                      |
|                 |                                                                                                                                                      | 4.5                    | 3.7                                 |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 4.7                                 |       |                                                      |
|                 |                                                                                                                                                      |                        |                                     |       |                                                      |
| V <sub>OL</sub> | Maximum Low Level Output Voltage                                                                                                                     | 3.0                    | 0.1                                 | V     | I <sub>OUT</sub> = 50 μA                             |
|                 |                                                                                                                                                      | 4.5                    | 0.1                                 |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 0.1                                 |       |                                                      |
|                 | (Note 2)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 24 mA    | 3.0                    | 0.50                                | V     |                                                      |
|                 |                                                                                                                                                      | 4.5                    | 0.50                                |       |                                                      |
|                 |                                                                                                                                                      | 5.5                    | 0.50                                |       |                                                      |
|                 |                                                                                                                                                      |                        |                                     |       |                                                      |
| I <sub>IN</sub> | Maximum Input Leakage Current                                                                                                                        | 5.5                    | ±1.0                                | μA    | V <sub>I</sub> = V <sub>CC</sub> , GND               |

## 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>OZ</sub>  | Maximum TRI-STATE Leakage Current | 5.5                    | ±5.0                                | µA    | V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub><br>V <sub>I</sub> = V <sub>CC</sub> , GND<br>V <sub>O</sub> = V <sub>CC</sub> , GND |
| I <sub>OLD</sub> | Minimum Dynamic                   | 5.5                    | 50                                  | mA    | V <sub>OLD</sub> = 1.65V Max                                                                                                                |
| I <sub>OHD</sub> | Output Current (Note 3)           | 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><br>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                    | 2.0                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V                                                                     |
|                  |                                   | 5.5                    | 2.0                                 |       |                                                                                                                          |
| V <sub>IL</sub>  | Maximum Low Level Input Voltage   | 4.5                    | 0.8                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V                                                                     |
|                  |                                   | 5.5                    | 0.8                                 |       |                                                                                                                          |
| V <sub>OH</sub>  | Minimum High Level Output Voltage | 4.5                    | 4.4                                 | V     | I <sub>OUT</sub> = -50 µA                                                                                                |
|                  |                                   | 5.5                    | 5.4                                 |       |                                                                                                                          |
|                  |                                   | 4.5                    | 3.70                                | V     | (Note 5)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -24 mA |
|                  |                                   | 5.5                    | 4.70                                |       |                                                                                                                          |
| V <sub>OL</sub>  | Maximum Low Level Output Voltage  | 4.5                    | 0.1                                 | V     | I <sub>OUT</sub> = 50 µA                                                                                                 |
|                  |                                   | 5.5                    | 0.1                                 |       |                                                                                                                          |
|                  |                                   | 4.5                    | 0.50                                | V     | (Note 5)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 24 mA   |
|                  |                                   | 5.5                    | 0.50                                |       |                                                                                                                          |
| I <sub>IN</sub>  | Maximum Input Leakage Current     | 5.5                    | ±1.0                                | µA    | V <sub>I</sub> = V <sub>CC</sub> , GND                                                                                   |
| I <sub>OZ</sub>  | Maximum TRI-STATE Leakage Current | 5.5                    | ±5.0                                | µA    | V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub><br>V <sub>O</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> | Minimum Dynamic                   | 5.5                    | 50                                  | mA    | V <sub>OLD</sub> = 1.65V Max                                                                                             |
| I <sub>OHD</sub> | Output Current (Note 6)           | 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><br>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 |
|------------------|---------------------|------------------------------------|---------------------------------------------------------------|------|-------|
|                  |                     |                                    | 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   | 3.3                                | 1.0                                                           | 11.0 | ns    |
|                  | Data to Output      | 5.0                                | 1.0                                                           | 8.5  |       |
| t <sub>PHL</sub> | Propagation Delay   | 3.3                                | 1.0                                                           | 10.5 | ns    |
|                  | Data to Output      | 5.0                                | 1.0                                                           | 8.0  |       |
| t <sub>PZH</sub> | Output Enable Time  | 3.3                                | 1.0                                                           | 11.5 | ns    |
|                  |                     | 5.0                                | 1.0                                                           | 9.0  |       |
| t <sub>PZL</sub> | Output Enable Time  | 3.3                                | 1.0                                                           | 13.0 | ns    |
|                  |                     | 5.0                                | 1.0                                                           | 10.5 |       |
| t <sub>PHZ</sub> | Output Disable Time | 3.3                                | 1.0                                                           | 12.5 | ns    |
|                  |                     | 5.0                                | 1.0                                                           | 10.5 |       |
| t <sub>PLZ</sub> | Output Disable Time | 3.3                                | 1.0                                                           | 13.5 | ns    |
|                  |                     | 5.0                                | 1.0                                                           | 11.0 |       |

