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# 4-Bit 140 Mb/s Configurable Dual-Supply Level Translator

## NL3X5004, NL3XN5004

The NL3X5004 and NL3XN5004 are 4-bit configurable dual-supply autosensing bidirectional level translators that do not require direction control pins. The A- and B-ports are designed to track two different power supply rails,  $V_{CCA}$  and  $V_{CCB}$  respectively. Both the  $V_{CCA}$  and the  $V_{CCB}$  supply rails are independently – configurable from 0.9 V to 3.6 V.

The NL3X5004 and NL3XN5004 have high dynamic output current capability, allowing the translators to drive high capacitive loads.

Enable input pins are available to reduce the power consumption. These pins may be used to disable both A- and B-ports by putting them in 3-state significantly reducing the supply current from both  $V_{CCA}$  and  $V_{CCB}$ . These pins are referenced to the  $V_{CCA}$  supply. The NL3X5004 has an active-High enable (EN) while the NL3XN5004 has active-Low enable ( $\overline{\text{EN}}$ ).

### Features

- Wide  $V_{CCA}$ ,  $V_{CCB}$  Operating Range: 0.9 V to 3.6 V
- $V_{CCA}$  and  $V_{CCB}$  are independent
  - $V_{CCA}$  may be greater than, equal to, or less than  $V_{CCB}$
- High 100 pF Capacitive Drive Capability
- High-Speed w/ 140 Mbps Guaranteed Data Rate for  $V_{CCA}$ ,  $V_{CCB} > 1.8$  V
- Low Bit-to-Bit skew
- Overvoltage Tolerant Enable and I/O Pins
- Non-preferential Power-Up Sequencing
- Partial Power-Off Protection
- Available packaging:
  - UQFN-12, SOIC14, TSSOP14, QFN-14, Other packages
- –Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and RoHS Compliant

### Typical Applications

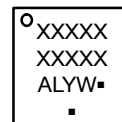
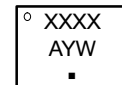
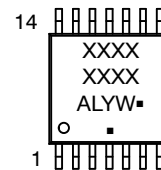
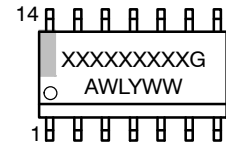
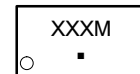
- Mobile Phones, Infotainment Systems, Other Devices

### Important Information

- ESD Protection for All Pins:
  - HBM (Human Body Model) – 4000 V



### MARKING DIAGRAMS



XXXXX = Specific Device Code  
 M = Date Code  
 A = Assembly Location  
 L or WL = Wafer Lot  
 Y = Year  
 W or WW = Work Week  
 G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 16 of this data sheet.

