National Semiconductor

September 1998

# 54AC521 • 54ACT521
# 8-Bit Identity Comparator

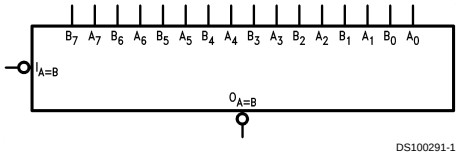
## General Description

The AC/ACT521 is an expandable 8-bit comparator. It compares two words of up to eight bits each and provides a LOW output when the two words match bit for bit. The expansion input $\overline{I}_{A=B}$ also serves as an active LOW enable input.

## Features

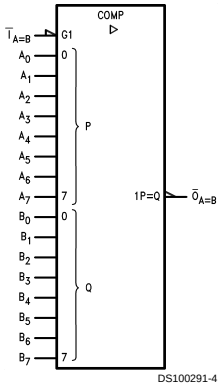
- $I_{CC}$ reduced by 50%
- Compares two 8-bit words in 6.5 ns typ
- Expandable to any word length
- Outputs source/sink 24 mA
- ACT521 has TTL-compatible inputs
- Standard microcircuit Drawing (SMD)
  54AC521: 5962-90985
  54ACT521: 5962-89793

## Logic Symbols




DS100291-1

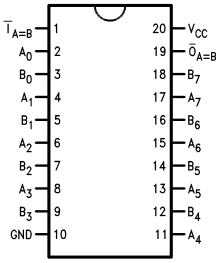
**IEEE/IEC**




DS100291-4

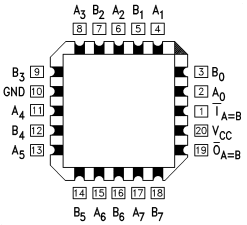
## Connection Diagram

**Pin Assignment for DIP and CERPACK**




DS100291-2

**Pin Assignment for LCC**




DS100291-3

## Pin Descriptions

| Pin Names | Description |
|---|---|
| $A_0$–$A_7$ | Word A Inputs |
| $B_0$–$B_7$ | Word B Inputs |
| $T_{A=B}$ | Expansion or Enable Input |
| $\overline{O}_{A=B}$ | Identity Output |

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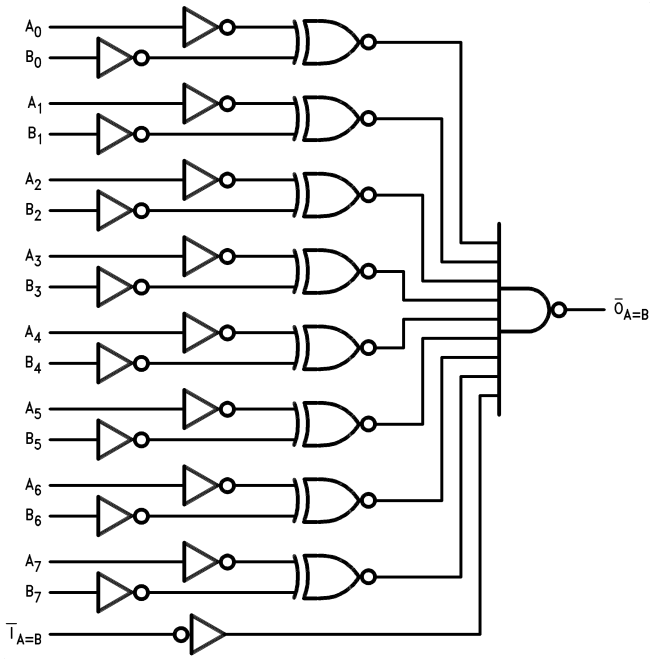
## Truth Table

| Inputs | | Outputs |
|---|---|---|
| $\overline{I}_{A=B}$ | A, B | $\overline{O}_{A=B}$ |
| L | A = B (Note 1) | L |
| L | A ≠ B | H |
| H | A = B (Note 1) | H |
| H | A ≠ B | H |

