

# Low Voltage Octal Buffer / Line Driver with 3-STATE Outputs

## 74LVX541

### General Description

The LVX541 is an octal non-inverting buffer and line driver designed to be employed as a memory address driver, clock driver and bus oriented transmitter or receiver which provides improved PC board density. The inputs tolerate up to 5.5 V allowing interface of 5 V systems to 3 V systems.

### Features

- Input Voltage Translation from 5 V to 3 V
- Ideal for Low Power / Low Noise 3.3 V Applications
- Guaranteed Simultaneous Switching Noise Level and Dynamic Threshold Performance
- This is a Pb-Free Device

### Logic Symbol

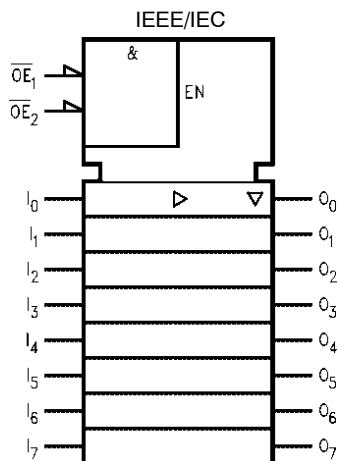
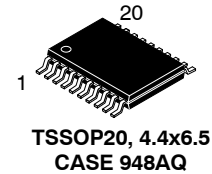


Figure 1. Logic Symbol

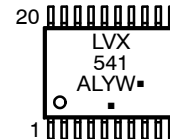
### TRUTH TABLE

| Inputs            |                   |   | Outputs |
|-------------------|-------------------|---|---------|
| $\overline{OE}_1$ | $\overline{OE}_2$ | I |         |
| L                 | L                 | H | H       |
| H                 | X                 | X | Z       |
| X                 | H                 | X | Z       |
| L                 | L                 | L | L       |

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



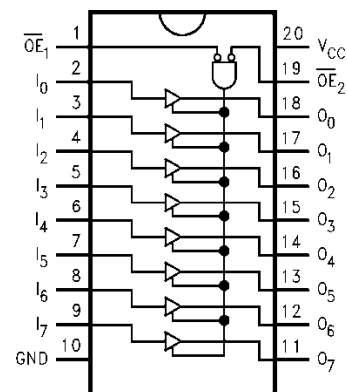
### MARKING DIAGRAM



LVX541 = 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 DESCRIPTION

| Pin Names                           | Description                   |
|-------------------------------------|-------------------------------|
| $\overline{OE}_1 - \overline{OE}_2$ | 3-STATE Outputs Enable Inputs |
| $I_0 - I_7$                         | Inputs                        |
| $O_0 - O_7$                         | 3-STATE Outputs               |

### ORDERING INFORMATION

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

## MAXIMUM RATINGS

| Symbol           | Parameter                                       |                        | Value                         | Unit |
|------------------|-------------------------------------------------|------------------------|-------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage                               |                        | –0.5 to +6.5                  | V    |
| V <sub>IN</sub>  | DC Input Voltage                                |                        | –0.5 to +6.5                  | V    |
| V <sub>OUT</sub> | DC Output Voltage                               |                        | –0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IN</sub>  | DC Input Current, per Pin                       |                        | ±20                           | mA   |
| I <sub>OUT</sub> | DC Output Current, per Pin                      |                        | ±25                           | mA   |
| I <sub>CC</sub>  | DC Supply Current, V <sub>CC</sub> and GND Pins |                        | ±75                           | mA   |
| I <sub>IK</sub>  | Input Clamp Current                             |                        | –20                           | mA   |
| I <sub>OK</sub>  | Output Clamp Current                            |                        | ±20                           | mA   |
| T <sub>STG</sub> | Storage Temperature Range                       |                        | –65 to +150                   | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds |                        | 260                           | °C   |
| T <sub>J</sub>   | Junction Temperature Under Bias                 |                        | +150                          | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Note 2)                     | TSSOP-20               | 150                           | °C/W |
| P <sub>D</sub>   | Power Dissipation in Still Air at 25 °C         | TSSOP-20               | 833                           | mW   |
| MSL              | Moisture Sensitivity                            |                        | Level 1                       | –    |
| F <sub>R</sub>   | Flammability Rating                             | Oxygen Index: 28 to 34 | UL 94 V–0 @ 0.573 in          | –    |
| V <sub>ESD</sub> | 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 | 3.6             | V    |
| V <sub>IN</sub>                 | DC Input Voltage (Note 4)  | 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    | 0   | 100             | ns/V |

