

# NLSX3014

## 4-Bit 100 Mb/s Configurable Dual-Supply Level Translator

The NLSX3014 is a 4-bit configurable dual-supply bidirectional level translator without a direction control pin. The I/O  $V_{CC}$ - and I/O  $V_L$ -ports are designed to track two different power supply rails,  $V_{CC}$  and  $V_L$  respectively. The  $V_{CC}$  supply rail is configurable from 1.3 V to 4.5 V while the  $V_L$  supply rail is configurable from 0.9 V to ( $V_{CC} - 0.4$ ) V. This allows lower voltage logic signals on the  $V_L$  side to be translated into higher voltage logic signals on the  $V_{CC}$  side, and vice-versa. Both I/O ports are auto-sensing; thus, no direction pin is required.

The Output Enable (EN) input, when Low, disables both I/O ports by putting them in 3-state. This significantly reduces the supply currents from both  $V_{CC}$  and  $V_L$ . The EN signal is designed to track  $V_L$ .

### Features

- Wide High-Side  $V_{CC}$  Operating Range: 1.3 V to 4.5 V  
Wide Low-Side  $V_L$  Operating Range: 0.9 V to ( $V_{CC} - 0.4$ ) V
- High-Speed with 100 Mb/s Guaranteed Data Rate for  $V_L > 1.6$  V
- Low Bit-to-Bit Skew
- Overvoltage Tolerant Enable and I/O Pins
- Non-preferential Powerup Sequencing
- Small packaging: 1.7 mm x 2.0 mm UQFN12
- This is a Pb-Free Device

### Typical Applications

- Mobile Phones, PDAs, Other Portable Devices



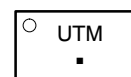
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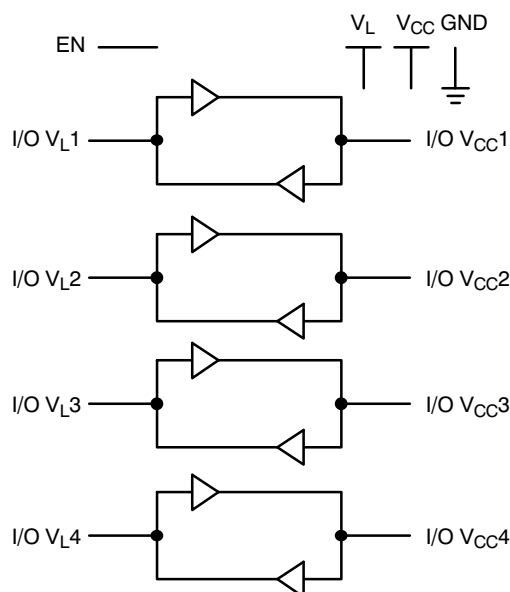
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UQFN12  
MU SUFFIX  
CASE 523AE

### MARKING DIAGRAM

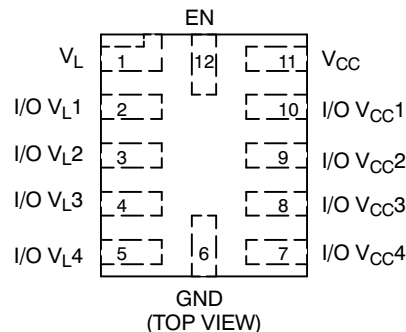


UT = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

### LOGIC DIAGRAM



### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

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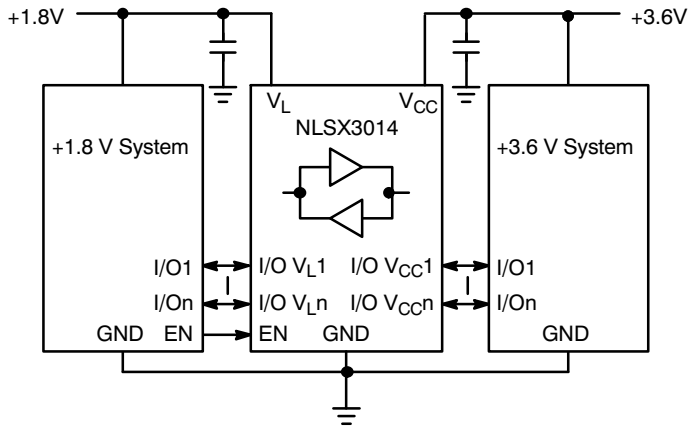


Figure 1. Typical Application Circuit

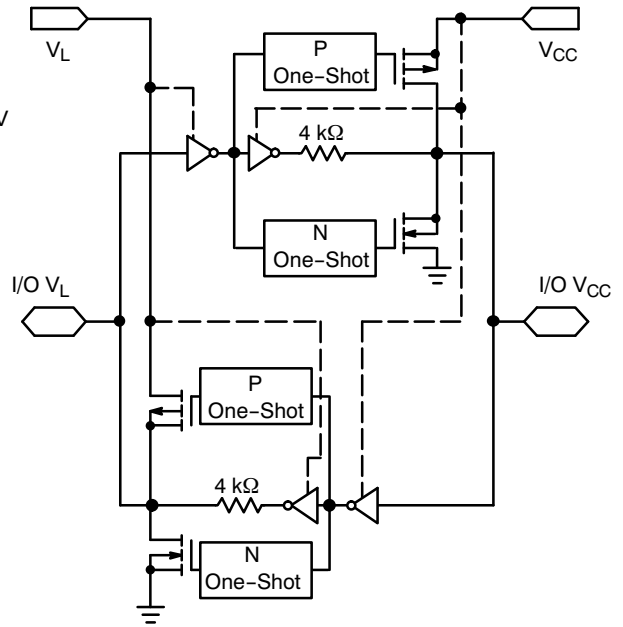


Figure 2. Simplified Functional Diagram (1 I/O Line)  
(EN = 1)