H = HIGH Voltage Level
L = LOW Voltage Level

**Note 1:** $A_0 = B_0$, $A_1 = B_1$, $A_2 = B_2$, etc.

## Logic Diagram

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

## Absolute Maximum Ratings (Note 2)

**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 ($I_O$) | ±50 mA |
| DC $V_{CC}$ or Ground Current per Output Pin ($I_{CC}$ or $I_{GND}$) | ±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 (ΔV/Δt) | |
| 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 (ΔV/Δt) | |
| ACT Devices | |
| $V_{IN}$ from 0.8V to 2.0V | |
| $V_{CC}$ @ 4.5V, 5.5V | 125 mV/ns |

**Note 2:** 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, output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

## DC Electrical Characteristics for AC

| Symbol | Parameter | $V_{CC}$ (V) | $T_A$ = −55˚C to +125˚C Guaranteed Limits | Units | Conditions |
|---|---|---|---|---|---|
| $V_{IH}$ | Minimum High Level Input Voltage | 3.0 | 2.1 | V | $V_{OUT}$ = 0.1V 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 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 μA |
| | | 4.5 | 4.4 | | |
| | | 5.5 | 5.4 | | |
| | | | | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ |
| | | 3.0 | 2.4 | | $I_{OH}$ = −4 mA |
| | | 4.5 | 3.7 | | $I_{OH}$ = −24 mA |
| | | 5.5 | 4.7 | | $I_{OH}$ = −24 mA (Note 3) |
| $V_{OL}$ | Maximum Low Level Output Voltage | 3.0 | 0.1 | V | $I_{OUT}$ = 50 μA |
| | | 4.5 | 0.1 | | |
| | | 5.5 | 0.1 | | |
| | | | | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ |
| | | 3.0 | 0.4 | | $I_{OL}$ = 12 mA |
| | | 4.5 | 0.5 | | $I_{OL}$ = 24 mA |
| | | 5.5 | 0.5 | | $I_{OL}$ = 24 mA (Note 3) |
| $I_{IN}$ (Note 5) | Maximum Input Leakage Current | 5.5 | ±1.0 | μA | $V_I$ = $V_{CC}$, GND |
| $I_{OLD}$ | Minimum Dynamic Output Current (Note 4) | 5.5 | 50 | mA | $V_{OLD}$ = 1.65V Max |
| $I_{OHD}$ | | 5.5 | −50 | mA | $V_{OHD}$ = 3.85V Min |
| $I_{CC}$ (Note 5) | Maximum Quiescent Supply Current | 5.5 | 80.0 | μA | $V_{IN}$ = $V_{CC}$ or GND |

**Note 3:** All outputs loaded; thresholds on input associated with output under test.

**Note 4:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 5:** $I_{IN}$ and $I_{CC}$ @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V $V_{CC}$.

## DC Electical Characteristics for ACT

| Symbol | Parameter | $V_{CC}$ (V) | $T_A$ = −55˚C to +125˚C Guaranteed Limits | Units | Conditions |
|---|---|---|---|---|---|
| $V_{IH}$ | Minimum High Level Input Voltage | 4.5<br>5.5 | 2.0<br>2.0 | V | $V_{OUT}$ = 0.1V or $V_{CC}$ − 0.1V |
| $V_{IL}$ | Maximum Low Level Input Voltage | 4.5<br>5.5 | 0.8<br>0.8 | V | $V_{OUT}$ = 0.1V or $V_{CC}$ − 0.1V |
| $V_{OH}$ | Minimum High Level Output Voltage | 4.5<br>5.5 | 4.4<br>5.4 | V | $I_{OUT}$ = −50 µA |
| | | 4.5<br>5.5 | 3.7<br>4.7 | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OH}$ = −24 mA<br>$I_{OH}$ = −24 mA (Note 6) |
| $V_{OL}$ | Maximum Low Level Output Voltage | 4.5<br>5.5 | 0.1<br>0.1 | V | $I_{OUT}$ = 50 µA |
| | | 4.5<br>5.5 | 0.5<br>0.5 | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OL}$ = 24 mA<br>$I_{OL}$ = 24 mA (Note 6) |
| $I_{IN}$ | Maximum Input Leakage Current | 5.5 | ±1.0 | µA | $V_I$ = $V_{CC}$, GND |
| $I_{CCT}$ | Maximum $I_{CC}$/Input | 5.5 | 1.5 | mA | $V_I$ = $V_{CC}$ − 2.1V |
| $I_{OLD}$ | Minimum Dynamic Output Current (Note 7) | 5.5 | 50 | mA | $V_{OLD}$ = 1.65V Max |
| $I_{OHD}$ | | 5.5 | −50 | mA | $V_{OHD}$ = 3.85V Min |
| $I_{CC}$ | Maximum Quiescent Supply Current | 5.5 | 80.0 | µA | $V_{IN}$ = $V_{CC}$ or GND |