# NL3X5004, NL3XN5004

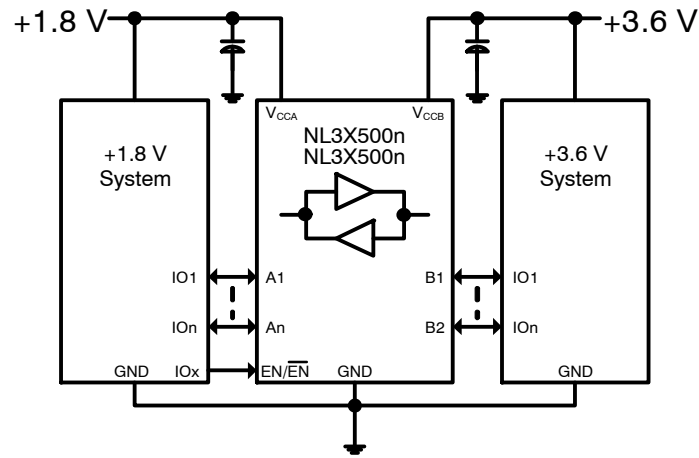


Figure 1. Typical Application Circuit

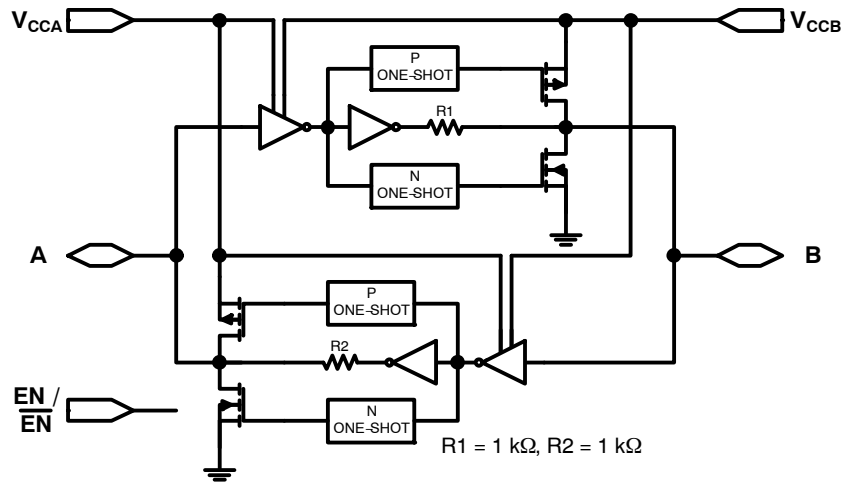


Figure 2. Functional Diagram (1 I/O Line)

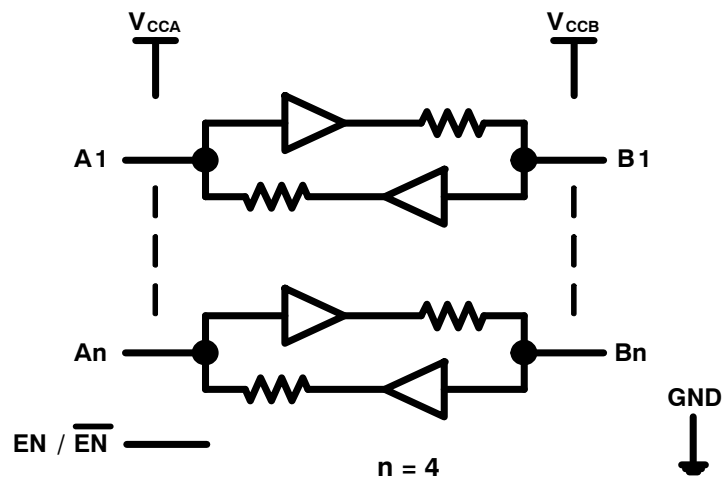


Figure 3. Logic Diagram

# NL3X5004, NL3XN5004

## PIN ASSIGNMENTS

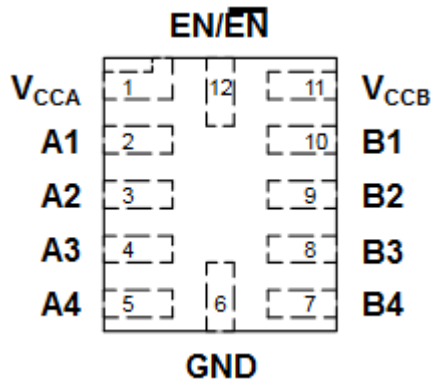


Figure 4. UQFN12

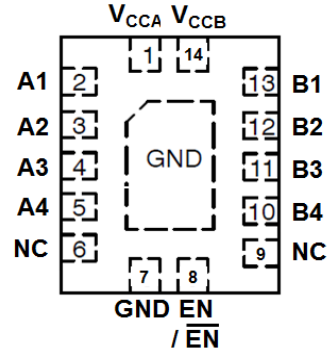


Figure 5. QFN14 (2.5 x 3.0)

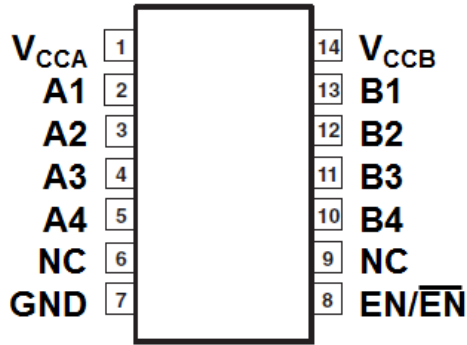


Figure 6. TSSOP / SOIC

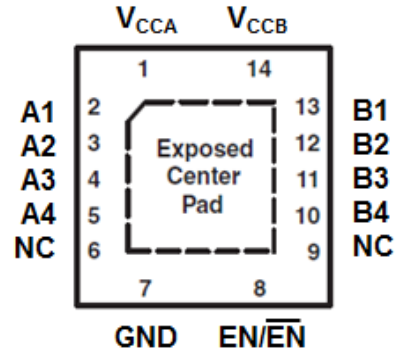


Figure 7. QFN14 (3.5 x 3.5)