## PIN ASSIGNMENT

| Pins                 | Description                             |
|----------------------|---|
| V <sub>CC</sub>      | V <sub>CC</sub> Input Voltage           |
| V <sub>L</sub>       | V <sub>L</sub> Input Voltage            |
| GND                  | Ground                                  |
| EN                   | Output Enable                           |
| I/O V <sub>CCn</sub> | I/O Port, Referenced to V <sub>CC</sub> |
| I/O V <sub>Ln</sub>  | I/O Port, Referenced to V <sub>L</sub>  |

## FUNCTION TABLE

| EN | Operating Mode      |
|----|---------------------|
| L  | Hi-Z                |
| H  | I/O Buses Connected |

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## MAXIMUM RATINGS

| Symbol       | Parameter                                    | Value                      | Condition   | Unit        |
|--------------|--|----------------------------|-------------|-------------|
| $V_{CC}$     | $V_{CC}$ Supply Voltage                      | -0.5 to +5.5               |             | V           |
| $V_L$        | $V_L$ Supply Voltage                         | -0.5 to +5.5               |             | V           |
| I/O $V_{CC}$ | $V_{CC}$ -Referenced DC Input/Output Voltage | -0.5 to ( $V_{CC} + 0.3$ ) |             | V           |
| I/O $V_L$    | $V_L$ -Referenced DC Input/Output Voltage    | -0.5 to ( $V_L + 0.3$ )    |             | V           |
| $V_{EN}$     | Enable Control Pin DC Input Voltage          | -0.5 to +5.5               |             | V           |
| $I_{IK}$     | Input Diode Clamp Current                    | -50                        | $V_I < GND$ | mA          |
| $I_{OK}$     | Output Diode Clamp Current                   | -50                        | $V_O < GND$ | mA          |
| $I_{CC}$     | DC Supply Current Through $V_{CC}$           | $\pm 100$                  |             | mA          |
| $I_L$        | DC Supply Current Through $V_L$              | $\pm 100$                  |             | mA          |
| $I_{GND}$    | DC Ground Current Through Ground Pin         | $\pm 100$                  |             | mA          |
| $T_{STG}$    | Storage Temperature                          | -65 to +150                |             | $^{\circ}C$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

| Symbol              | Parameter   | Min                       | Max            | Unit        |
|---------------------|---|---------------------------|----------------|-------------|
| $V_{CC}$            | $V_{CC}$ Supply Voltage   | 1.3                       | 4.5            | V           |
| $V_L$               | $V_L$ Supply Voltage  | 0.9                       | $V_{CC} - 0.4$ | V           |
| $V_{EN}$            | Enable Control Pin Voltage  | GND                       | 4.5            | V           |
| $V_{IO}$            | Bus Input/Output Voltage  | I/O $V_{CC}$<br>I/O $V_L$ | 4.5<br>4.5     | V           |
| $T_A$               | Operating Temperature Range   | -40                       | +85            | $^{\circ}C$ |
| $\Delta I/\Delta V$ | Input Transition Rise or Rate<br>$V_I, V_{IO}$ from 30% to 70% of $V_{CC}$ ; $V_{CC} = 3.3 V \pm 0.3 V$ | 0                         | 10             | ns          |