**Note 6:** All outputs loaded; thresholds on input associated with output under test.

**Note 7:** Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics for AC

| Symbol | Parameter | $V_{CC}$ (V) (Note 8) | $T_A$ = −55˚C to +125˚C, $C_L$ = 50 pF Min | $T_A$ = −55˚C to +125˚C, $C_L$ = 50 pF Max | Units |
|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay $A_n$ or $B_n$ to $\overline{O}_{A = B}$ | 3.3<br>5.0 | 1.0<br>1.0 | 15.0<br>11.0 | ns |
| $t_{PHL}$ | Propagation Delay $A_n$ or $B_n$ to $\overline{O}_{A = B}$ | 3.3<br>5.0 | 1.0<br>1.0 | 10.5<br>8.0 | ns |
| $t_{PLH}$ | Propagation Delay $\overline{I}_{A = B}$ to $\overline{O}_{A = B}$ | 3.3<br>5.0 | 1.0<br>1.0 | 15.0<br>11.0 | ns |
| $t_{PHL}$ | Propagation Delay $\overline{I}_{A = B}$ to $\overline{O}_{A = B}$ | 3.3<br>5.0 | 1.0<br>1.0 | 10.5<br>8.0 | ns |

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

Voltage Range 5.0 is 5.0V ±0.5V

## AC Electrical Characteristics for ACT

| Symbol | Parameter | $V_{CC}$ (V) (Note 9) | $T_A$ = −55˚C to +125˚C, $C_L$ = 50 pF | | Units |
|---|---|---|---|---|---|
| | | | Min | Max | |
| $t_{PLH}$ | Propagation Delay $A_n$ or $B_n$ to $\overline{O}_{A = B}$ | 5.0 | 1.5 | 11.0 | ns |
| $t_{PHL}$ | Propagation Delay $A_n$ or $B_n$ to $\overline{O}_{A = B}$ | 5.0 | 1.5 | 12.0 | ns |
| $t_{PLH}$ | Propagation Delay $\bar{I}_{A = B}$ to $\overline{O}_{A = B}$ | 5.0 | 1.5 | 7.5 | ns |
| $t_{PHL}$ | Propagation Delay $\bar{I}_{A = B}$ to $\overline{O}_{A = B}$ | 5.0 | 1.5 | 8.5 | ns |

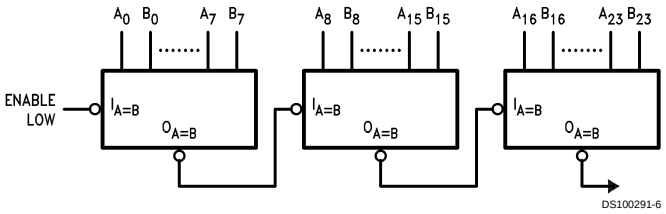
**Note 9:** Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

| Symbol | Parameter | Typ | Units | Conditions |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 4.5 | pF | $V_{CC}$ = OPEN |
| $C_{PD}$ | Power Dissipation Capacitance | 40 | pF | $V_{CC}$ = 5.0V |