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>          | 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                      | 1.5                    | –    | –     | 1.5                               | –    | V    |
|                 |                                  |                                                                                                  | 3.0                      | 2.0                    | –    | –     | 2.0                               | –    |      |
|                 |                                  |                                                                                                  | 3.6                      | 2.4                    | –    | –     | 2.4                               | –    |      |
| V <sub>IL</sub> | LOW Level Input Voltage          |                                                                                                  | 2.0                      | –                      | –    | 0.5   | –                                 | 0.5  | V    |
|                 |                                  |                                                                                                  | 3.0                      | –                      | –    | 0.8   | –                                 | 0.8  |      |
|                 |                                  |                                                                                                  | 3.6                      | –                      | –    | 0.8   | –                                 | 0.8  |      |
| 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    |
|                 |                                  |                                                                                                  | I <sub>OH</sub> = -50 µA | 3.0                    | 2.9  | 3.0   | –                                 | 2.9  |      |
|                 |                                  |                                                                                                  | I <sub>OH</sub> = -4 mA  | 3.0                    | 2.58 | –     | –                                 | 2.48 |      |
| 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                               | –    | V    |
|                 |                                  |                                                                                                  | I <sub>OL</sub> = 50 µA  | 3.0                    | –    | 0.0   | 0.1                               | –    |      |
|                 |                                  |                                                                                                  | I <sub>OL</sub> = 4 mA   | 3.0                    | –    | –     | 0.36                              | –    |      |
| I <sub>OZ</sub> | 3-STATE Output Off-State Current | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>OUT</sub> = V <sub>CC</sub> or GND | 3.6                      | –                      | –    | ±0.25 | –                                 | ±2.5 | µA   |
| I <sub>IN</sub> | Input Leakage Current            | V <sub>IN</sub> = 5.5 V or GND                                                                   | 3.6                      | –                      | –    | ±0.1  | –                                 | ±1.0 | µA   |
| I <sub>CC</sub> | Quiescent Supply Current         | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                         | 3.6                      | –                      | –    | 4.0   | –                                 | 40.0 | µA   |

## NOISE CHARACTERISTICS (Note 5)

| Symbol           | Parameter                                    | Conditions<br>C <sub>L</sub> (pF) | V <sub>CC</sub> (V) | T <sub>A</sub> = 25 °C |        | Unit |
|------------------|----------------------------------------------|-----------------------------------|---------------------|------------------------|--------|------|
|                  |                                              |                                   |                     | Typ                    | Limits |      |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 50                                | 3.3                 | 0.5                    | 0.8    | V    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 50                                | 3.3                 | -0.5                   | -0.8   | V    |
| V <sub>IHD</sub> | Minimum HIGH Level Dynamic Input Voltage     | 50                                | 3.3                 | –                      | 2.0    | V    |
| V <sub>ILD</sub> | Maximum LOW Level Dynamic Input Voltage      | 50                                | 3.3                 | –                      | 0.8    | V    |

5. Input t<sub>r</sub> = t<sub>f</sub> = 3 ns

## 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                           | 2.7                 | –                      | 6.1  | 11.3 | 1.0                               | 13.5 | ns   |
|                                          |                                   | C <sub>L</sub> = 50 pF                           |                     | –                      | 8.6  | 14.9 | 1.0                               | 17.0 |      |
|                                          |                                   | C <sub>L</sub> = 15 pF                           | 3.3 ±0.3            | –                      | 4.7  | 7.0  | 1.0                               | 8.5  | ns   |
|                                          |                                   | C <sub>L</sub> = 50 pF                           |                     | –                      | 7.2  | 10.5 | 1.0                               | 12.0 |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub>   | 3-STATE<br>Output Enable Time     | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 1 kΩ | 2.7                 | –                      | 7.1  | 13.8 | 1.0                               | 16.5 | ns   |
|                                          |                                   | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ  |                     | –                      | 9.6  | 17.3 | 1.0                               | 20.0 |      |
|                                          |                                   | C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 kΩ  | 3.3 ±0.3            | –                      | 6.8  | 10.5 | 1.0                               | 12.5 | ns   |
|                                          |                                   | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ  |                     | –                      | 9.3  | 14.0 | 1.0                               | 16.0 |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub>   | 3-STATE<br>Output Disable Time    | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ  | 2.7                 | –                      | 11.6 | 17.9 | 1.0                               | 20.0 | ns   |
|                                          |                                   | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ  | 3.3 ±0.3            | –                      | 10.7 | 15.4 | 1.0                               | 17.5 |      |
| t <sub>OSLH</sub> ,<br>t <sub>OSHL</sub> | Output to Output<br>Skew (Note 6) | C <sub>L</sub> = 50 pF                           | 2.7                 | –                      | –    | 1.5  | –                                 | 1.5  | ns   |
|                                          |                                   |                                                  | 3.3                 | –                      | –    | 1.5  | –                                 | 1.5  |      |

6. Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLHm</sub> – t<sub>PLHn</sub>|; t<sub>OSHL</sub> = |t<sub>PHLm</sub> – t<sub>PHLn</sub>|

## CAPACITANCE

| Symbol           | Parameter                              | T <sub>A</sub> = 25 °C |     |     | T <sub>A</sub> = -40 °C to +85 °C |     | Unit |
|------------------|----------------------------------------|------------------------|-----|-----|-----------------------------------|-----|------|
|                  |                                        | Min                    | Typ | Max | Min                               | Max |      |
| C <sub>IN</sub>  | Input Capacitance                      | –                      | 4   | 10  | –                                 | 10  | pF   |
| C <sub>OUT</sub> | Output Capacitance                     | –                      | 6   | –   | –                                 | –   | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance (Note 7) | –                      | 19  | –   | –                                 | –   | pF   |

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 Latch).

## ORDERING INFORMATION

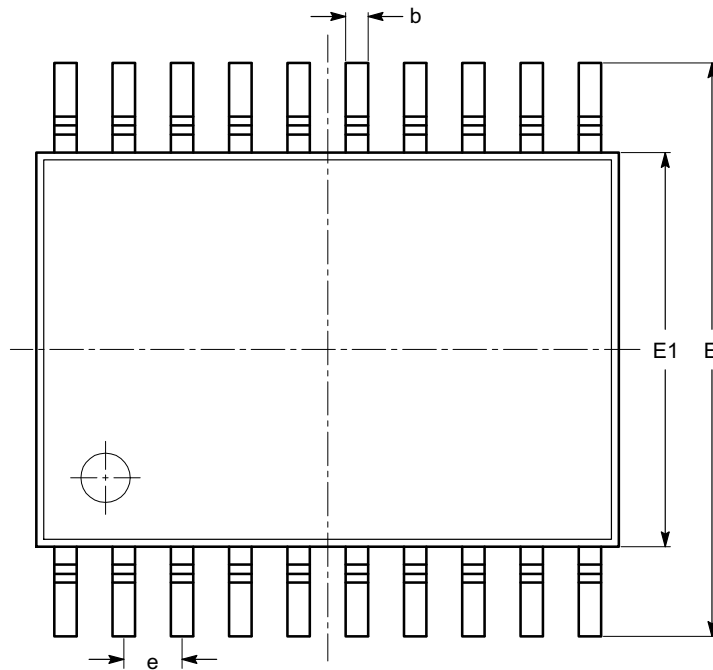
| Device       | Marking    | Package  | Shipping <sup>†</sup>    |
|--------------|------------|----------|--------------------------|
| 74LVX541MTCX | LVX<br>541 | TSSOP-20 | 2500 Units / Tape & Reel |

<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](#).



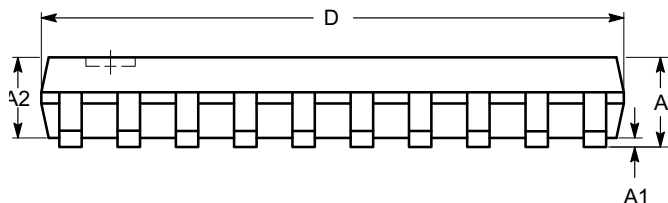
**TSSOP20, 4.4x6.5**  
CASE 948AQ  
ISSUE A

DATE 19 MAR 2009

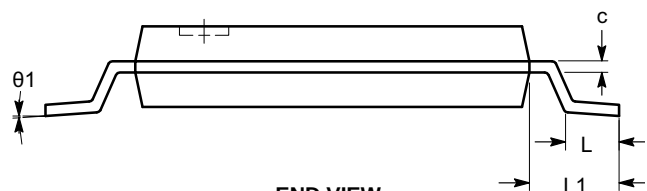


TOP VIEW

| 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 |      |      |
| θ      | 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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