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## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                               | Test Conditions<br>(Note 1)                | V <sub>CC</sub> (V)<br>(Note 2) | V <sub>L</sub> (V)<br>(Note 3) | -40°C to +85°C        |                 |                       | Unit |
|------------------|---|--|---------------------------------|--------------------------------|-----------------------|-----------------|-----------------------|------|
|                  |   |  |                                 |                                | Min                   | Typ<br>(Note 4) | Max                   |      |
| V <sub>IHC</sub> | I/O V <sub>CC</sub> Input HIGH Voltage  |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | 0.8 * V <sub>CC</sub> | -               | -                     | V    |
| V <sub>ILC</sub> | I/O V <sub>CC</sub> Input LOW Voltage   |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | -                     | -               | 0.2 * V <sub>CC</sub> | V    |
| V <sub>IHL</sub> | I/O V <sub>L</sub> Input HIGH Voltage   |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | 0.8 * V <sub>L</sub>  | -               | -                     | V    |
| V <sub>ILL</sub> | I/O V <sub>L</sub> Input LOW Voltage    |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | -                     | -               | 0.2 * V <sub>L</sub>  | V    |
| V <sub>IH</sub>  | Control Pin Input HIGH Voltage          | T <sub>A</sub> = +25°C                     | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | 0.8 * V <sub>L</sub>  | -               | -                     | V    |
| V <sub>IL</sub>  | Control Pin Input LOW Voltage           | T <sub>A</sub> = +25°C                     | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | -                     | -               | 0.2 * V <sub>L</sub>  | V    |
| V <sub>OHC</sub> | I/O V <sub>CC</sub> Output HIGH Voltage | I/O V <sub>CC</sub> Source Current = 20 μA | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | 0.8 * V <sub>CC</sub> | -               | -                     | V    |
| V <sub>OLC</sub> | I/O V <sub>CC</sub> Output LOW Voltage  | I/O V <sub>CC</sub> Sink Current = 20 μA   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | -                     | -               | 0.2 * V <sub>CC</sub> | V    |
| V <sub>OHL</sub> | I/O V <sub>L</sub> Output HIGH Voltage  | I/O V <sub>L</sub> Source Current = 20 μA  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | 0.8 * V <sub>L</sub>  | -               | -                     | V    |
| V <sub>OLL</sub> | I/O V <sub>L</sub> Output LOW Voltage   | I/O V <sub>L</sub> Sink Current = 20 μA    | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4) | -                     | -               | 0.2 * V <sub>L</sub>  | V    |

1. Normal test conditions are V<sub>EN</sub> = 0 V, C<sub>I0VCC</sub> = 15 pF and C<sub>I0VL</sub> = 15 pF, unless otherwise specified.
2. V<sub>CC</sub> is the supply voltage associated with the high voltage port, and V<sub>CC</sub> ranges from +1.3 V to 4.5 V under normal operating conditions.
3. V<sub>L</sub> is the supply voltage associated with the low voltage port. V<sub>L</sub> must be less than or equal to (V<sub>CC</sub> - 0.4) V during normal operation. However, during startup and shutdown conditions, V<sub>L</sub> can be greater than (V<sub>CC</sub> - 0.4) V.
4. Typical values are for V<sub>CC</sub> = +2.8 V, V<sub>L</sub> = +1.8 V and T<sub>A</sub> = +25°C. All units are production tested at T<sub>A</sub> = +25°C. Limits over the operating temperature range are guaranteed by design.

## POWER CONSUMPTION

| Symbol              | Parameter   | Test Conditions<br>(Note 5)   | V <sub>CC</sub> (V)<br>(Note 6) | V <sub>L</sub> (V)<br>(Note 7) | -40°C to +85°C |     |      | Unit |
|---------------------|---|---|---------------------------------|--------------------------------|----------------|-----|------|------|
|                     |   |   |                                 |                                | Min            | Typ | Max  |      |
| I <sub>Q-VCC</sub>  | Supply Current from V <sub>CC</sub>                 | EN = V <sub>L</sub> ; I/O V <sub>CCn</sub> = 0 V, I/O V <sub>Ln</sub> = 0 V, I/O V <sub>CCn</sub> = V <sub>CC</sub> or I/O V <sub>Ln</sub> = V <sub>L</sub> and I <sub>o</sub> = 0            | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 1.0  | μA   |
| I <sub>Q-VL</sub>   | Supply Current from V <sub>L</sub>                  | EN = V <sub>L</sub> ; I/O V <sub>CCn</sub> = 0 V, I/O V <sub>Ln</sub> = 0 V, I/O V <sub>CCn</sub> = V <sub>CC</sub> or I/O V <sub>Ln</sub> = V <sub>L</sub> and I <sub>o</sub> = 0            | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 1.0  | μA   |
|                     |   | EN = V <sub>L</sub> ; I/O V <sub>CCn</sub> = 0 V, I/O V <sub>Ln</sub> = 0 V, I/O V <sub>CCn</sub> = V <sub>CC</sub> or I/O V <sub>Ln</sub> = (V <sub>CC</sub> - 0.2 V) and I <sub>o</sub> = 0 |                                 | < (V <sub>CC</sub> - 0.2)      | -              | -   | 2.0  |      |
| I <sub>TS-VCC</sub> | V <sub>CC</sub> Tristate Output Mode Supply Current | EN = 0 V  | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 1.0  | μA   |
| I <sub>TS-VL</sub>  | V <sub>L</sub> Tristate Output Mode Supply Current  | EN = 0 V  | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 0.2  | μA   |
|                     |   | EN = 0 V  |                                 | V <sub>CC</sub> - 0.2          | -              | -   | 2.0  |      |
| I <sub>OZ</sub>     | I/O Tristate Output Mode Leakage Current            | EN = 0 V  | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 0.15 | μA   |
|                     |   | EN = 0 V  |                                 | V <sub>CC</sub> - 0.2          | -              | -   | 2.0  |      |
| I <sub>EN</sub>     | Output Enable Pin Input Current                     | -   | 1.3 to 3.6                      | 0.9 to (V <sub>CC</sub> - 0.4) | -              | -   | 1.0  | μA   |

5. Normal test conditions are V<sub>EN</sub> = 0 V, C<sub>I0VCC</sub> = 15 pF and C<sub>I0VL</sub> = 15 pF, unless otherwise specified.
6. V<sub>CC</sub> is the supply voltage associated with the high voltage port, and V<sub>CC</sub> ranges from +1.3 V to 3.6 V.
7. V<sub>L</sub> is the supply voltage associated with the low voltage port. V<sub>L</sub> must be less than or equal to (V<sub>CC</sub> - 0.4) V during normal operation. However, during startup and shutdown conditions, V<sub>L</sub> can be greater than (V<sub>CC</sub> - 0.4) V.

