

## 54AC245 • 54ACT245

### Octal Bidirectional Transceiver with TRI-STATE® Inputs/Outputs

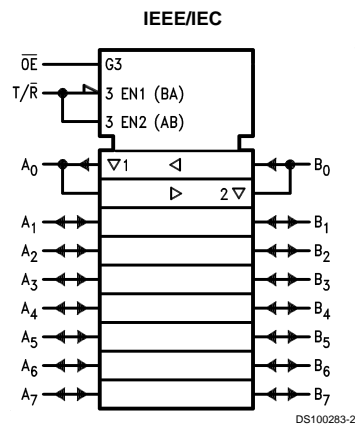
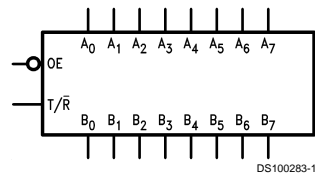
#### General Description

The 'AC/ACT245 contains eight non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus-oriented applications. Current sinking capability is 24 mA at both the A and B ports. The Transmit/Receive (T/R) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B ports to A ports. The Output Enable input, when HIGH, disables both A and B ports by placing them in a HIGH Z condition.

#### Features

- $I_{CC}$  and  $I_{OZ}$  reduced by 50%
- Noninverting buffers
- Bidirectional data path
- A and B outputs source/sink 24 mA
- 'ACT245 has TTL-compatible inputs
- Standard Microcircuit Drawing (SMD)
  - 'AC245: 5962-87758
  - 'ACT245: 5962-87663

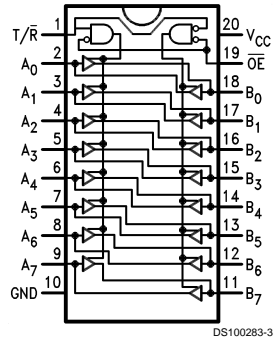
#### Logic Symbols



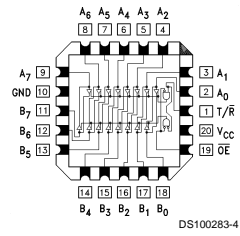
| Pin Names                      | Description                                  |
|--------------------------------|--|
| OE                             | Output Enable Input                          |
| T/R                            | Transmit/Receive Input                       |
| A <sub>0</sub> -A <sub>7</sub> | Side A TRI-STATE Inputs or TRI-STATE Outputs |
| B <sub>0</sub> -B <sub>7</sub> | Side B TRI-STATE Inputs or TRI-STATE Outputs |

## Connection Diagrams

Pin Assignment for  
DIP and Flatpak



Pin Assignment for LCC



## Truth Table

| Inputs |     | Outputs             |
|--------|-----|---------------------|
| OE     | T/R |                     |
| L      | L   | Bus B Data to Bus A |
| L      | H   | Bus A Data to Bus B |
| H      | X   | HIGH-Z State        |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

## 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 ( $I_O$ )                             | ±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 ( $\Delta V/\Delta t$ ) |                 |
| '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<br>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)<br>$V_{IN} = V_{IL}$ 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)<br>$V_{IN} = V_{IL}$ 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             | ±1.0                       | μA    | $V_I = V_{CC}, GND$                    |  |

### 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<br>Limits                |       |  |
| I <sub>OLD</sub> | (Note 3) Minimum<br>Dynamic Output<br>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<br>Supply Current           | 5.5                    | 80.0                                | μA    | V <sub>IN</sub> = V <sub>CC</sub><br>or GND  |
| I <sub>OZT</sub> | Maximum I/O<br>Leakage Current                | 5.5                    | ±5.5                                | μA    | V <sub>I(OE)</sub> = 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 |

**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<br>Limits                |       |  |  |
| V <sub>IH</sub>   | Minimum High Level<br>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<br>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<br>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>-24 mA |
|                   |   |                        | 5.5                                 | 4.70  |  |  |
| V <sub>OL</sub>   | Maximum Low Level<br>Output Voltage           | 4.5                    | 0.1                                 | V     | I <sub>OUT</sub> = 50 μA                             |  |
|                   |   | 5.5                    | 0.1                                 |       |  |  |
|                   |   | 4.5                    | 0.50                                |       |  | V  |
| 5.5               | 0.50  |                        |                                     |       |  |  |
| I <sub>IN</sub>   | Maximum Input Leakage<br>Current              | 5.5                    | ±1.0                                | μA    | V <sub>I</sub> = V <sub>CC</sub> , GND               |  |
| I <sub>CC</sub> T | Maximum<br>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<br>Dynamic Output<br>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<br>Supply Current           | 5.5                    | 80.0                                | μA    | V <sub>IN</sub> = V <sub>CC</sub><br>or GND          |  |

