

DATA SHEET

74LVT245B

3.3V Octal transceiver with direction pin
(3-State)

Product specification

1999 Mar 19

IC23 Data Handbook

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

FEATURES

- Octal bidirectional bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-State
- No bus current loading when output is tied to 5V bus
- Latch-up protection exceeds 500mA per JEDEC Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The LVT245B is a high-performance BiCMOS product designed for V_{CC} operation at 3.3V.

This device is an octal transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The control function implementation minimizes external timing requirements. The device features an Output Enable (\overline{OE}) input for easy cascading and a Direction (DIR) input for direction control.

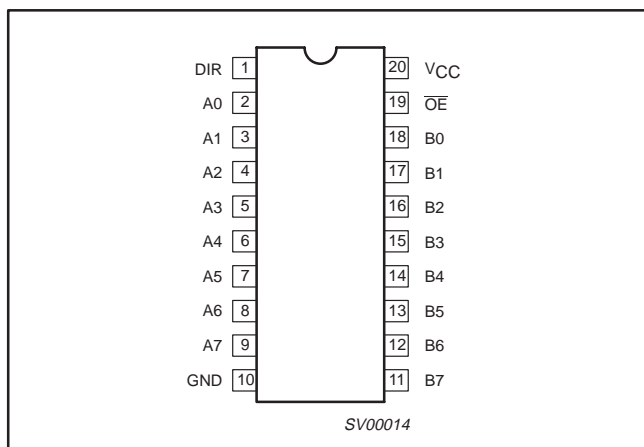
QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS $T_{amb} = 25^{\circ}\text{C}; \text{GND} = 0\text{V}$ | TYPICAL | UNIT |
|------------------------|---|--|---------|------|
| t_{PLH} t_{PHL} | Propagation delay An to Bn or Bn to An | $C_L = 50\text{pF};$ $V_{CC} = 3.3\text{V}$ | 2.4 | ns |
| C_{IN} | Input capacitance DIR, \overline{OE} | $V_I = 0\text{V}$ or 3.0V | 4 | pF |
| $C_{I/O}$ | I/O pin capacitance | Outputs disabled; $V_{I/O} = 0\text{V}$ or 3.0V | 10 | pF |
| I_{CCZ} | Total supply current | Outputs disabled; $V_{CC} = 3.6\text{V}$ | 0.13 | mA |

ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | ORDERING INFORMATION | DWG NUMBER |
|----------------------|--|----------------------|------------|
| 20-Pin Plastic SO | -40°C to $+85^{\circ}\text{C}$ | 74LVT245B D | SOT163-1 |
| 20-Pin Plastic SSOP | -40°C to $+85^{\circ}\text{C}$ | 74LVT245B DB | SOT339-1 |
| 20-Pin Plastic TSSOP | -40°C to $+85^{\circ}\text{C}$ | 74LVT245B PW | SOT360-1 |