## Applications

**Ripple Expansion**

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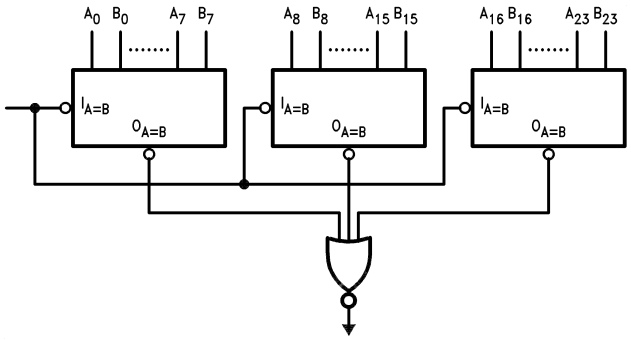
**Parallel Expansion**

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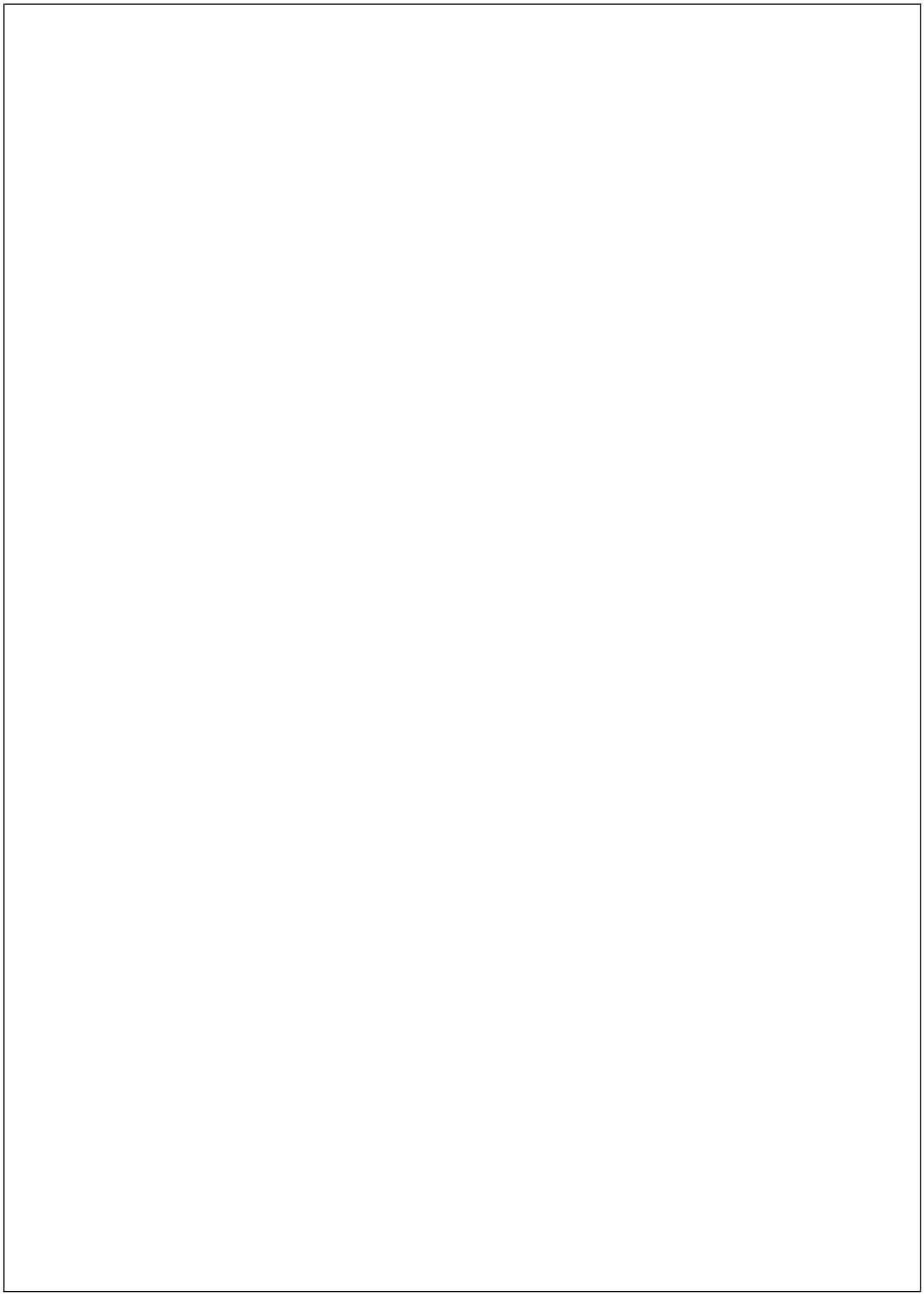
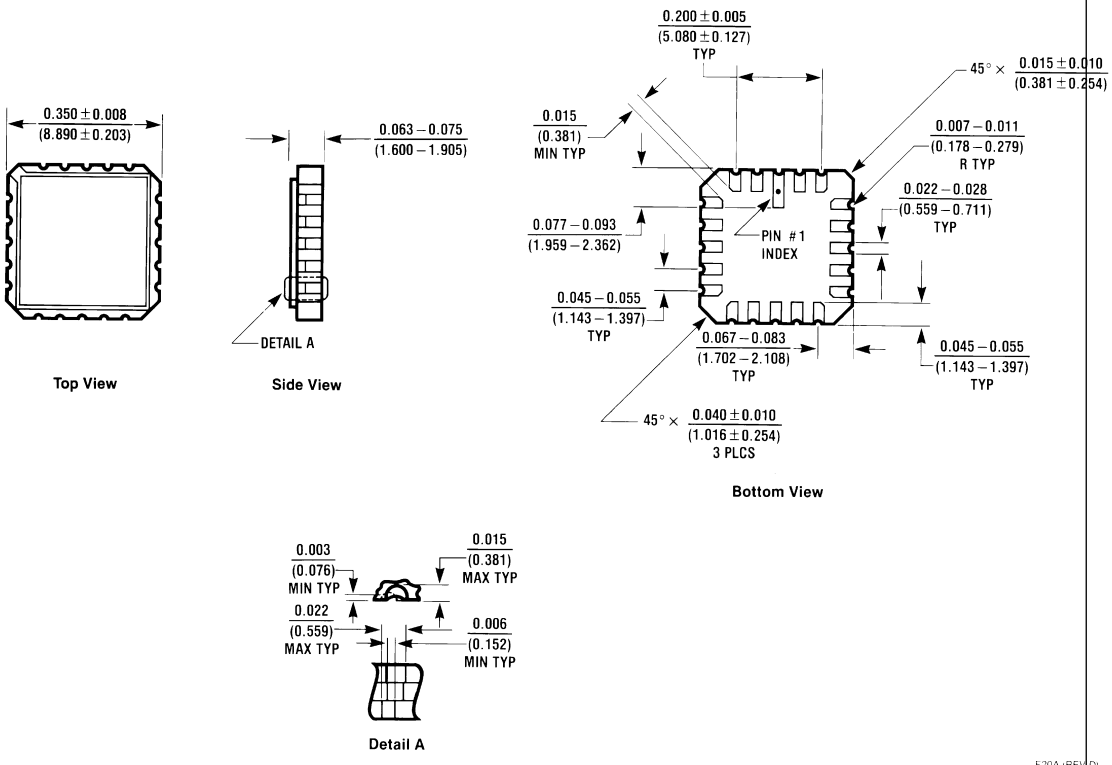
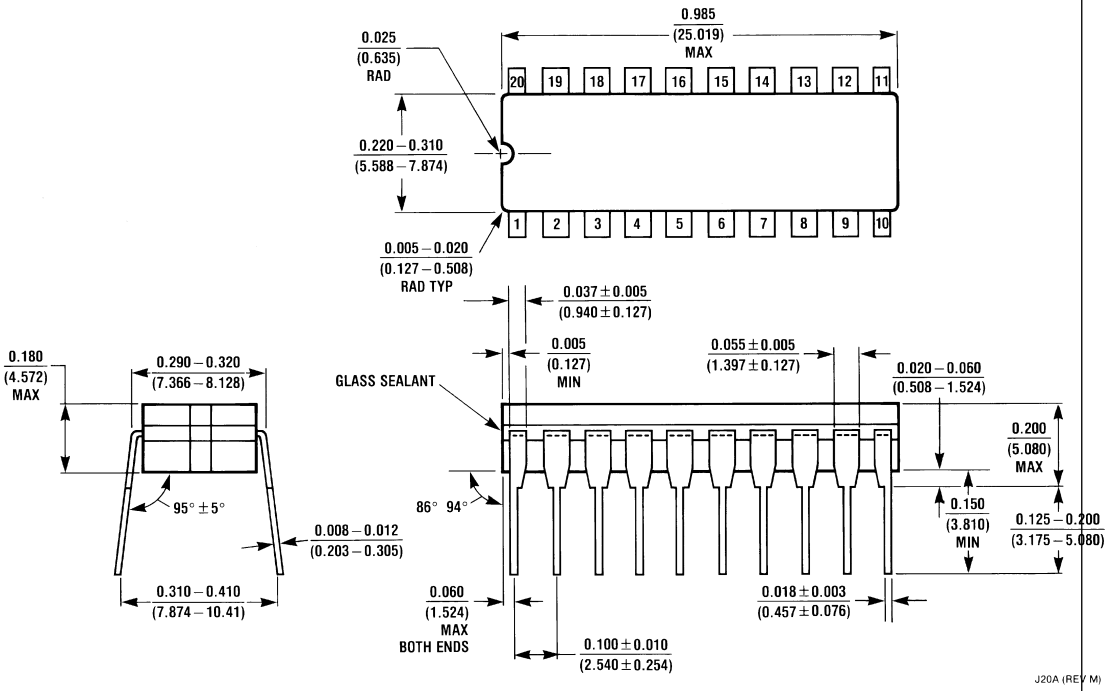