### PIN DESCRIPTIONS

| Pins                   | Description                                                   |
|------------------------|---------------------------------------------------------------|
| V <sub>CCA</sub>       | A-Port Supply Voltage                                         |
| V <sub>CCB</sub>       | B-Port Supply Voltage                                         |
| GND                    | Ground                                                        |
| EN                     | Active-High Enable (NL3X500n), Referenced to V <sub>CCA</sub> |
| $\overline{\text{EN}}$ | Active-Low Enable (NL3XN500n), Referenced to V <sub>CCA</sub> |
| An                     | A-Port, Referenced to V <sub>CCA</sub>                        |
| Bn                     | B-Port, Referenced to V <sub>CCB</sub>                        |

### FUNCTION TABLE

| NL3X500n | NL3XN500n              | Operating Mode      |
|----------|------------------------|---------------------|
| EN       | $\overline{\text{EN}}$ |                     |
| L        | H                      | An and Bn at Hi-Z   |
| H        | L                      | An and Bn Connected |

# NL3X5004, NL3XN5004

**Table 1. MAXIMUM RATINGS**

| Symbol        | Parameter                                           | Value        | Condition             | Unit |
|---------------|-----------------------------------------------------|--------------|-----------------------|------|
| $V_{CCA}$     | A-side DC Supply Voltage                            | -0.5 to +4.3 |                       | V    |
| $V_{CCB}$     | B-side DC Supply Voltage                            | -0.5 to +4.3 |                       | V    |
| $V_{IN}$      | Input/Output Voltage $EN/\overline{EN}$             | -0.5 to +4.3 |                       | V    |
|               | Power Down Mode ( $V_{CCA}$ and/or $V_{CCB} = 0$ V) | -0.5 to +4.3 |                       |      |
|               | Tri-State Mode ( $EN = L$ or $\overline{EN} = H$ )  | -0.5 to +4.3 |                       |      |
|               | Active Mode                                         | A-Port       | -0.5 to $V_{CCA}+0.5$ |      |
|               |                                                     | B-Port       | -0.5 to $V_{CCB}+0.5$ |      |
| $I_{IK}$      | DC Input Diode Current                              | -50          | $V_{IN} < GND$        | mA   |
| $I_{OK}$      | DC Output Diode Current                             | -50          | $V_O < GND$           | mA   |
| $I_{CCA}$     | DC Supply Current Through $V_{CCA}$                 | $\pm 100$    |                       | mA   |
| $I_{CCB}$     | DC Supply Current Through $V_{CCB}$                 | $\pm 100$    |                       | mA   |
| $I_{GND}$     | DC Ground Current Through Ground Pin                | $\pm 100$    |                       | mA   |
| $T_{STG}$     | Storage Temperature                                 | -65 to +150  |                       | °C   |
| $\theta_{JA}$ | Thermal Resistance (Note 1)                         | UQFN12       | 143                   | °C/W |
|               |                                                     | SOIC-14      | 116                   |      |
|               |                                                     | QFN14        | 130                   |      |
|               |                                                     | TSSOP14      | 150                   |      |
| $P_D$         | Power Dissipation in Still Air                      | UQFN12       | 875                   | mW   |
|               |                                                     | SOIC-14      | 1077                  |      |
|               |                                                     | QFN14        | 962                   |      |
|               |                                                     | TSSOP14      | 833                   |      |

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. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.

**Table 2. RECOMMENDED OPERATING CONDITIONS**

| Symbol              | Parameter                                                                        | Min    | Max       | Unit |
|---------------------|----------------------------------------------------------------------------------|--------|-----------|------|
| $V_{CCA}$           | A-Port Supply Voltage                                                            | 0.9    | 3.6       | V    |
| $V_{CCB}$           | B-Port Supply Voltage                                                            | 0.9    | 3.6       | V    |
| $V_I$               | Input/Output Voltage $EN/\overline{EN}$                                          | GND    | 3.6       | V    |
|                     | Power Down Mode ( $V_{CCA}$ and/or $V_{CCB} = 0$ V)                              | GND    | 3.6       |      |
|                     | Tri-State Mode ( $EN = L$ or $\overline{EN} = H$ )                               | GND    | 3.6       |      |
|                     | Active Mode                                                                      | A-Port | $V_{CCA}$ |      |
|                     |                                                                                  | B-Port | $V_{CCB}$ |      |
| $T_A$               | Operating Temperature Range                                                      | -40    | +125      | °C   |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate<br>$V_I$ from 30% to 70% of $V_{CCA}/V_{CCB}$ | 0      | 10        | 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.