PIN CONFIGURATION



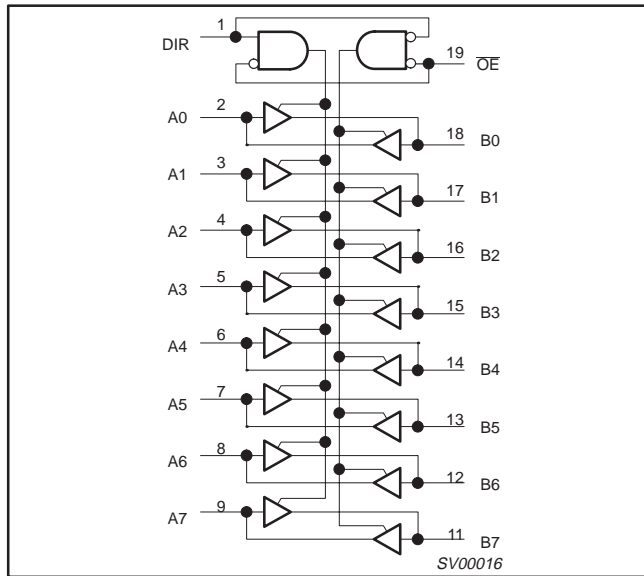
PIN DESCRIPTION

| PIN NUMBER | SYMBOL | NAME AND FUNCTION |
|-----------------------------------|-----------------|-------------------------------------|
| 1 | DIR | Direction control input |
| 2, 3, 4, 5, 6, 7, 8, 9 | A0 – A7 | Data inputs/outputs (A side) |
| 18, 17, 16, 15, 14, 13, 12, 11 | B0 – B7 | Data inputs/outputs (B side) |
| 19 | \overline{OE} | Output enable input (active–Low) |
| 10 | GND | Ground (0V) |
| 20 | V_{CC} | Positive supply voltage |

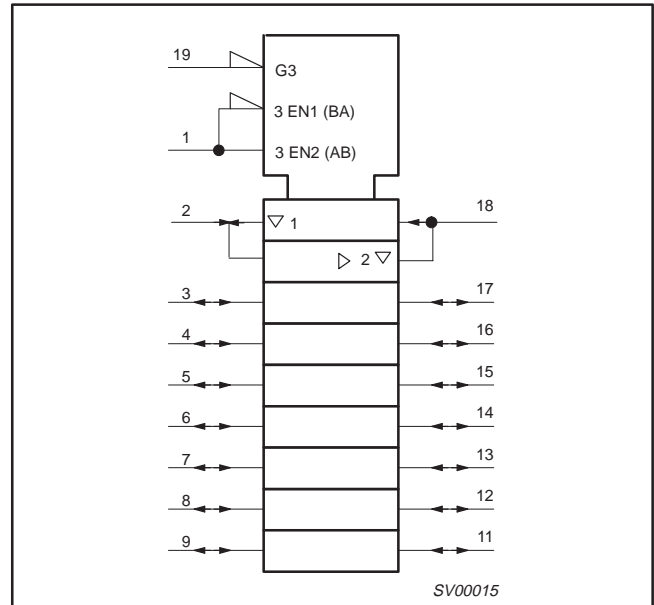
3.3V Octal transceiver with direction pin (3-State)

74LVT245B

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

| INPUTS | | INPUTS/OUTPUTS | |
|------------------|-----|----------------|--------|
| \overline{OEn} | DIR | An | Bn |
| L | L | An= Bn | Inputs |
| L | H | Inputs | Bn =An |
| H | X | Z | Z |

H = High voltage level
 L = Low voltage level
 X = Don't care
 Z = High impedance "Off" state

ABSOLUTE MAXIMUM RATINGS^{1,2}

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|-----------|--------------------------------|-----------------------------|--------------|------|
| V_{CC} | DC supply voltage | | -0.5 to +4.6 | V |
| I_{IK} | DC input diode current | $V_I < 0$ | -50 | mA |
| V_I | DC input voltage ³ | | -0.5 to +7.0 | V |
| I_{OK} | DC output diode current | $V_O < 0$ | -50 | mA |
| V_{OUT} | DC output voltage ³ | Output in Off or High state | -0.5 to +7.0 | V |
| I_{OUT} | DC output current | Output in Low state | 128 | mA |
| | | Output in High state | -64 | |
| T_{stg} | Storage temperature range | | -65 to +150 | °C |

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | UNIT |
|------------------|--|--------|-----|------|
| | | MIN | MAX | |
| V _{CC} | DC supply voltage | 2.7 | 3.6 | V |
| V _I | Input voltage | 0 | 5.5 | V |
| V _{IH} | High-level input voltage | 2.0 | | V |
| V _{IL} | Input voltage | | 0.8 | V |
| I _{OH} | High-level output current | | -32 | mA |
| I _{OL} | Low-level output current | | 32 | mA |
| | Low-level output current; current duty cycle ≤ 50%; f ≥ 1kHz | | 64 | |
| Dt/Dv | Input transition rise or fall rate; Outputs enabled | | 10 | ns/V |
| T _{amb} | Operating free-air temperature range | -40 | +85 | °C |

