

## 74ALVC245

### Low Voltage Bidirectional Transceiver with 3.6V Tolerant Inputs and Outputs

#### General Description

The ALVC245 contains eight non-inverting bidirectional buffers with 3-STATE outputs and is intended for bus oriented applications. The  $T/\bar{R}$  input determines the direction of data flow. The  $\bar{OE}$  input disables both the A and B ports by placing them in a high impedance state.

The 74ALVC245 is designed for low voltage (1.65V to 3.6V)  $V_{CC}$  applications with I/O compatibility up to 3.6V.

The 74ALVC245 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

#### Features

- 1.65V to 3.6V  $V_{CC}$  supply operation
- 3.6V tolerant inputs and outputs
- Power-off high impedance inputs and outputs
- Supports Live Insertion and Withdrawal (Note 1)
- $t_{PD}$ 
  - 3.4 ns max for 3.0V to 3.6V  $V_{CC}$
  - 3.9 ns max for 2.3V to 2.7V  $V_{CC}$
  - 6 ns max for 1.65V to 1.95V  $V_{CC}$
- 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,  $\bar{OE}_n$  should be tied to  $V_{CC}$  through a pull up resistor. The minimum value of the resistor is determined by the current sourcing capability of the driver.

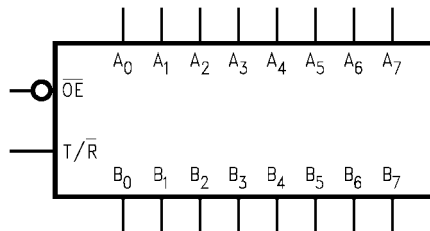
#### Ordering Code:

Order Number	Package Number	Package Description
74ALVC245WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74ALVC245MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ALVC245MTCX_NL (Note 2)	MTC20	Pb-Free 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.

**Note 2:** "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

#### Logic Symbol

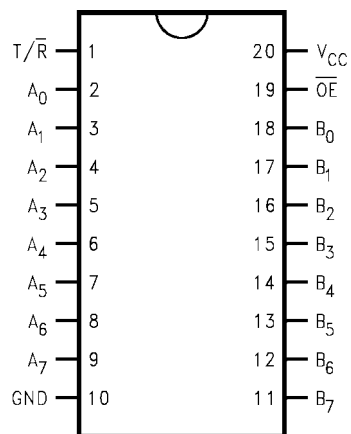


#### Pin Descriptions

Pin Names	Description
$\bar{OE}$	Output Enable Input (Active LOW)
$T/\bar{R}$	Transmit/Receive Input
$A_0$ - $A_7$	Side A Inputs or 3-STATE Outputs
$B_0$ - $B_7$	Side B Inputs or 3-STATE Outputs

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**Connection Diagram**



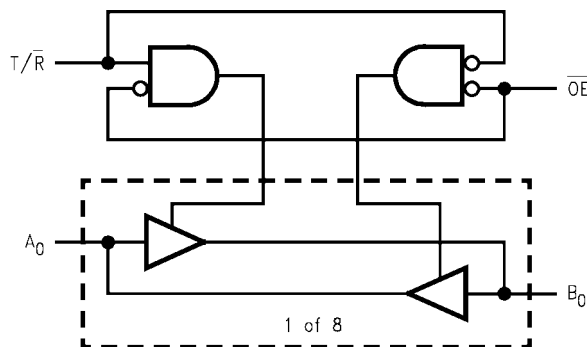
**Truth Table**

Inputs		Outputs
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 3)

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance

**Note 3:** Unused bus terminals during HIGH Z State must be held HIGH or LOW.

**Logic Diagram**



**Absolute Maximum Ratings** (Note 4)

Supply Voltage ( $V_{CC}$ )	-0.5V to +4.6V
DC Input Voltage ( $V_I$ )	-0.5V to 4.6V
Output Voltage ( $V_O$ ) (Note 5)	-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 ( $I_{OH}/I_{OL}$ )	$\pm 50$ mA
DC $V_{CC}$ or GND Current per Supply Pin ( $I_{CC}$ or GND)	$\pm 100$ mA
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C

**Recommended Operating Conditions** (Note 6)

Power Supply	
Operating	1.65V to 3.6V
Input Voltage ( $V_I$ )	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 4:** 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 5:**  $I_O$  Absolute Maximum Rating must be observed, limited to 4.6V.