# NL3X5004, NL3XN5004

**Table 3. DC ELECTRICAL CHARACTERISTICS**

| Symbol           | Parameter                           | Test Conditions<br>(Note 2)                                                                                  | Pin/Port                      | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | -40°C to +85°C          |                         |                         | -40°C to +125°C         |                         | Unit    |
|------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------|
|                  |                                     |                                                                                                              |                               |                         |                         | Min                     | Typ<br>(Note 3)         | Max                     | Min                     | Max                     |         |
| V <sub>IH</sub>  | Input HIGH Voltage                  |                                                                                                              | A, EN/ $\overline{\text{EN}}$ | 0.9                     | 0.9 – 3.6               | –                       | 0.65 * V <sub>CCA</sub> | –                       | –                       | –                       | V       |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | 0.65 * V <sub>CCA</sub> | –                       | –                       | 0.65 * V <sub>CCA</sub> | –                       |         |
|                  |                                     |                                                                                                              | B                             | 0.9 – 3.6               | 0.9                     | –                       | 0.65 * V <sub>CCB</sub> | –                       | –                       | –                       |         |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | 0.65 * V <sub>CCB</sub> | –                       | –                       | 0.65 * V <sub>CCB</sub> | –                       |         |
| V <sub>IL</sub>  | Input LOW Voltage                   |                                                                                                              | A, EN/ $\overline{\text{EN}}$ | 0.9                     | 0.9 – 3.6               | –                       | 0.35 * V <sub>CCA</sub> | –                       | –                       | –                       | V       |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | –                       | –                       | 0.35 * V <sub>CCA</sub> | –                       | 0.35 * V <sub>CCA</sub> |         |
|                  |                                     |                                                                                                              | B                             | 0.9 – 3.6               | 0.9                     | –                       | 0.35 * V <sub>CCB</sub> | –                       | –                       | –                       |         |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | –                       | –                       | 0.35 * V <sub>CCB</sub> | –                       | 0.35 * V <sub>CCB</sub> |         |
| V <sub>OH</sub>  | Output HIGH Voltage                 | I <sub>OH</sub> = –20 $\mu$ A                                                                                | A                             | 0.9                     | 0.9 – 3.6               | –                       | 0.9 * V <sub>CCA</sub>  | –                       | –                       | –                       | V       |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | 0.9 * V <sub>CCA</sub>  | –                       | –                       | 0.9 * V <sub>CCA</sub>  | –                       |         |
|                  |                                     |                                                                                                              | B                             | 0.9 – 3.6               | 0.9                     | –                       | 0.9 * V <sub>CCB</sub>  | –                       | –                       | –                       |         |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | 0.9 * V <sub>CCB</sub>  | –                       | –                       | 0.9 * V <sub>CCB</sub>  | –                       |         |
| V <sub>OL</sub>  | Output LOW Voltage                  | I <sub>OL</sub> = 20 $\mu$ A                                                                                 | A                             | 0.9                     | 0.9 – 3.6               | –                       | 0.2                     | –                       | –                       | –                       | V       |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | –                       | –                       | 0.2                     | –                       | 0.2                     |         |
|                  |                                     |                                                                                                              | B                             | 0.9 – 3.6               | 0.9                     | –                       | 0.2                     | –                       | –                       | –                       |         |
|                  |                                     |                                                                                                              |                               | 1.1 – 3.6               | 1.1 – 3.6               | –                       | –                       | 0.2                     | –                       | 0.2                     |         |
| I <sub>OZ</sub>  | Tristate Output Leakage             | (EN = 0V or = V <sub>CCA</sub> );<br>(A = 0 V or V <sub>CCA</sub> )<br>(B = 0 V or V <sub>CCB</sub> )        |                               |                         |                         |                         |                         |                         |                         |                         | $\mu$ A |
|                  |                                     |                                                                                                              | A                             | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.01                    | ±1.5                    | –                       | ±4.5                    |         |
|                  |                                     |                                                                                                              | B                             | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.01                    | ±1                      | –                       | ±3.5                    |         |
| I <sub>I</sub>   | Input Pin Leakage                   | V <sub>IN</sub> = 0 V to V <sub>CCA</sub>                                                                    | EN/ $\overline{\text{EN}}$    | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.01                    | ±1                      | –                       | ±3                      | $\mu$ A |
| I <sub>CC</sub>  | Supply Current                      | (EN = V <sub>CCA</sub> or = 0 V);                                                                            | V <sub>CCA</sub>              | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.4                     | 2.0                     | –                       | 6.0                     | $\mu$ A |
|                  |                                     | I <sub>O</sub> = 0 A, (A = 0 V, B = 0 V) or (A = V <sub>CCA</sub> , B = V <sub>CCB</sub> )                   | V <sub>CCB</sub>              | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.4                     | 2.0                     | –                       | 6.0                     |         |
| I <sub>CCZ</sub> | Tristate Output Mode Supply Current | (EN = 0V or = V <sub>CCA</sub> ),<br>(A = 0 V, B = 0 V) or<br>(A = V <sub>CCA</sub> , B = V <sub>CCB</sub> ) | V <sub>CCA</sub>              | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.2                     | 1.5                     | –                       | 7.0                     | $\mu$ A |
|                  |                                     |                                                                                                              | V <sub>CCB</sub>              | 0.9 – 3.6               | 0.9 – 3.6               | –                       | 0.2                     | 1.5                     | –                       | 6.0                     |         |