DC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|--------------------|--|---|----------------------------|----------------------|------|------|
| | | | Temp = -40°C to +85°C | | | |
| | | | MIN | TYP ¹ | MAX | |
| V _{IK} | Input clamp voltage | V _{CC} = 2.7V; I _{IK} = -18mA | | -0.9 | -1.2 | V |
| V _{OH} | High-level output voltage | V _{CC} = 2.7 to 3.6V; I _{OH} = -100μA | V _{CC} -0.2 | V _{CC} -0.1 | | V |
| | | V _{CC} = 2.7V; I _{OH} = -8mA | 2.4 | 2.5 | | |
| | | V _{CC} = 3.0V; I _{OH} = -32mA | 2.0 | 2.2 | | |
| V _{OL} | Low-level output voltage | V _{CC} = 2.7V; I _{OL} = 100μA | | 0.1 | 0.2 | V |
| | | V _{CC} = 2.7V; I _{OL} = 24mA | | 0.3 | 0.5 | |
| | | V _{CC} = 3.0V; I _{OL} = 16mA | | 0.25 | 0.4 | |
| | | V _{CC} = 3.0V; I _{OL} = 32mA | | 0.3 | 0.5 | |
| | | V _{CC} = 3.0V; I _{OL} = 64mA | | 0.4 | 0.55 | |
| I _I | Input leakage current | V _{CC} = 0 or 3.6V; V _I = 5.5V | Control pins | 1 | 10 | μA |
| | | V _{CC} = 3.6V; V _I = V _{CC} or GND | | ±0.1 | ±1 | |
| | | V _{CC} = 3.6V; V _I = 5.5V | I/O Data pins ⁴ | 1 | 20 | |
| | | V _{CC} = 3.6V; V _I = V _{CC} | | 0.1 | 1 | |
| | | V _{CC} = 3.6V; V _I = 0 | | -1 | -5 | |
| I _{OFF} | Output off current | V _{CC} = 0V; V _I or V _O = 0 to 4.5V | | 1 | ±100 | μA |
| I _{HOLD} | Bus Hold current A inputs ⁵ | V _{CC} = 3V; V _I = 0.8V | 75 | 150 | | μA |
| | | V _{CC} = 3V; V _I = 2.0V | -75 | -150 | | |
| | | V _{CC} = 0V to 3.6V; V _{CC} = 3.6V | ±500 | | | |
| I _{EX} | Current into an output in the High state when V _O > V _{CC} | V _O = 5.5V; V _{CC} = 3.0V | | 60 | 125 | μA |
| I _{PU/PD} | Power up/down 3-State output current ³ | V _{CC} ≤ 1.2V; V _O = 0.5V to V _{CC} ; V _I = GND or V _{CC} ; OE/OE = Don't care | | 15 | ±100 | μA |
| I _{CCH} | Quiescent supply current | V _{CC} = 3.6V; Outputs High, V _I = GND or V _{CC} , I _O = 0 | | 0.13 | 0.19 | mA |
| I _{CCL} | | V _{CC} = 3.6V; Outputs Low, V _I = GND or V _{CC} , I _O = 0 | | 3 | 12 | |
| I _{CCZ} | | V _{CC} = 3.6V; Outputs Disabled; V _I = GND or V _{CC} , I _O = 0 | | 0.13 | 0.19 | |
| ΔI _{CC} | Additional supply current per input pin ² | V _{CC} = 3V to 3.6V; One input at V _{CC} -0.6V, Other inputs at V _{CC} or GND | | 0.1 | 0.2 | mA |

NOTES:

- All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
- This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND
- This parameter is valid for any V_{CC} between 0V and 1.2V with a transition time of up to 10msec. From V_{CC} = 1.2V to V_{CC} = 3.3V ± 0.3V a transition time of 100μsec is permitted. This parameter is valid for T_{amb} = +25°C only.
- Unused pins at V_{CC} or GND.
- This is the bus hold overdrive current required to force the input to the opposite logic state.

