

## 74ALVC2245

### Low Voltage Bidirectional Transceiver with 3.6V Tolerant Inputs and Outputs and 26Ω Series Resistors in B Outputs

#### General Description

The ALVC2245 contains eight non-inverting bidirectional buffers with 3-STATE outputs and is intended for bus oriented applications. The T/R input determines the direction of data flow. The OE input disables both the A and B ports by placing them in a high impedance state.

The 74ALVC2245 is designed for low voltage (1.65V to 3.6V) V<sub>CC</sub> applications with I/O compatibility up to 3.6V. The ALVC2245 is also designed with 26Ω series resistance in the B Port outputs. This design reduces line noise in applications such as memory address drivers, clock drivers, and bus transceivers transmitters.

The 74ALVC2245 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

#### Features

- 1.65V to 3.6V V<sub>CC</sub> supply operation
- 3.6V tolerant inputs and outputs
- 26Ω series resistors in B Port outputs
- Power-off high impedance inputs and outputs
- Supports Live Insertion and Withdrawal (Note 1)
- t<sub>PD</sub> (A to B)
  - 4.9 ns max for 3.0V to 3.6V V<sub>CC</sub>
  - 6.1 ns max for 2.3V to 2.7V V<sub>CC</sub>
  - 9.8 ns max for 1.65V to 1.95V V<sub>CC</sub>
- Uses patented Quiet Series™ noise/EMI reduction circuitry
- Latchup conforms to JEDEC JED78
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

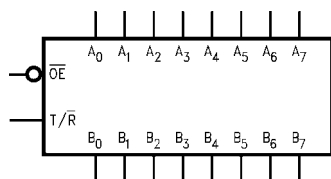
**Note 1:** To ensure the high impedance state during power up and power down, OE<sub>n</sub> should be tied to V<sub>CC</sub> through a pull up resistor. The minimum value of the resistor is determined by the current sourcing capability of the driver.

#### Ordering Code:

| Order Number  | Package Number | Package Description                                                         |
|---------------|----------------|-----------------------------------------------------------------------------|
| 74ALVC2245WM  | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74ALVC2245MTC | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

#### Logic Symbol

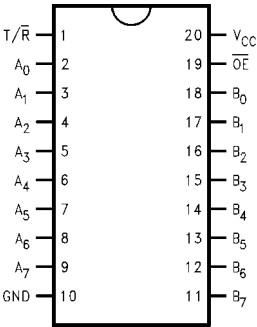


#### Pin Descriptions

| Pin Names                      | Description                      |
|--------------------------------|----------------------------------|
| OE                             | Output Enable Input (Active LOW) |
| 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 |

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Connection Diagram

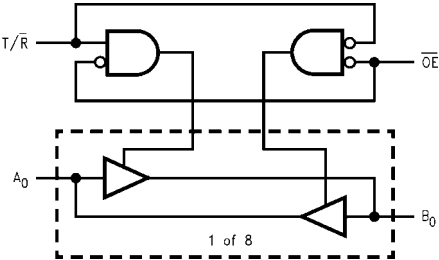


Truth Table

| Inputs          |     | Outputs                                                                                  |
|-----------------|-----|------------------------------------------------------------------------------------------|
| $\overline{OE}$ | T/R |                                                                                          |
| L               | L   | Bus B <sub>0</sub> –B <sub>7</sub> Data to Bus A <sub>0</sub> –A <sub>7</sub>            |
| L               | H   | Bus A <sub>0</sub> –A <sub>7</sub> Data to Bus B <sub>0</sub> –B <sub>7</sub>            |
| H               | X   | HIGH Z State on A <sub>0</sub> –A <sub>7</sub> , B <sub>0</sub> –B <sub>7</sub> (Note 2) |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance  
**Note 2:** Unused bus terminals during HIGH Z State must be held HIGH or LOW.