## Physical Dimensions inches (millimeters) unless otherwise noted

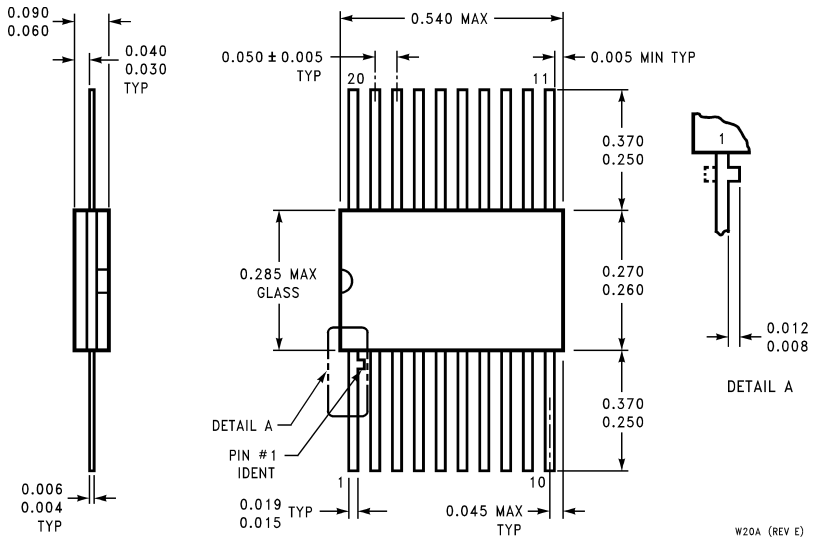



**20-Lead Ceramic Leadless Chip Carrier**
**Package Number E20A**

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




**20-Lead Ceramic Dual-in-line**
**J20A**




**20-Lead Cerpack**
**Package Number W20A**

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