**Note 8:** Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

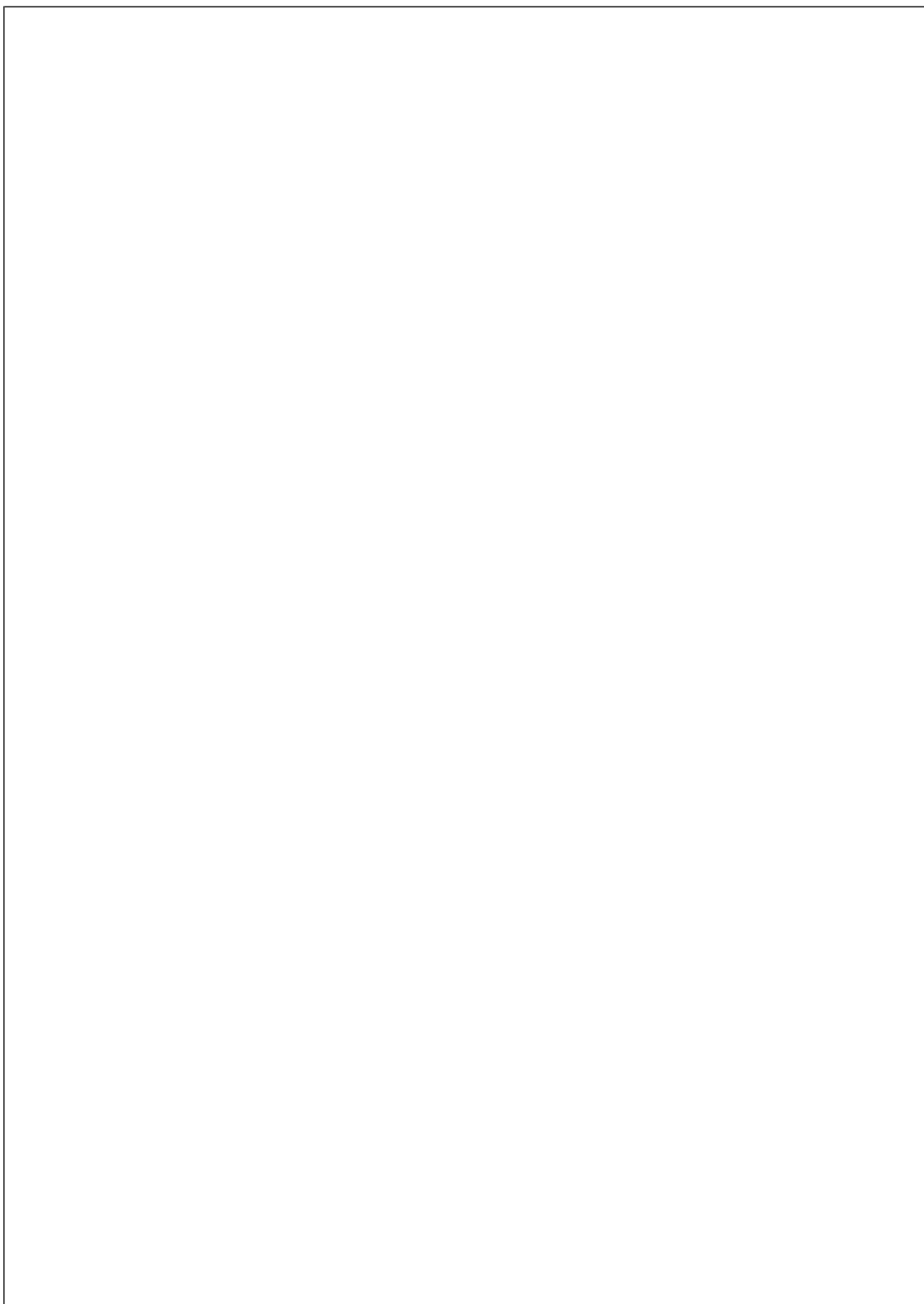
## AC Electrical Characteristics

| Symbol           | Parameter                           | V <sub>CC</sub><br>(V)<br>(Note 9) | 54ACT                                                         |      | Units |
|------------------|-------------------------------------|------------------------------------|---------------------------------------------------------------|------|-------|
|                  |                                     |                                    | 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>Data to Output | 5.0                                | 1.0                                                           | 9.5  | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>Data to Output | 5.0                                | 1.0                                                           | 9.0  | ns    |