Logic Diagram



**Absolute Maximum Ratings**(Note 3)

|                                                              |                         |
|--------------------------------------------------------------|-------------------------|
| Supply Voltage ( $V_{CC}$ )                                  | -0.5V to +4.6V          |
| DC Input Voltage ( $V_I$ )                                   | -0.5V to 4.6V           |
| Output Voltage ( $V_O$ ) (Note 4)                            | -0.5V to $V_{CC}$ +0.5V |
| DC Input Diode Current ( $I_{IK}$ )                          |                         |
| $V_I < 0V$                                                   | -50 mA                  |
| DC Output Diode Current ( $I_{OK}$ )                         |                         |
| $V_O < 0V$                                                   | -50 mA                  |
| DC Output Source/Sink Current ( $I_{OH}/I_{OL}$ )            | ±50 mA                  |
| DC $V_{CC}$ or GND Current per Supply Pin ( $I_{CC}$ or GND) | ±100 mA                 |
| Storage Temperature Range ( $T_{STG}$ )                      | -65°C to +150°C         |

**Recommended Operating Conditions** (Note 5)

|                                                 |                |
|-------------------------------------------------|----------------|
| Power Supply                                    |                |
| Operating                                       | 1.65V to 3.6V  |
| Input Voltage                                   | 0V to $V_{CC}$ |
| Output Voltage ( $V_O$ )                        | 0V to $V_{CC}$ |
| Free Air Operating Temperature ( $T_A$ )        | -40°C to +85°C |
| Minimum Input Edge Rate ( $\Delta t/\Delta V$ ) |                |
| $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$        | 10 ns/V        |

**Note 3:** The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 4:**  $I_O$  Absolute Maximum Rating must be observed.

**Note 5:** Floating or unused control inputs must be held HIGH or LOW.

**DC Electrical Characteristics**

| Symbol   | Parameter                              | Conditions                       | $V_{CC}$<br>(V)                       | Min                           | Max                           | Units |
|----------|----------------------------------------|----------------------------------|---------------------------------------|-------------------------------|-------------------------------|-------|
| $V_{IH}$ | HIGH Level Input Voltage               |                                  | 1.65 - 1.95<br>2.3 - 2.7<br>2.7 - 3.6 | 0.65 × $V_{CC}$<br>1.7<br>2.0 |                               | V     |
| $V_{IL}$ | LOW Level Input Voltage                |                                  | 1.65 - 1.95<br>2.3 - 2.7<br>2.7 - 3.6 |                               | 0.35 × $V_{CC}$<br>0.7<br>0.8 | V     |
| $V_{OH}$ | HIGH Level Output Voltage<br>A Outputs | $I_{OH} = -100 \mu A$            | 1.65 - 3.6                            | $V_{CC} - 0.2$                |                               | V     |
|          |                                        | $I_{OH} = -4 \text{ mA}$         | 1.65                                  | 1.2                           |                               |       |
|          |                                        | $I_{OH} = -6 \text{ mA}$         | 2.3                                   | 2.0                           |                               |       |
|          |                                        | $I_{OH} = -12 \text{ mA}$        | 2.3                                   | 1.7                           |                               |       |
|          |                                        |                                  | 2.7                                   | 2.2                           |                               |       |
|          |                                        |                                  | 3.0                                   | 2.4                           |                               |       |
|          | HIGH Level Output Voltage<br>B Outputs | $I_{OH} = -24 \text{ mA}$        | 3.0                                   | 2                             |                               |       |
|          |                                        | $I_{OH} = -100 \mu A$            | 1.65 - 3.6                            | $V_{CC} - 0.2$                |                               |       |
|          |                                        | $I_{OH} = -2 \text{ mA}$         | 1.65                                  | 1.2                           |                               |       |
|          |                                        | $I_{OH} = -4 \text{ mA}$         | 2.3                                   | 1.9                           |                               |       |
|          |                                        | $I_{OH} = -6 \text{ mA}$         | 2.3                                   | 1.7                           |                               |       |
|          |                                        | $I_{OH} = -8 \text{ mA}$         | 2.7                                   | 2                             |                               |       |
| $V_{OL}$ | LOW Level Output Voltage<br>A Outputs  | $I_{OL} = 100 \mu A$             | 1.65 - 3.6                            |                               | 0.2                           | V     |
|          |                                        | $I_{OL} = 4 \text{ mA}$          | 1.65                                  |                               | 0.45                          |       |
|          |                                        | $I_{OL} = 6 \text{ mA}$          | 2.3                                   |                               | 0.4                           |       |
|          |                                        | $I_{OL} = 12 \text{ mA}$         | 2.3                                   |                               | 0.7                           |       |
|          |                                        |                                  | 2.7                                   |                               | 0.4                           |       |
|          |                                        |                                  | 3.0                                   |                               | 0.55                          |       |
|          | LOW Level Output Voltage<br>B Outputs  | $I_{OL} = 100 \mu A$             | 1.65 - 3.6                            |                               | 0.2                           |       |
|          |                                        | $I_{OL} = 2 \text{ mA}$          | 1.65                                  |                               | 0.45                          |       |
|          |                                        | $I_{OL} = 4 \text{ mA}$          | 2.3                                   |                               | 0.4                           |       |
|          |                                        | $I_{OL} = 6 \text{ mA}$          | 2.3                                   |                               | 0.55                          |       |
|          |                                        | $I_{OL} = 8 \text{ mA}$          | 3.0                                   |                               | 0.55                          |       |
|          |                                        |                                  | 2.7                                   |                               | 0.6                           |       |
| $I_I$    | Input Leakage Current                  | $0 \leq V_I \leq 3.6V$           | 1.65 - 3.6                            |                               | ±5.0                          | μA    |
| $I_{CC}$ | Quiescent Supply Current               | $V_I = V_{CC}$ or GND, $I_O = 0$ | 3.6                                   |                               | 40                            | μA    |