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

| Symbol           | Parameter                      | V <sub>CC</sub><br>(V) | 54ACT                               |  | Units | Conditions  |
|------------------|--------------------------------|------------------------|-------------------------------------|--|-------|---|
|                  |                                |                        | T <sub>A</sub> =<br>-55°C to +125°C |  |       |   |
|                  |                                |                        | Guaranteed<br>Limits                |  |       |   |
| I <sub>OZT</sub> | Maximum I/O<br>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 |

**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 |      |       |             |
|                  |   |                                    | C <sub>L</sub> = 50 pF              |      |       |             |
|                  |   |                                    | Min                                 | Max  |       |             |
| t <sub>PLH</sub> | Propagation Delay<br>A <sub>n</sub> to B <sub>n</sub> or B <sub>n</sub> to A <sub>n</sub> | 3.3                                | 1.0                                 | 11.5 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 8.5  |       |             |
| t <sub>PHL</sub> | Propagation Delay<br>A <sub>n</sub> to B <sub>n</sub> or B <sub>n</sub> to A <sub>n</sub> | 3.3                                | 1.0                                 | 10.0 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 7.5  |       |             |
| t <sub>PZH</sub> | Output Enable Time  | 3.3                                | 1.0                                 | 13.5 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 10.0 |       |             |
| t <sub>PZL</sub> | Output Enable Time  | 3.3                                | 1.0                                 | 14.5 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 10.5 |       |             |
| t <sub>PHZ</sub> | Output Disable Time   | 3.3                                | 1.0                                 | 13.5 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 10.5 |       |             |
| t <sub>PLZ</sub> | Output Disable Time   | 3.3                                | 1.0                                 | 14.0 | ns    |             |
|                  |   | 5.0                                | 1.0                                 | 10.5 |       |             |

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

Voltage Range 5.0 is 5.0V ±0.5V

## AC Electrical Characteristics

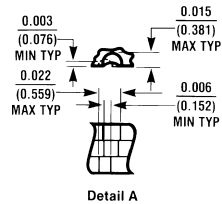
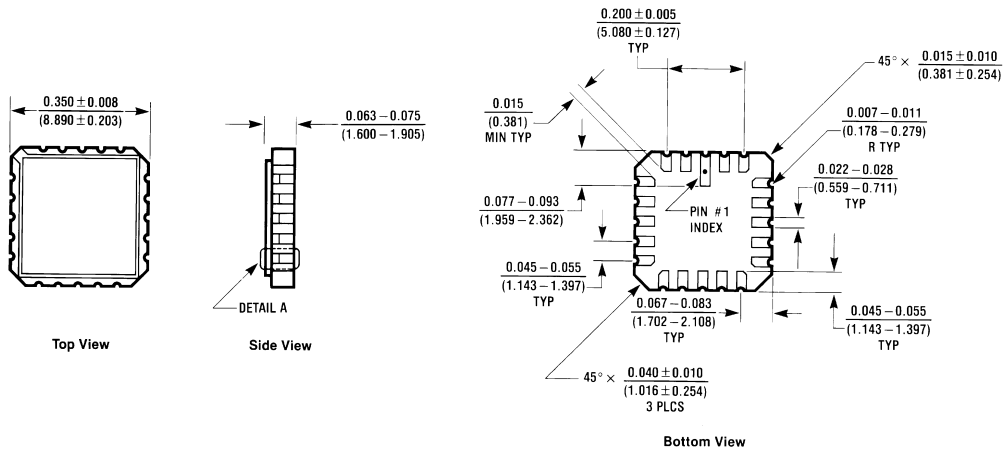
| Symbol           | Parameter   | V <sub>CC</sub><br>(V)<br>(Note 9) | 54ACT                               |      | Units |
|------------------|---|------------------------------------|-------------------------------------|------|-------|
|                  |   |                                    | T <sub>A</sub> = -55°C<br>to +125°C |      |       |
|                  |   |                                    | C <sub>L</sub> = 50 pF              |      |       |
|                  |   |                                    | Min                                 | Max  |       |
| t <sub>PLH</sub> | Propagation Delay<br>A <sub>n</sub> to B <sub>n</sub> or B <sub>n</sub> to A <sub>n</sub> | 5.0                                | 1.0                                 | 9.0  | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>A <sub>n</sub> to B <sub>n</sub> or B <sub>n</sub> to A <sub>n</sub> | 5.0                                | 1.0                                 | 10.0 | ns    |
| t <sub>PZH</sub> | Output Enable Time  | 5.0                                | 1.0                                 | 12.0 | ns    |
| t <sub>PZL</sub> | Output Enable Time  | 5.0                                | 1.0                                 | 13.0 | ns    |
| t <sub>PHZ</sub> | Output Disable Time   | 5.0                                | 1.0                                 | 12.0 | ns    |
| t <sub>PLZ</sub> | Output Disable Time   | 5.0                                | 1.0                                 | 12.0 | ns    |