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## TIMING CHARACTERISTICS

| Symbol                 | Parameter   | Test Conditions<br>(Note 8)  | V <sub>CC</sub> (V)<br>(Note 9) | V <sub>L</sub> (V)<br>(Note 10) | -40°C to +85°C |                  |     | Unit |
|------------------------|---|--|---------------------------------|---------------------------------|----------------|------------------|-----|------|
|                        |   |  |                                 |                                 | Min            | Typ<br>(Note 11) | Max |      |
| t <sub>R-VCC</sub>     | I/O V <sub>CC</sub> Rise Time<br>(Output = I/O_V <sub>CC</sub> )                              | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 1.3              | 1.7 | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.9              | 1.1 |      |
| t <sub>F-VCC</sub>     | I/O V <sub>CC</sub> Falltime<br>(Output = I/O_V <sub>CC</sub> )                               | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 0.8              | 1.2 | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.6              | 1.0 |      |
| t <sub>R-VL</sub>      | I/O V <sub>L</sub> Risettime<br>(Output = I/O_V <sub>L</sub> )                                | C <sub>IOVL</sub> = 15 pF  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 2.7              | 3.0 | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.8              | 1.0 |      |
| t <sub>F-VL</sub>      | I/O V <sub>L</sub> Falltime<br>(Output = I/O_V <sub>L</sub> )                                 | C <sub>IOVL</sub> = 15 pF  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 0.8              | 1.0 | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.7              | 0.8 |      |
| Z <sub>O-VCC</sub>     | I/O V <sub>CC</sub> One-Shot<br>Output Impedance  |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 30               |     | Ω    |
| Z <sub>O-VL</sub>      | I/O V <sub>L</sub> One-Shot<br>Output Impedance   |  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 30               |     | Ω    |
| t <sub>PD_VL-VCC</sub> | Propagation Delay<br>(Output = I/O_V <sub>CC</sub> ,<br>t <sub>PHL</sub> , t <sub>PLH</sub> ) | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 15               | 17  | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 4                | 5   |      |
| t <sub>PD_VCC-VL</sub> | Propagation Delay<br>(Output = I/O_V <sub>L</sub> ,<br>t <sub>PHL</sub> , t <sub>PLH</sub> )  | C <sub>IOVL</sub> = 15 pF  | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 10               | 11  | ns   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 3                | 4   |      |
| t <sub>SK_VL-VCC</sub> | Channel-to-Channel<br>Skew (Output =<br>I/O_V <sub>CC</sub> )                                 | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 0.6              | 1   | nS   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.2              | 0.8 |      |
| t <sub>SK_VCC-VL</sub> | Channel-to-Channel<br>Skew<br>(Output = I/O_V <sub>L</sub> )                                  | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 0.4              | 0.6 | nS   |
|                        |   |  | > 2.0                           | > 1.6                           |                | 0.2              | 0.3 |      |
|                        | Maximum Data Rate   | (Output = I/O_V <sub>CC</sub> ,<br>C <sub>IOVCC</sub> = 15 pF)<br>(Output = I/O_V <sub>L</sub> ,<br>C <sub>IOVL</sub> = 15 pF) | 1.3 to 4.5                      | 0.9 to (V <sub>CC</sub> - 0.4)  | 60             |                  |     | Mb/s |
|                        |   |  | > 2.0                           | > 1.6                           | 100            |                  |     |      |

8. Normal test conditions are V<sub>EN</sub> = 0 V, C<sub>IOVCC</sub> = 15 pF and C<sub>IOVL</sub> = 15 pF, unless otherwise specified.

9. V<sub>CC</sub> is the supply voltage associated with the high voltage port, and V<sub>CC</sub> ranges from +1.3 V to 4.5 V under normal operating conditions.

10. V<sub>L</sub> is the supply voltage associated with the low voltage port. V<sub>L</sub> must be less than or equal to (V<sub>CC</sub> - 0.4) V during normal operation. However, during startup and shutdown conditions, V<sub>L</sub> can be greater than (V<sub>CC</sub> - 0.4) V.

11. Typical values are for V<sub>CC</sub> = +2.8 V, V<sub>L</sub> = +1.8 V and T<sub>A</sub> = +25°C. All units are production tested at T<sub>A</sub> = +25°C. Limits over the operating temperature range are guaranteed by design.