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

AC CHARACTERISTICS

GND = 0V; $t_R = t_F = 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; $T_{\text{amb}} = -40^\circ\text{C}$ to $+85^\circ\text{C}$.

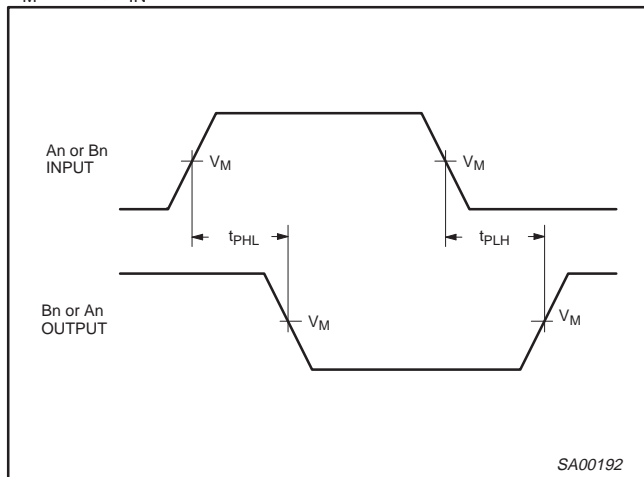
| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | UNIT |
|------------------------|--|----------|--------------------------------------|------------------|------------|------------------------|------|
| | | | $V_{CC} = 3.3\text{V} + 0.3\text{V}$ | | | $V_{CC} = 2.7\text{V}$ | |
| | | | MIN | TYP ¹ | MAX | MAX | |
| t_{PLH} t_{PHL} | Propagation delay An to Bn or Bn to An | 1 | 1.2 1.2 | 2.4 2.4 | 3.5 3.5 | 4.0 4.0 | ns |
| t_{PZH} t_{PZL} | Output enable time to High and Low level | 2 | 1.3 1.7 | 3.3 3.2 | 5.5 5.5 | 7.1 6.5 | ns |
| t_{PHZ} t_{PLZ} | Output disable time from High and Low Level | 2 | 2.2 2.2 | 3.6 3.4 | 5.9 5.0 | 6.5 5.1 | ns |

NOTES:

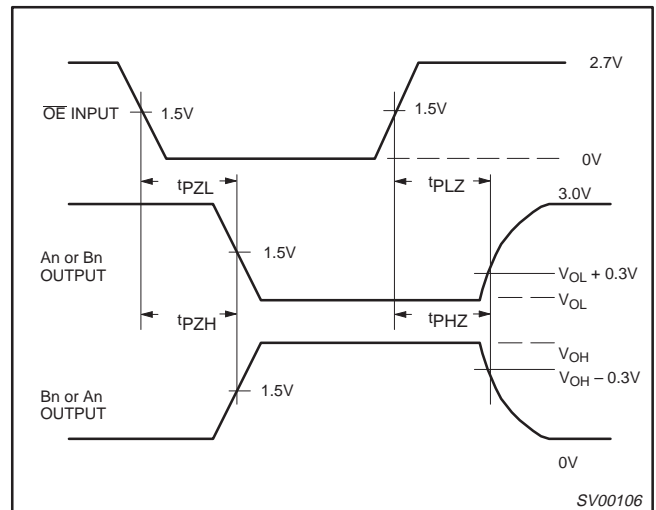
- All typical values are at $V_{CC} = 3.3\text{V}$ and $T_{\text{amb}} = 25^\circ\text{C}$.