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

## Capacitance

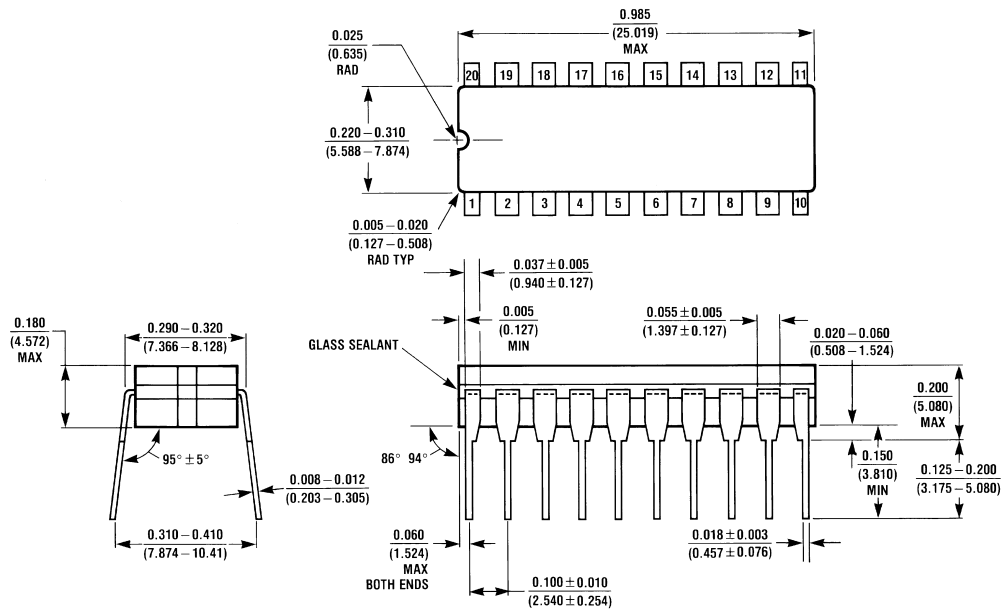
| Symbol    | Parameter                     | Typ  | Units | Conditions      |
|-----------|-------------------------------|------|-------|-----------------|
| $C_{IN}$  | Input Capacitance             | 4.5  | pF    | $V_{CC} = OPEN$ |
| $C_{I/O}$ | Input/Output Capacitance      | 15.0 | pF    | $V_{CC} = 5.0V$ |
| $C_{PD}$  | Power Dissipation Capacitance | 45.0 | pF    | $V_{CC} = 5.0V$ |

**Physical Dimensions** inches (millimeters) unless otherwise noted



E20A (REV D)

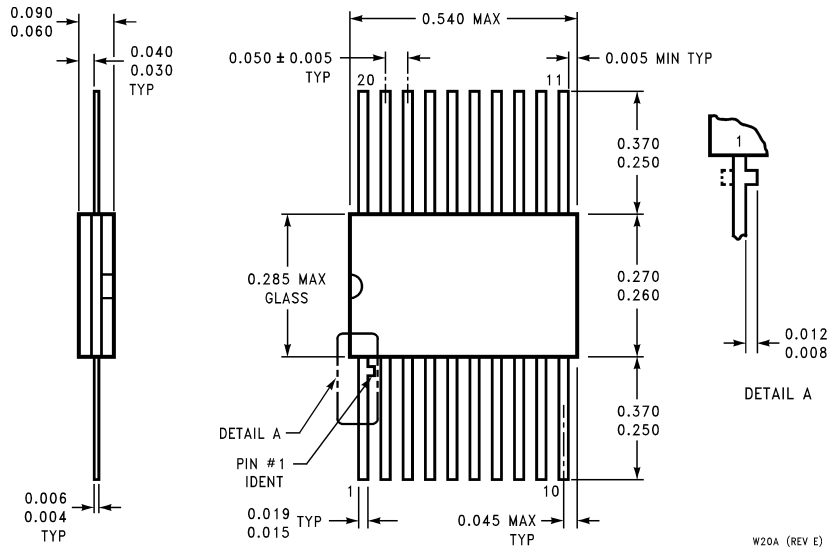
**20 Terminal Ceramic Leadless Chip Carrier (L)**  
 NS Package Number E20A



J20A (REV M)

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

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



**20-Lead Ceramic Flatpak (F)  
NS Package Number W20A**

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