ENABLE / DISABLE TIME MEASUREMENTS

| Symbol               | Parameter  | Test Conditions<br>(Note 12) | V <sub>CC</sub> (V)<br>(Note 13) | V <sub>L</sub> (V)<br>(Note 14) | -40°C to +85°C |                  |     | Unit |
|----------------------|--|------------------------------|----------------------------------|---------------------------------|----------------|------------------|-----|------|
|                      |  |                              |                                  |                                 | Min            | Typ<br>(Note 15) | Max |      |
| t <sub>EN-VCC</sub>  | Turn-On Enable Time (Output = I/O_V <sub>CC</sub> , t <sub>pZH</sub> )   | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 80               | 140 | ns   |
|                      | Turn-On Enable Time (Output = I/O_V <sub>CC</sub> , t <sub>pZL</sub> )   | C <sub>IOVL</sub> = 15 pF    | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 175              | 300 | ns   |
| t <sub>EN-VL</sub>   | Turn-On Enable Time (Output = I/O_V <sub>L</sub> , t <sub>pZH</sub> )    | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 250              | 475 | ns   |
|                      | Turn-On Enable Time (Output = I/O_V <sub>L</sub> , t <sub>pZL</sub> )    | C <sub>IOVL</sub> = 15 pF    | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 175              | 250 | ns   |
| t <sub>DIS-VCC</sub> | Turn-Off Disable Time (Output = I/O_V <sub>CC</sub> , t <sub>pHZ</sub> ) | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 90               | 140 | ns   |
|                      | Propagation Delay (Output = I/O_V <sub>CC</sub> , t <sub>pLZ</sub> )     | C <sub>IOVL</sub> = 15 pF    | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 150              | 200 | ns   |
| t <sub>DIS-VL</sub>  | Turn-Off Disable Time (Output = I/O_V <sub>L</sub> , t <sub>pHZ</sub> )  | C <sub>IOVCC</sub> = 15 pF   | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 200              | 300 | ns   |
|                      | Propagation Delay (Output = I/O_V <sub>L</sub> , t <sub>pLZ</sub> )      | C <sub>IOVL</sub> = 15 pF    | 1.3 to 4.5                       | 0.9 to (V <sub>CC</sub> - 0.4)  |                | 150              | 250 | ns   |

- 12. Normal test conditions are V<sub>EN</sub> = 0 V, C<sub>IOVCC</sub> = 15 pF and C<sub>IOVL</sub> = 15 pF, unless otherwise specified.
- 13. V<sub>CC</sub> is the supply voltage associated with the high voltage port, and V<sub>CC</sub> ranges from +1.3 V to 4.5 V under normal operating conditions.
- 14. V<sub>L</sub> is the supply voltage associated with the low voltage port. V<sub>L</sub> must be less than or equal to (V<sub>CC</sub> - 0.4) V during normal operation. However, during startup and shutdown conditions, V<sub>L</sub> can be greater than (V<sub>CC</sub> - 0.4) V.
- 15. Typical values are for V<sub>CC</sub> = +2.8 V, V<sub>L</sub> = +1.8 V and T<sub>A</sub> = +25 °C. All units are production tested at T<sub>A</sub> = +25 °C. Limits over the operating temperature range are guaranteed by design.