| t <sub>PZH</sub> | Output Enable Time                  | 5.0                                | 1.0                                                           | 10.0 | ns    |
| t <sub>PZL</sub> | Output Enable Time                  | 5.0                                | 1.0                                                           | 11.5 | ns    |
| t <sub>PHZ</sub> | Output Disable Time                 | 5.0                                | 1.0                                                           | 11.0 | ns    |
| t <sub>PLZ</sub> | Output Disable Time                 | 5.0                                | 1.0                                                           | 11.5 | ns    |

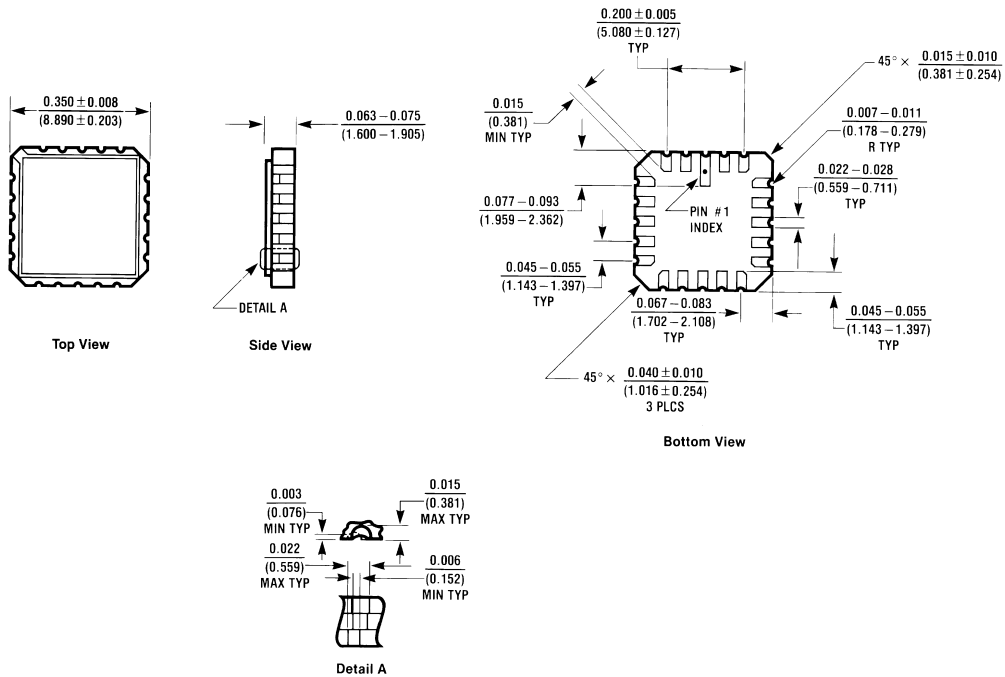
**Note 9:** Voltage Range 5.0 is 5.0V ±0.5V