## DC Electrical Characteristics (Continued)

| Symbol          | Parameter                      | Conditions               | V <sub>CC</sub><br>(V) | Min | Max | Units   |
|-----------------|--------------------------------|--------------------------|------------------------|-----|-----|---------|
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input | $V_{IH} = V_{CC} - 0.6V$ | 2.7 - 3.6              |     | 750 | $\mu A$ |

## AC Electrical Characteristics

| Symbol                              | Parameter                     | T <sub>A</sub> = -40°C to +85°C, R <sub>L</sub> = 500Ω |     |                        |     |                              |     |                                |     | Units |
|-------------------------------------|-------------------------------|--------------------------------------------------------|-----|------------------------|-----|------------------------------|-----|--------------------------------|-----|-------|
|                                     |                               | C <sub>L</sub> = 50 pF                                 |     |                        |     | C <sub>L</sub> = 30 pF       |     |                                |     |       |
|                                     |                               | V <sub>CC</sub> = 3.3V ± 0.3V                          |     | V <sub>CC</sub> = 2.7V |     | V <sub>CC</sub> = 2.5 ± 0.2V |     | V <sub>CC</sub> = 1.8V ± 0.15V |     |       |
|                                     |                               | Min                                                    | Max | Min                    | Max | Min                          | Max | Min                            | Max |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Propagation Delay<br>A to B   | 1.1                                                    | 4.9 | 1.3                    | 6.1 | 0.8                          | 5.6 | 1.5                            | 9.8 | ns    |
|                                     | Propagation Delay<br>B to A   | 1.1                                                    | 4.0 | 1.3                    | 4.7 | 0.8                          | 4.2 | 1.5                            | 8.4 |       |
| t <sub>PZL</sub> , t <sub>PZH</sub> | Output Enable Time<br>A to B  | 1.1                                                    | 5.5 | 1.3                    | 7.1 | 0.8                          | 6.6 | 1.5                            | 9.8 | ns    |
|                                     | Output Enable Time<br>B to A  | 1.1                                                    | 5.0 | 1.3                    | 6.1 | 0.8                          | 5.6 | 1.5                            | 9.8 |       |
| t <sub>PLZ</sub> , t <sub>PHZ</sub> | Output Disable Time<br>A to B | 1.1                                                    | 4.7 | 1.3                    | 5.2 | 0.8                          | 4.7 | 1.5                            | 8.5 | ns    |
|                                     | Output Disable Time<br>B to A | 1.1                                                    | 4.1 | 1.3                    | 4.5 | 0.8                          | 4.0 | 1.5                            | 7.2 |       |

## Capacitance

| Symbol   | Parameter                     | Conditions                                                   | $T_A = +25^\circ C$ |         | Units |
|----------|-------------------------------|--------------------------------------------------------------|---------------------|---------|-------|
|          |                               |                                                              | V <sub>CC</sub>     | Typical |       |
| $C_{IN}$ | Input Capacitance             | $V_I = 0V \text{ or } V_{CC}$                                | 3.3                 | 6       | pF    |
| $C_{IO}$ | Input, Output Capacitance     | $V_O = 0V \text{ or } V_{CC}$                                | 3.3                 | 7       | pF    |
| $C_{PD}$ | Power Dissipation Capacitance | Outputs Enabled<br>$f = 10 \text{ MHz}, C_L = 50 \text{ pF}$ | 3.3                 | 20      | pF    |
|          |                               |                                                              | 2.5                 | 20      |       |