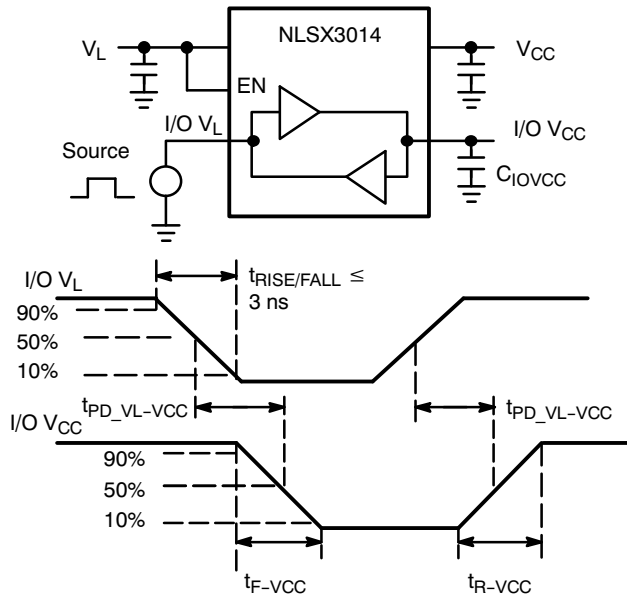


Figure 3. Driving I/O V<sub>L</sub> Test Circuit and Timing

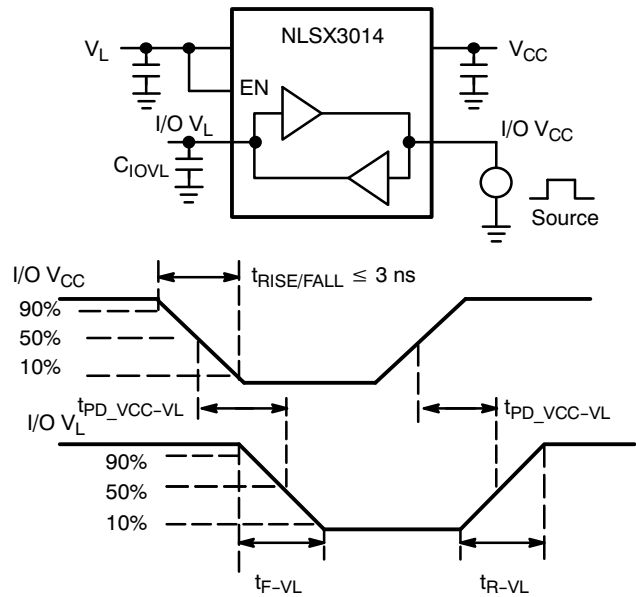
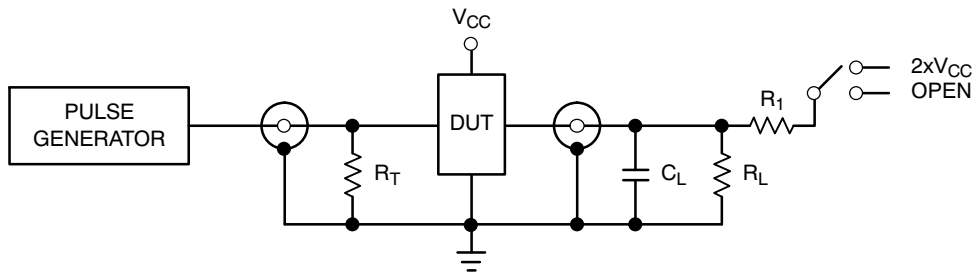


Figure 4. Driving I/O V<sub>CC</sub> Test Circuit and Timing

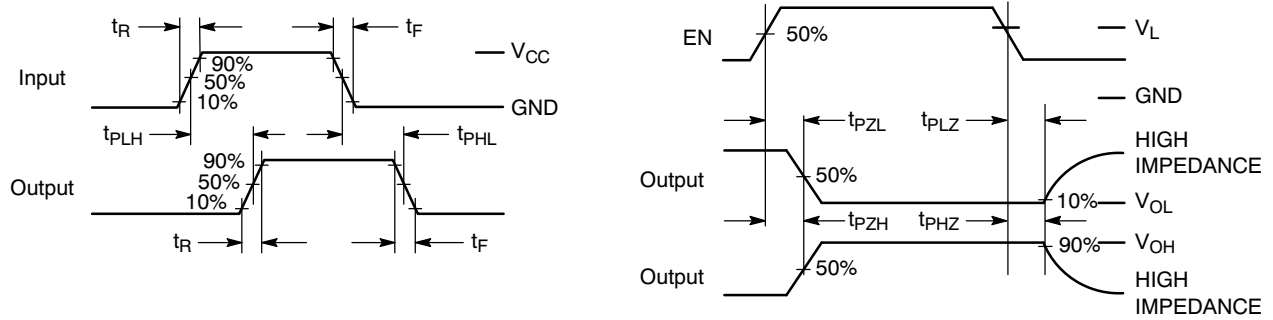
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| Test                  | Switch            |
|-----------------------|-------------------|
| $t_{PZH}$ , $t_{PHZ}$ | Open              |
| $t_{PZL}$ , $t_{PLZ}$ | $2 \times V_{CC}$ |

$C_L = 15 \text{ pF}$  or equivalent (Includes jig and probe capacitance)  
 $R_L = R_1 = 50 \text{ k}\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

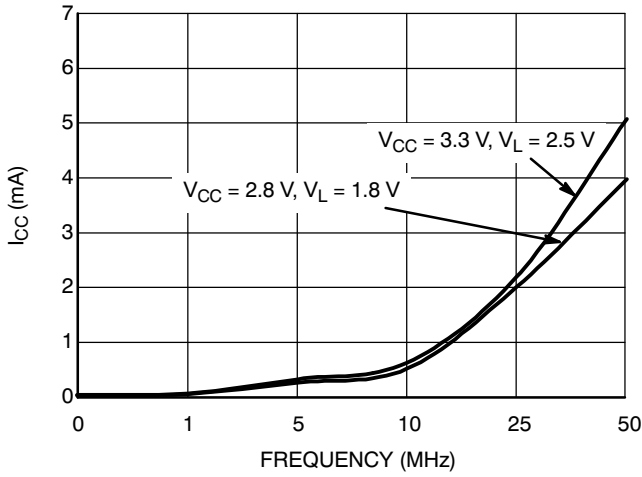
**Figure 5. Test Circuit for Enable/Disable Time Measurement**



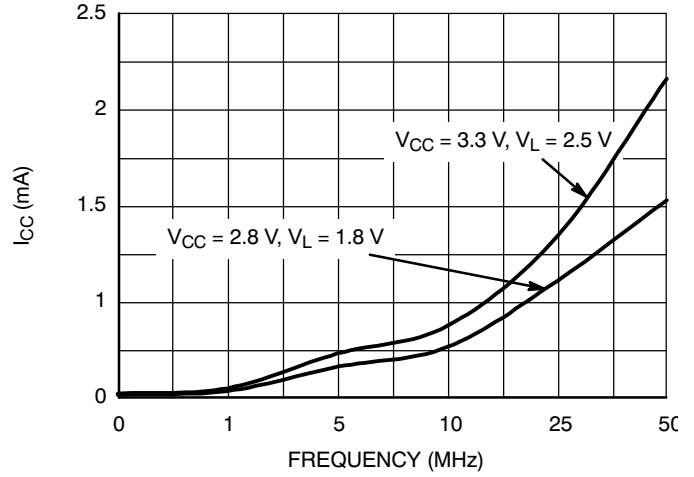
**Figure 6. Timing Definitions for Propagation Delays and Enable/Disable Measurement**

