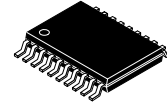


# Octal Bidirectional Transceiver with 3-STATE Outputs

## 74VHC245



TSSOP20, 4.4x6.5  
CASE 948AQ

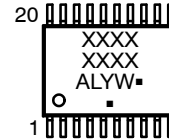
### General Description

The VHC245 is an advanced high speed CMOS octal bus transceiver fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The VHC245 is intended for bidirectional asynchronous communication between data busses. The direction of data transmission is determined by the level of the T/R input. The enable input can be used to disable the device so that the busses are effectively isolated. All inputs are equipped with protection circuits against static discharge.

### Features

- High Speed:  $t_{PD} = 4.0 \text{ ns}$  (Typ) at  $V_{CC} = 5 \text{ V}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min)
- Power Down Protection is Provided on All Inputs
- Low Noise:  $V_{OLP} = 0.9 \text{ V}$  (Typ)
- Low Power Dissipation:  $I_{CC} = 4 \mu\text{A}$  (Max) @  $T_A = 25^\circ\text{C}$
- Pin and Function Compatible with 74HC245
- This is a Pb-Free Device

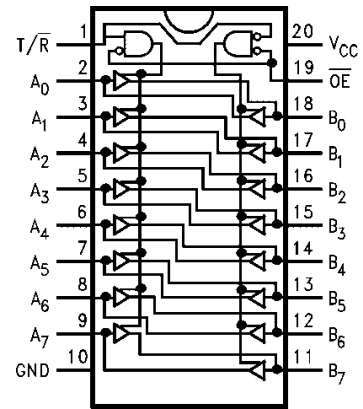
### MARKING DIAGRAM



- XXXXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

### CONNECTION DIAGRAM



### PIN DESCRIPTIONS

| Pin Names                      | Description                      |
|--------------------------------|----------------------------------|
| OE                             | Output Enable Input              |
| T/R                            | Transmit/Receive Input           |
| A <sub>0</sub> -A <sub>7</sub> | Side A Inputs or 3-STATE Outputs |
| B <sub>0</sub> -B <sub>7</sub> | Side B Inputs or 3-STATE Outputs |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# 74VHC245

## Logic Symbol

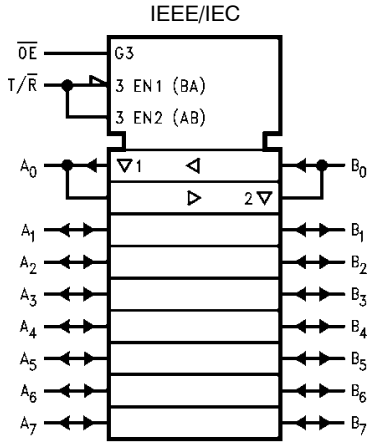


Figure 1. Logic Symbol

## TRUTH TABLES

| 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  
Any unused bus terminals during HIGH-Z State must be held HIGH or LOW.

## MAXIMUM RATINGS

| Symbol        | Parameter  |                        | Value                  | Unit          |
|---------------|--|------------------------|------------------------|---------------|
| $V_{CC}$      | DC Supply Voltage                                |                        | -0.5 to +6.5           | V             |
| $V_{IN}$      | DC Input Voltage                                 | T/R, OE                | -0.5 to +6.5           | V             |
| $V_{OUT}$     | DC Output Voltage                                |                        | -0.5 to $V_{CC} + 0.5$ | V             |
| $I_{IN}$      | DC Input Current                                 |                        | $\pm 20$               | mA            |
| $I_{OUT}$     | DC Output Current                                |                        | $\pm 25$               | mA            |
| $I_{CC}$      | DC Supply Current, $V_{CC}$ and GND Pins         |                        | $\pm 75$               | mA            |
| $I_{IK}$      | Input Clamp Current                              | T/R, OE                | -20                    | mA            |
| $I_{OK}$      | Output Clamp Current                             |                        | $\pm 20$               | mA            |
| $T_{STG}$     | Storage Temperature Range                        |                        | -65 to +150            | $^{\circ}C$   |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds  |                        | 260                    | $^{\circ}C$   |
| $T_J$         | Junction Temperature under Bias                  |                        | +150                   | $^{\circ}C$   |
| $\theta_{JA}$ | Thermal Resistance (Note 2)                      |                        | 150                    | $^{\circ}C/W$ |
| $P_D$         | Power Dissipation in Still Air at 25 $^{\circ}C$ |                        | 833                    | mW            |
| MSL           | Moisture Sensitivity                             |                        | Level 1                | -             |
| $F_R$         | Flammability Rating                              | Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.574 in   | -             |
| $V_{ESD}$     | ESD Withstand Voltage (Note 3)                   | Human Body Model       | 2000                   | V             |
|               |  | Charged Device Model   | N/A                    |               |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                  |         | Min                              | Max             | Unit |      |
|---------------------------------|----------------------------|---------|----------------------------------|-----------------|------|------|
| V <sub>CC</sub>                 | DC Supply Voltage          |         | 2.0                              | 5.5             | V    |      |
| V <sub>IN</sub>                 | DC Input Voltage (Note 4)  | T/R, OE | 0                                | 5.5             | V    |      |
| V <sub>OUT</sub>                | DC Output Voltage (Note 4) |         | 0                                | V <sub>CC</sub> | V    |      |
| T <sub>A</sub>                  | Operating Temperature      |         | -40                              | +85             | °C   |      |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Rate    |         | V <sub>CC</sub> = 3.0 V to 3.6 V | 0               | 100  | ns/V |
|                                 |                            |         | V <sub>CC</sub> = 4.5 V to 5.5 V | 0               | 20   |      |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

4. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

## DC ELECTRICAL CHARACTERISTICS

| Symbol                    | Parameter                        | Conditions   | V <sub>CC</sub> (V)      | T <sub>A</sub> = 25°C |      |                       | T <sub>A</sub> = -40°C to +85°C |                       | Unit |   |
|---------------------------|----------------------------------|--|--------------------------|-----------------------|------|-----------------------|---------------------------------|-----------------------|------|---|
|                           |                                  |  |                          | Min                   | Typ  | Max                   | Min                             | Max                   |      |   |
| V <sub>IH</sub>           | HIGH Level Input Voltage         |  | 2.0                      | 1.50                  | -    | -                     | 1.50                            | -                     | V    |   |
|                           |                                  |  | 3.0-5.5                  | 0.7 × V <sub>CC</sub> | -    | -                     | 0.7 × V <sub>CC</sub>           | -                     |      |   |
| V <sub>IL</sub>           | LOW Level Input Voltage          |  | 2.0                      | -                     | -    | 0.50                  | -                               | 0.50                  | V    |   |
|                           |                                  |  | 3.0-5.5                  | -                     | -    | 0.3 × V <sub>CC</sub> | -                               | 0.3 × V <sub>CC</sub> |      |   |
| V <sub>OH</sub>           | HIGH Level Output Voltage        | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>   | I <sub>OH</sub> = -50 μA | 2.0                   | 1.9  | 2.0                   | -                               | 1.9                   | -    | V |
|                           |                                  |  |                          | 3.0                   | 2.9  | 3.0                   | -                               | 2.9                   | -    |   |
|                           |                                  |  |                          | 4.5                   | 4.4  | 4.5                   | -                               | 4.4                   | -    |   |
|                           |                                  | I <sub>OH</sub> = -4 mA  | 3.0                      | 2.58                  | -    | -                     | 2.48                            | -                     |      |   |
| 4.5                       | 3.94                             |  | -                        | -                     | 3.80 | -                     |                                 |                       |      |   |
| V <sub>OL</sub>           | LOW Level Output Voltage         | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>   | I <sub>OL</sub> = 50 μA  | 2.0                   | -    | 0.0                   | 0.1                             | -                     | 0.1  | V |
|                           |                                  |  |                          | 3.0                   | -    | 0.0                   | 0.1                             | -                     | 0.1  |   |
|                           |                                  |  |                          | 4.5                   | -    | 0.0                   | 0.1                             | -                     | 0.1  |   |
|                           |                                  | I <sub>OL</sub> = 4 mA   | 3.0                      | -                     | -    | 0.36                  | -                               | 0.44                  |      |   |
|                           |                                  |  | 4.5                      | -                     | -    | 0.36                  | -                               | 0.44                  |      |   |
| I <sub>OZ</sub>           | 3-STATE Output Off-State Current | V <sub>IN</sub> = V <sub>CC</sub> or GND, V <sub>OUT</sub> = V <sub>CC</sub> or GND, V <sub>IN</sub> (OE) = V <sub>IH</sub> or V <sub>IL</sub> | 5.5                      | -                     | -    | ±0.25                 | -                               | ±2.5                  | μA   |   |
| I <sub>IN</sub> (T/R, OE) | Input Leakage Current            | V <sub>IN</sub> = 5.5 V or GND   | 0-5.5                    | -                     | -    | ±0.1                  | -                               | ±1.0                  | μA   |   |
| I <sub>CC</sub>           | Quiescent Supply Current         | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 5.5                      | -                     | -    | 4.0                   | -                               | 40.0                  | μA   |   |