**Note 6:** Floating or unused control inputs must be held HIGH or LOW.

**DC Electrical Characteristics**

Symbol	Parameter	Conditions	$V_{CC}$ (V)	Min	Max	Units
$V_{IH}$	HIGH Level Input Voltage		1.65 - 1.95 2.3 - 2.7 2.7 - 3.6	$0.65 \times V_{CC}$ 1.7 2.0		V
$V_{IL}$	LOW Level Input Voltage		1.65 - 1.95 2.3 - 2.7 2.7 - 3.6		$0.35 \times V_{CC}$ 0.7 0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	1.65 - 3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -4$ mA	1.65	1.2		
		$I_{OH} = -6$ mA	2.3	2.0		
		$I_{OH} = -12$ mA	2.3 2.7 3.0	1.7 2.2 2.4		
		$I_{OH} = -24$ mA	3.0	2		
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu A$	1.65 - 3.6		0.2	V
		$I_{OL} = 4$ mA	1.65		0.45	
		$I_{OL} = 6$ mA	2.3		0.4	
		$I_{OL} = 12$ mA	2.3 2.7		0.7 0.4	
		$I_{OL} = 24$ mA	3.0		0.55	
$I_I$	Input Leakage Current	$0 \leq V_I \leq 3.6V$	3.6		$\pm 5.0$	$\mu A$
$I_{OZ}$	3-STATE Output Leakage	$0 \leq V_O \leq 3.6V$	3.6		$\pm 10$	$\mu A$
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6		10	$\mu A$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6V$	3 - 3.6		750	$\mu A$

AC Electrical Characteristics										
Symbol	Parameter	$T_A = -40^\circ\text{C to } +85^\circ\text{C}, R_L = 500\Omega$								Units
		$C_L = 50\text{ pF}$				$C_L = 30\text{ pF}$				
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V \pm 0.15V$		
		Min	Max	Min	Max	Min	Max	Min	Max	
$t_{PHL}, t_{PLH}$	Propagation Delay	1.3	3.4		3.9	1.0	3.5	1.5	6.0	ns
$t_{PZL}, t_{PZH}$	Output Enable Time	1.6	5.5		6.3	2.0	6.0	2.7	8.6	ns
$t_{PLZ}, t_{PHZ}$	Output Disable Time	1.7	5.5		5.3	0.8	4.8	1.5	8.0	ns
Capacitance										
Symbol	Parameter		Conditions	$T_A = +25^\circ\text{C}$		Units				
				$V_{CC}$	Typical					
$C_{IN}$	Input Capacitance	Control	$V_I = 0V \text{ or } V_{CC}$	3.3	3	pF				
$C_{I/O}$	Input/ Output Capacitance	A or B Ports	$V_I = 0V \text{ or } V_{CC}$	3.3	6					
$C_{PD}$	Power Dissipation Capacitance	Outputs Enabled	$f = 10\text{ MHz}, C_L = 0\text{ pF}$	3.3	30	pF				
				2.5	27					
				1.8	25					
		Outputs Disabled	$f = 10\text{ MHz}, C_L = 0\text{ pF}$	3.3	0					
				2.5	0					
1.8	0									

### AC Loading and Waveforms

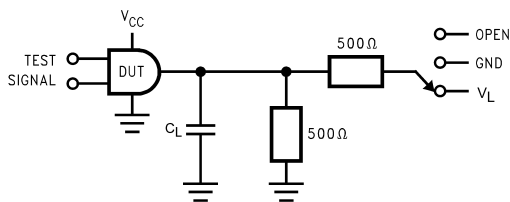


TABLE 1. Values for Figure 1

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

FIGURE 1. AC Test Circuit

TABLE 2. Variable Matrix  
(Input Characteristics:  $f = 1\text{MHz}$ ;  $t_r = t_f = 2\text{ns}$ ;  $Z_0 = 50\Omega$ )