**TEST CONDITIONS**

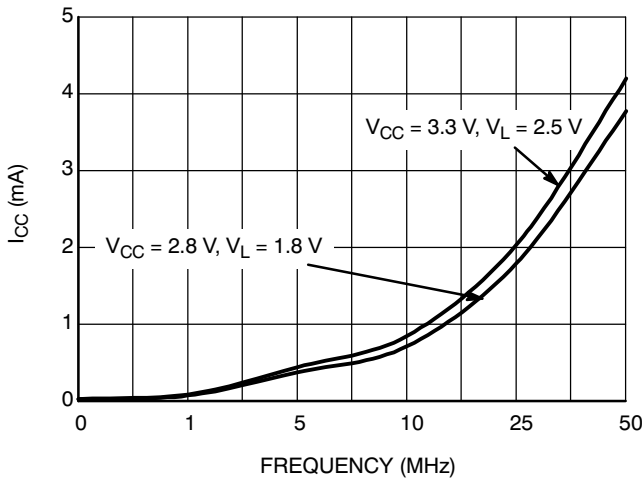
1.  $T_A = +25^\circ\text{C}$ ,
2. Input Applied to 1 channel, the other 3 inputs are grounded,
3.  $C_{\text{Load}} = 15 \text{ pF}$



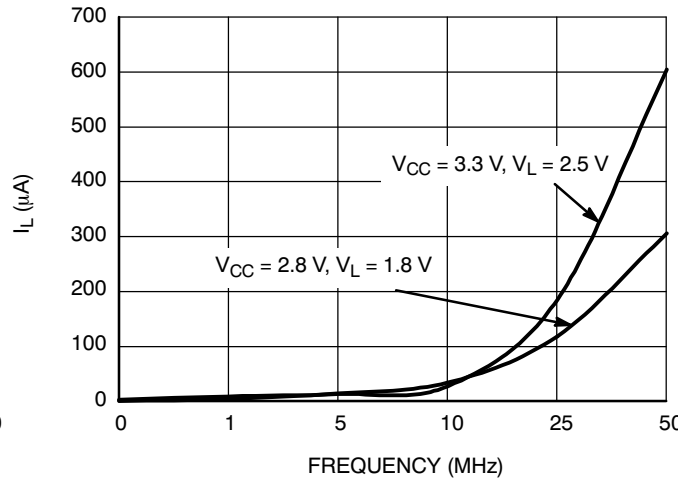
**Figure 7.  $I_{\text{CC}}$  vs. Frequency**  
(Input = I/O  $V_{\text{CC}}$ , Output = I/O  $V_{\text{L}}$ )



**Figure 8.  $I_{\text{L}}$  vs. Frequency**  
(Input = I/O  $V_{\text{CC}}$ , Output = I/O  $V_{\text{L}}$ )



**Figure 9.  $I_{\text{CC}}$  vs. Frequency**  
(Input = I/O  $V_{\text{L}}$ , Output = I/O  $V_{\text{CC}}$ )



**Figure 10.  $I_{\text{L}}$  vs. Frequency**  
(Input = I/O  $V_{\text{L}}$ , Output = I/O  $V_{\text{CC}}$ )



## IMPORTANT APPLICATIONS INFORMATION

### Level Translator Architecture

The NLSX3014 auto sense translator provides bi-directional voltage level shifting to transfer data in multiple supply voltage systems. This device has two supply voltages,  $V_L$  and  $V_{CC}$ , which set the logic levels on the input and output sides of the translator. When used to transfer data from the  $V_L$  to the  $V_{CC}$  ports, input signals referenced to the  $V_L$  supply are translated to output signals with a logic level matched to  $V_{CC}$ . In a similar manner, the  $V_{CC}$  to  $V_L$  translation shifts input signals with a logic level compatible to  $V_{CC}$  to an output signal matched to  $V_L$ .

The NLSX3014 consists of four bi-directional channels that independently determine the direction of the data flow without requiring a directional pin. The one-shot circuits are used to detect the rising or falling input signals. In addition, the one shots decrease the rise and fall time of the output signal for high-to-low and low-to-high transitions.

### Input Driver Requirements

For proper operation, the input driver to the auto sense translator should be capable of driving 2.0 mA of peak output current.

### Output Load Requirements

The NLSX3014 is designed to drive CMOS inputs. Resistive pullup or pulldown loads of less than 50 k $\Omega$  should not be used with this device. The NLSX3373 or NLSX3378 open-drain auto sense translators are alternate translator options for an application such as the I<sup>2</sup>C bus that requires pullup resistors.