## NOISE CHARACTERISTICS

| Symbol                    | Parameter                                    | Conditions             | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |        | Unit |
|---------------------------|--|------------------------|---------------------|-----------------------|--------|------|
|                           |  |                        |                     | Typ                   | Limits |      |
| V <sub>OLP</sub> (Note 5) | Quiet Output Maximum Dynamic V <sub>OL</sub> | C <sub>L</sub> = 50 pF | 5.0                 | 0.9                   | 1.2    | V    |
| V <sub>OLV</sub> (Note 5) | Quiet Output Minimum Dynamic V <sub>OL</sub> | C <sub>L</sub> = 50 pF | 5.0                 | -0.9                  | -1.2   | V    |
| V <sub>IHD</sub> (Note 5) | Minimum HIGH Level Dynamic Input Voltage     | C <sub>L</sub> = 50 pF | 5.0                 | -                     | 3.5    | V    |
| V <sub>ILD</sub> (Note 5) | Maximum LOW Level Dynamic Input Voltage      | C <sub>L</sub> = 50 pF | 5.0                 | -                     | 1.5    | V    |

5. Parameter guaranteed by design.

# 74VHC245

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                   | Parameter                     | Conditions              | V <sub>CC</sub> (V)    | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> = -40°C to +85°C |     | Unit |    |
|--|-------------------------------|-------------------------|------------------------|-----------------------|-----|------|---------------------------------|-----|------|----|
|  |                               |                         |                        | Min                   | Typ | Max  | Min                             | Max |      |    |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub>   | Propagation Delay Time        |                         | C <sub>L</sub> = 15 pF | 3.3 ±0.3              | -   | 5.8  | 8.4                             | 1.0 | 10.0 | ns |
|  |                               |                         | C <sub>L</sub> = 50 pF |                       | -   | 8.3  | 11.9                            | 1.0 | 13.5 |    |
|  |                               |                         | C <sub>L</sub> = 15 pF | 5.0 ±0.5              | -   | 4.0  | 5.5                             | 1.0 | 6.5  |    |
|  |                               |                         | C <sub>L</sub> = 50 pF |                       | -   | 5.5  | 7.5                             | 1.0 | 8.5  |    |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub>   | 3-STATE Output Enable Time    | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 15 pF | 3.3 ±0.3              | -   | 8.5  | 13.2                            | 1.0 | 15.5 | ns |
|  |                               |                         | C <sub>L</sub> = 50 pF |                       | -   | 11.0 | 16.7                            | 1.0 | 19.0 |    |
|  |                               |                         | C <sub>L</sub> = 15 pF | 5.0 ±0.5              | -   | 5.8  | 8.5                             | 1.0 | 10.0 |    |
|  |                               |                         | C <sub>L</sub> = 50 pF |                       | -   | 7.3  | 10.6                            | 1.0 | 12.0 |    |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub>   | 3-STATE Output Disable Time   | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 50 pF | 3.3 ±0.3              | -   | 11.5 | 15.8                            | 1.0 | 18.0 | ns |
|  |                               |                         | C <sub>L</sub> = 50 pF | 5.0 ±0.5              | -   | 7.0  | 9.7                             | 1.0 | 11.0 |    |
| t <sub>OSLH</sub> ,<br>t <sub>OSSL</sub> | Output to Output Skew         | (Note 6)                | C <sub>L</sub> = 50 pF | 3.3 ±0.3              | -   | -    | 1.5                             | -   | 1.5  | ns |
|  |                               |                         | C <sub>L</sub> = 50 pF | 5.0 ±0.5              | -   | -    | 1.0                             | -   | 1.0  |    |
| C <sub>IN</sub><br>(T/R, OE)             | Input Capacitance             | V <sub>CC</sub> = Open  |                        |                       | -   | 4    | 10                              | -   | 10   | pF |
| C <sub>I/O</sub>                         | Output Capacitance            | V <sub>CC</sub> = 5.0 V |                        |                       | -   | 8    | -                               | -   | -    | pF |
| C <sub>PD</sub>                          | Power Dissipation Capacitance | (Note 7)                |                        |                       | -   | 21   | -                               | -   | -    | pF |

6. Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLHmax</sub> - t<sub>PLHmin</sub>|; t<sub>OSSL</sub> = |t<sub>PHLmax</sub> - t<sub>PHLmin</sub>|

7. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC</sub> (opr.) = C<sub>PD</sub> × V<sub>CC</sub> × f<sub>IN</sub> + I<sub>CC</sub>/8 (per bit).