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

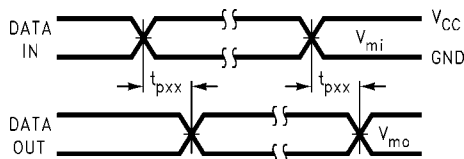


FIGURE 2. Waveform for Inverting and Non-Inverting Functions

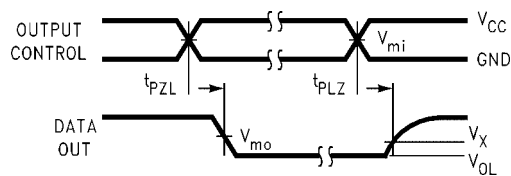
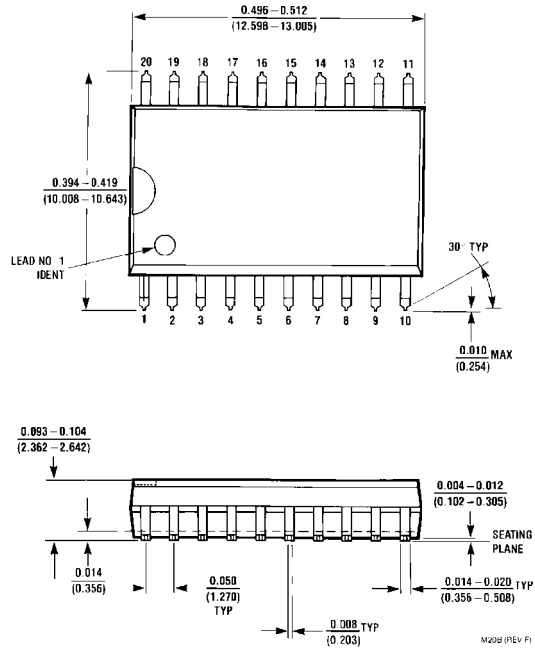


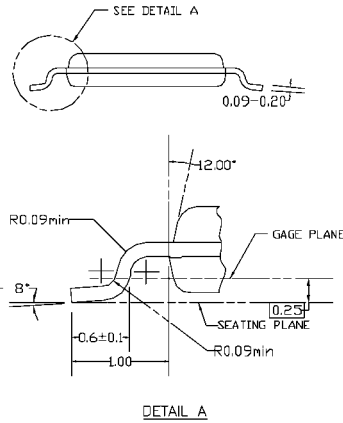
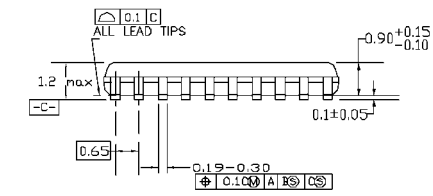
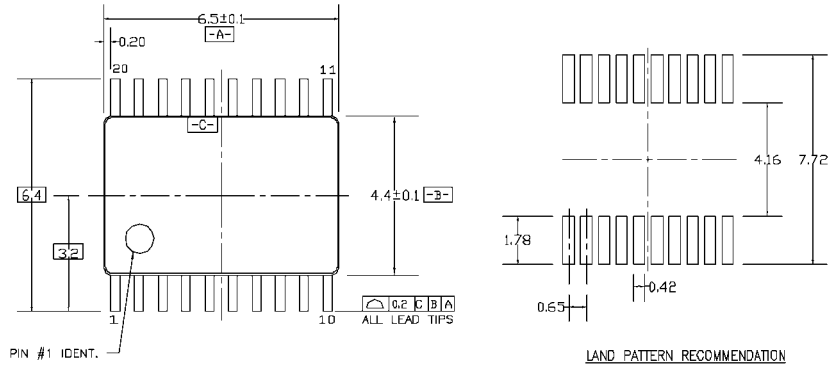
FIGURE 3. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

**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)



DIMENSIONS ARE IN MILLIMETERS

**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20REVD1

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

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