## AC Loading and Waveforms

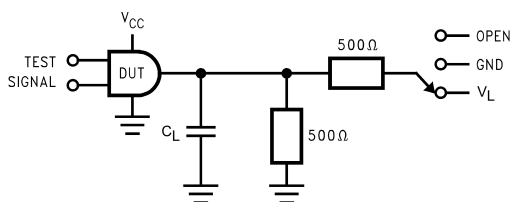


FIGURE 1. AC Test Circuit

TABLE 1. Values for Figure 1

| TEST                  | SWITCH |
|-----------------------|--------|
| $t_{PLH}$ , $t_{PHL}$ | Open   |
| $t_{PZL}$ , $t_{PLZ}$ | $V_L$  |
| $t_{PZH}$ , $t_{PHZ}$ | GND    |

TABLE 2. Variable Matrix  
(Input Characteristics:  $f = 1\text{MHz}$ ;  $t_r = t_f = 2\text{ns}$ ;  $Z_O = 50\Omega$ )

| Symbol   | $V_{CC}$                      |                        |                         |                                |
|----------|-------------------------------|------------------------|-------------------------|--------------------------------|
|          | $3.3\text{V} \pm 0.3\text{V}$ | $2.7\text{V}$          | $2.5 \pm 0.2\text{V}$   | $1.8\text{V} \pm 0.15\text{V}$ |
| $V_{mi}$ | $1.5\text{V}$                 | $1.5\text{V}$          | $V_{CC}/2$              | $V_{CC}/2$                     |
| $V_{mo}$ | $1.5\text{V}$                 | $1.5\text{V}$          | $V_{CC}/2$              | $V_{CC}/2$                     |
| $V_X$    | $V_{OL} + 0.3\text{V}$        | $V_{OL} + 0.3\text{V}$ | $V_{OL} + 0.15\text{V}$ | $V_{OL} + 0.15\text{V}$        |
| $V_Y$    | $V_{OH} - 0.3\text{V}$        | $V_{OH} - 0.3\text{V}$ | $V_{OH} - 0.15\text{V}$ | $V_{OH} - 0.15\text{V}$        |
| $V_L$    | $6\text{V}$                   | $6\text{V}$            | $V_{CC} \times 2$       | $V_{CC} \times 2$              |

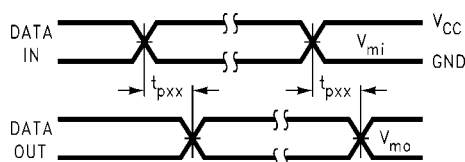


FIGURE 2. Waveform for Inverting and Non-inverting Functions

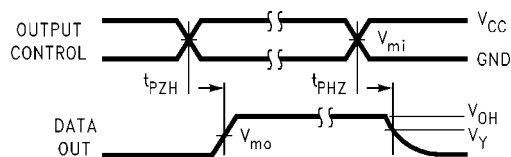


FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic

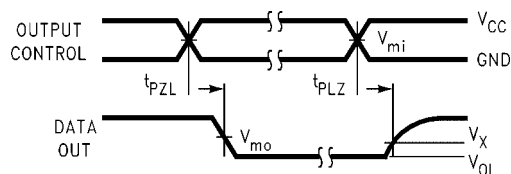
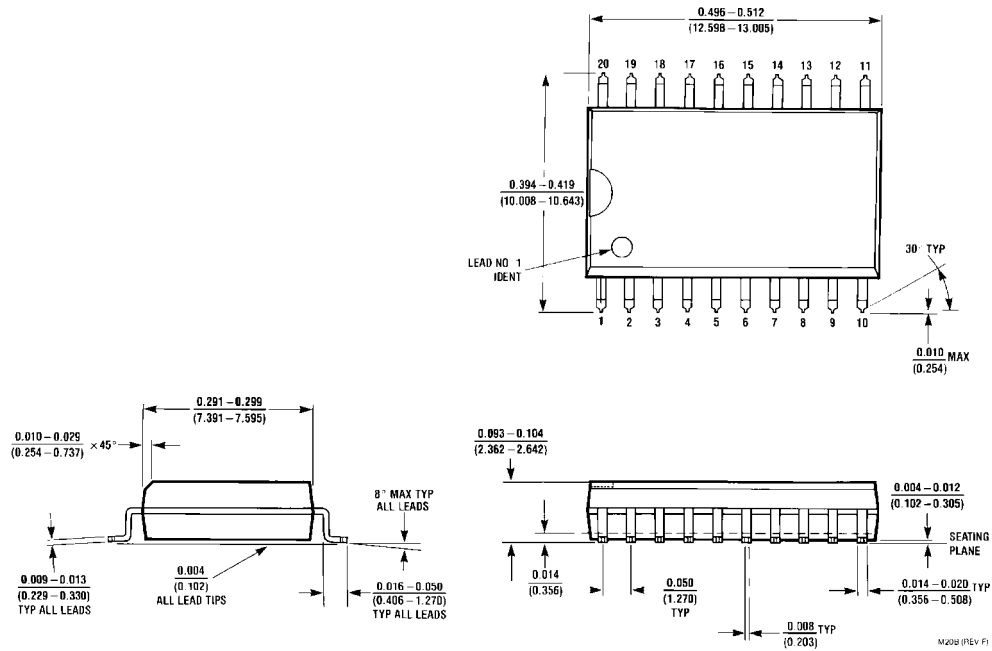