## 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 | 45.0 | pF    | V <sub>CC</sub> = 5.0V |

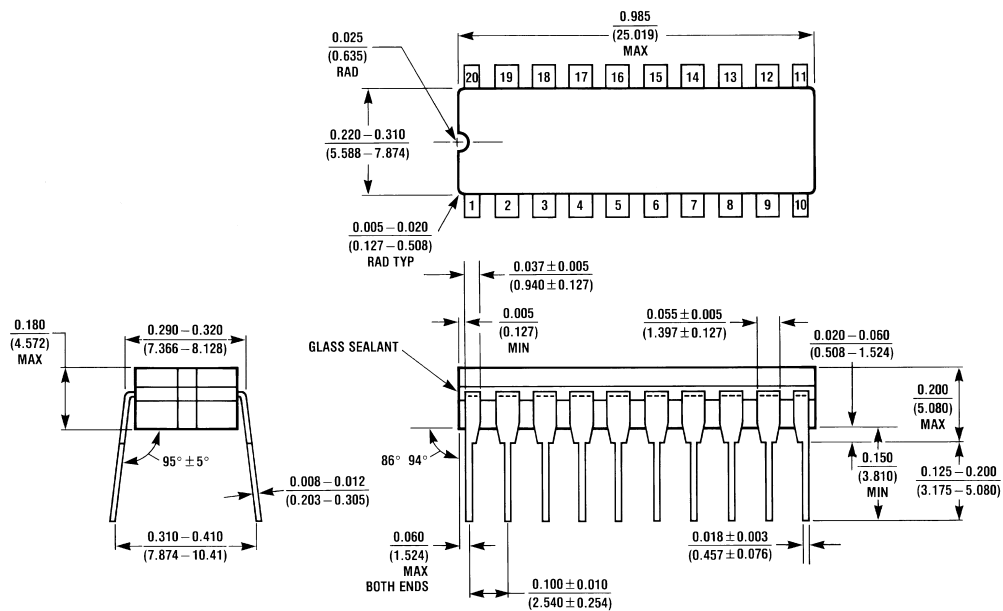


## Physical Dimensions inches (millimeters) unless otherwise noted



E20A (REV D)

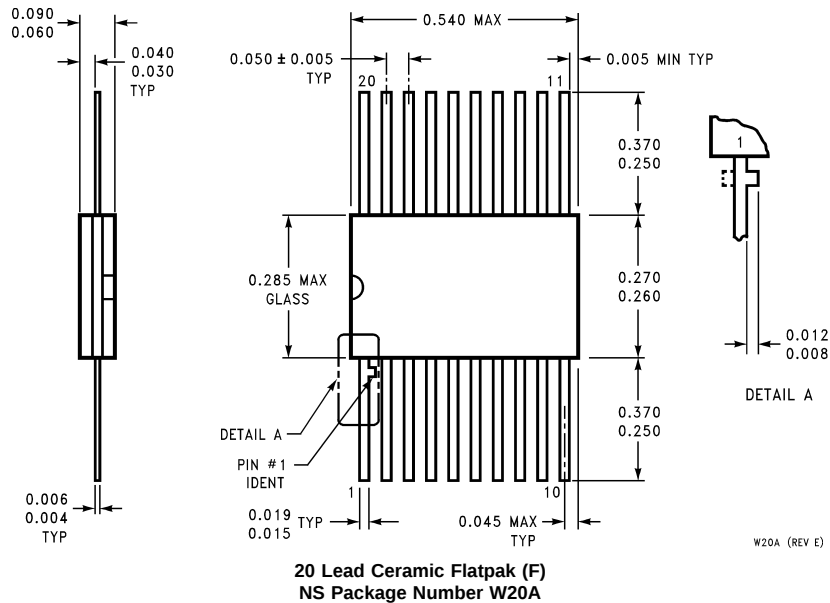
### 20 Terminal Ceramic Leadless Chip Carrier (L) NS Package Number E20A



J20A (REV M)

### 20 Lead Ceramic Dual-In-Line Package (D) NS Package Number J20A

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



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