### Enable Input (EN)

The NLSX3014 has an Enable pin (EN) that provides tri-state operation at the I/O pins. Driving the Enable pin to a low logic level minimizes the power consumption of

the device and drives the I/O  $V_{CC}$  and I/O  $V_L$  pins to a high impedance state. Normal translation operation occurs when the EN pin is equal to a logic high signal. The EN pin is referenced to the  $V_L$  supply and has Over-Voltage Tolerant (OVT) protection.

### Uni-Directional versus Bi-Directional Translation

The NLSX3014 can function as a non-inverting uni-directional translator. One advantage of using the translator as a uni-directional device is that each I/O pin can be configured as either an input or output. The configurable input or output feature is especially useful in applications such as SPI that use multiple uni-directional I/O lines to send data to and from a device. The flexible I/O port of the auto sense translator simplifies the trace connections on the PCB.

### Power Supply Guidelines

It is recommended that the  $V_L$  supply should be less than or equal to the value of the  $V_{CC}$  minus 0.4 V. The sequencing of the power supplies will not damage the device during the power up operation; however, the current consumption of the device will increase if  $V_L$  exceeds  $V_{CC}$  minus 0.4 V. In addition, the I/O  $V_{CC}$  and I/O  $V_L$  pins are in the high impedance state if either supply voltage is equal to 0 V.

For optimal performance, 0.01 to 0.1  $\mu$ F decoupling capacitors should be used on the  $V_L$  and  $V_{CC}$  power supply pins. Ceramic capacitors are a good design choice to filter and bypass any noise signals on the power supply voltage lines to the ground plane of the PCB. The noise immunity will be maximized by placing the capacitors as close as possible to the supply and ground pins, along with minimizing the PCB connection traces.

## ORDERING INFORMATION

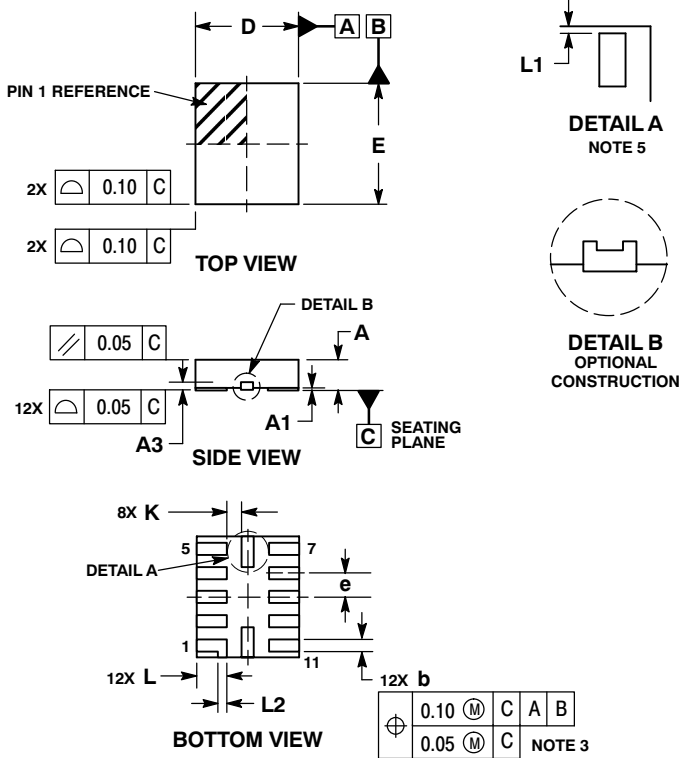
| Device        | Package             | Shipping <sup>†</sup> |
|---------------|---------------------|-----------------------|
| NLSX3014MUTAG | UQFN12<br>(Pb-Free) | 3000 / Tape & Reel    |

<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.

# NLSX3014

## PACKAGE DIMENSIONS

UQFN12 1.7x2.0, 0.4P  
CASE 523AE-01  
ISSUE A

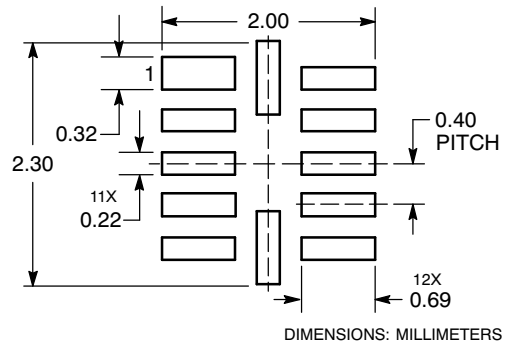


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE. FLASH 0.03 MAX ON BOTTOM SURFACE OF TERMINALS.
5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR TERMINALS.

| MILLIMETERS |           |      |
|-------------|-----------|------|
| DIM         | MIN       | MAX  |
| A           | 0.45      | 0.55 |
| A1          | 0.00      | 0.05 |
| A3          | 0.127 REF |      |
| b           | 0.15      | 0.25 |
| D           | 1.70 BSC  |      |
| E           | 2.00 BSC  |      |
| e           | 0.40 BSC  |      |
| K           | 0.20      | ---- |
| L           | 0.45      | 0.55 |
| L1          | 0.00      | 0.03 |
| L2          | 0.15 REF  |      |

### MOUNTING FOOTPRINT SOLDERMASK DEFINED



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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