AC WAVEFORMS

$V_M = 1.5\text{V}$, $V_{IN} = \text{GND to } 2.7\text{V}$



Waveform 1. Input (An or Bn) to Output (Bn or An) Propagation Delays

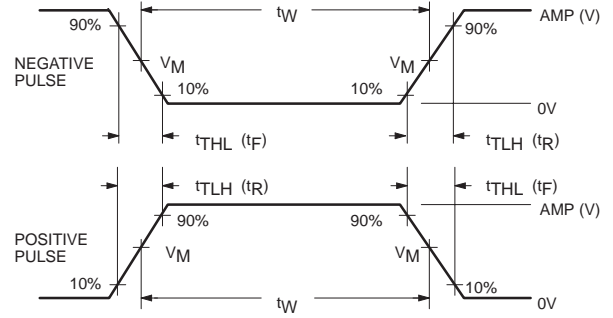
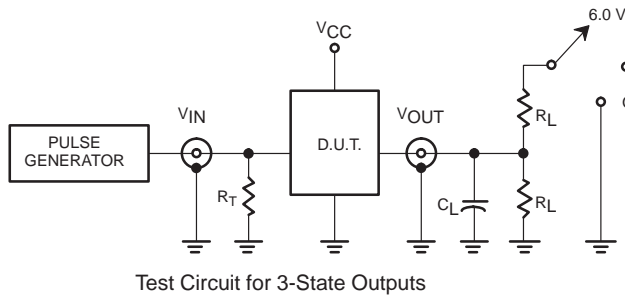


Waveform 2. 3-State Output Enable and Disable Times

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

TEST CIRCUIT AND WAVEFORMS



SWITCH POSITION

| TEST | SWITCH |
|-------------------|--------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 6V |
| t_{PHZ}/t_{PZH} | GND |

DEFINITIONS

- R_L = Load resistor; see AC CHARACTERISTICS for value.
- C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
- R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

| FAMILY | INPUT PULSE REQUIREMENTS | | | | |
|--------|--------------------------|----------------------|--------|----------------------|----------------------|
| | Amplitude | Rep. Rate | t_W | t_R | t_F |
| 74LVT | 2.7 V | $\leq 10\text{ MHz}$ | 500 ns | $\leq 2.5\text{ ns}$ | $\leq 2.5\text{ ns}$ |

SV00092

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 2.65 | 0.30 0.10 | 2.45 2.25 | 0.25 | 0.49 0.36 | 0.32 0.23 | 13.0 12.6 | 7.6 7.4 | 1.27 | 10.65 10.00 | 1.4 | 1.1 0.4 | 1.1 1.0 | 0.25 | 0.25 | 0.1 | 0.9 0.4 | 8° 0° |
| inches | 0.10 | 0.012 0.004 | 0.096 0.089 | 0.01 | 0.019 0.014 | 0.013 0.009 | 0.51 0.49 | 0.30 0.29 | 0.050 | 0.419 0.394 | 0.055 | 0.043 0.016 | 0.043 0.039 | 0.01 | 0.01 | 0.004 | 0.035 0.016 | |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT163-1 | 075E04 | MS-013AC | | | | 95-01-24 97-05-22 |

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|------------|-----|------|-----|------------------|----------|
| mm | 2.0 | 0.21 0.05 | 1.80 1.65 | 0.25 | 0.38 0.25 | 0.20 0.09 | 7.4 7.0 | 5.4 5.2 | 0.65 | 7.9 7.6 | 1.25 | 1.03 0.63 | 0.9 0.7 | 0.2 | 0.13 | 0.1 | 0.9 0.5 | 8° 0° |

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT339-1 | | MO-150AE | | | | 93-09-08 95-02-04 |

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽²⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|-----|----------------|------------|-----|------|-----|------------------|----------|
| mm | 1.10 | 0.15 0.05 | 0.95 0.80 | 0.25 | 0.30 0.19 | 0.2 0.1 | 6.6 6.4 | 4.5 4.3 | 0.65 | 6.6 6.2 | 1.0 | 0.75 0.50 | 0.4 0.3 | 0.2 | 0.13 | 0.1 | 0.5 0.2 | 8° 0° |

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|------------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT360-1 | | MO-153AC | | | | -93-06-16- 95-02-04 |

3.3V Octal transceiver with direction pin (3-State)

74LVT245B

Data sheet status

| Data sheet status | Product status | Definition [1] |
|---------------------------|----------------|--|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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