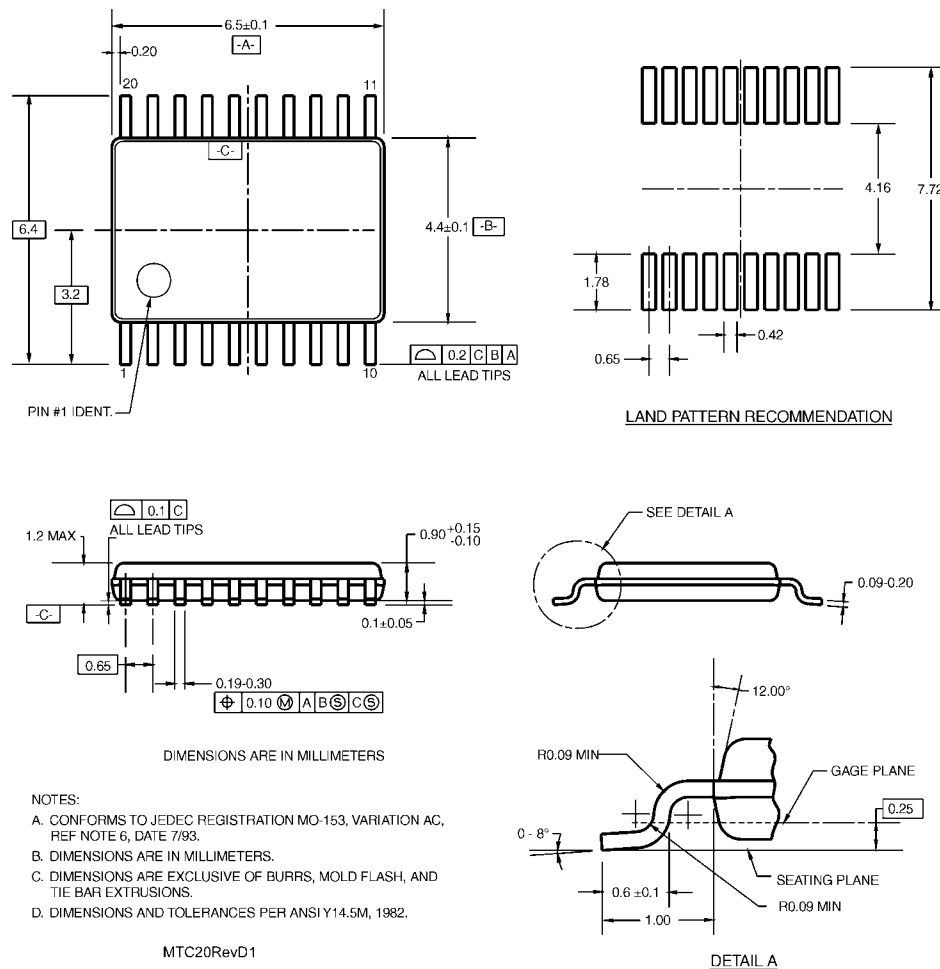
FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

# Physical Dimensions inches (millimeters) unless otherwise noted



20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M20B

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



**20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC20**

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