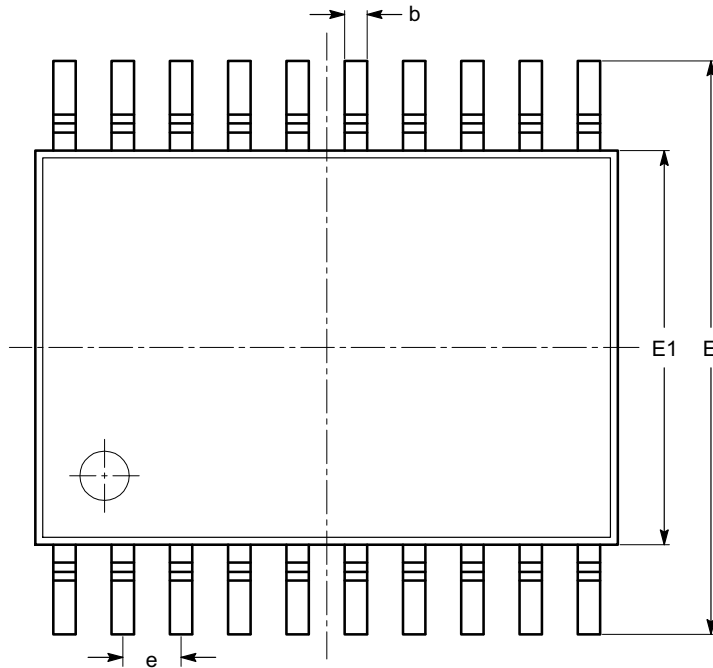
## ORDERING INFORMATION

| Device       | Marking    | Package              | Shipping <sup>†</sup>    |
|--------------|------------|----------------------|--------------------------|
| 74VHC245MTCX | VHC<br>245 | TSSOP20<br>(Pb-Free) | 2500 Units / Tape & Reel |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

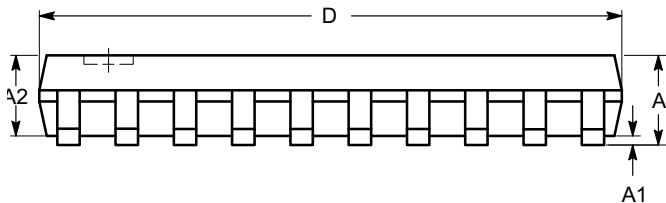
**TSSOP20, 4.4x6.5**  
**CASE 948AQ**  
**ISSUE A**

DATE 19 MAR 2009

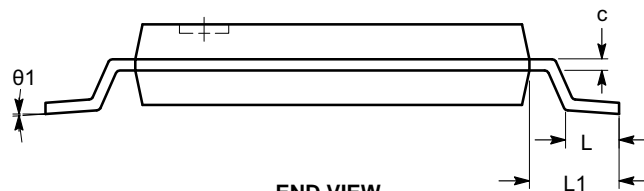


**TOP VIEW**

| SYMBOL   | MIN      | NOM  | MAX  |
|----------|----------|------|------|
| A        |          |      | 1.20 |
| A1       | 0.05     |      | 0.15 |
| A2       | 0.80     |      | 1.05 |
| b        | 0.19     |      | 0.30 |
| c        | 0.09     |      | 0.20 |
| D        | 6.40     | 6.50 | 6.60 |
| E        | 6.30     | 6.40 | 6.50 |
| E1       | 4.30     | 4.40 | 4.50 |
| e        | 0.65 BSC |      |      |
| L        | 0.45     | 0.60 | 0.75 |
| L1       | 1.00 REF |      |      |
| $\theta$ | 0°       |      | 8°   |



**SIDE VIEW**



**END VIEW**

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-153.

|                         |                         |   |
|-------------------------|-------------------------|---|
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