# NL3X5004, NL3XN5004

**Table 3. DC ELECTRICAL CHARACTERISTICS** (continued)

| Symbol           | Parameter         | Test Conditions<br>(Note 2)       | Pin/Port | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |     | –40°C to +125°C |     | Unit |
|------------------|-------------------|-----------------------------------|----------|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|-----|------|
|                  |                   |                                   |          |                         |                         | Min            | Typ<br>(Note 3) | Max | Min             | Max |      |
|                  |                   |                                   |          |                         |                         |                |                 |     |                 |     |      |
| I <sub>OFF</sub> | Power Off Leakage | A = 0 to 3.6 V,<br>B = 0 to 3.6 V | A, B     | 0                       | 0                       | –              | 0.02            | 1.5 | –               | 5.0 | μA   |
|                  |                   |                                   |          | 0.9 – 3.6               | 0                       | –              | 0.01            | 1.5 | –               | 5.0 |      |
|                  |                   |                                   |          | 0                       | 0.9 – 3.6               | –              | 0.01            | 1.5 | –               | 5.0 |      |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Normal test conditions are V<sub>I</sub> = 0 V, C<sub>LA</sub> ≤ 15 pF and C<sub>LB</sub> ≤ 15 pF, unless otherwise specified.

3. Typical values are for T<sub>A</sub> = +25°C. All units are production tested at T<sub>A</sub> = +25°C.

# NL3X5004, NL3XN5004

Table 4. TIMING CHARACTERISTICS

| Symbol          | Parameter         | Test Conditions        |        | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | -40°C to +85°C |                 |      | -40°C to +125°C |      | Unit |
|-----------------|-------------------|------------------------|--------|-------------------------|-------------------------|----------------|-----------------|------|-----------------|------|------|
|                 |                   |                        |        |                         |                         | Min            | Typ<br>(Note 4) | Max  | Min             | Max  |      |
| t <sub>PD</sub> | Propagation Delay | C <sub>L</sub> = 15 pF | A to B | 0.9 – 3.6               | 0.9 – 3.6               | –              | 24              | –    | –               | –    | ns   |
|                 |                   |                        |        | 1.1 – 3.6               | 1.1 – 3.6               | –              | 8.8             | 30   | –               | 35   |      |
|                 |                   |                        |        | 1.2                     | 1.8                     | –              | 7.3             | 9    | –               | 9    |      |
|                 |                   |                        |        | 1.8                     | 1.2                     | –              | 9.9             | 12   | –               | 12   |      |
|                 |                   |                        |        | 1.8                     | 2.8                     | –              | 4.9             | 7    | –               | 7    |      |
|                 |                   |                        |        | 2.8                     | 1.8                     | –              | 5.8             | 7.5  | –               | 7.5  |      |
|                 |                   |                        |        | 1.8                     | 3.3                     | –              | 4.6             | 6    | –               | 6    |      |
|                 |                   |                        |        | 3.3                     | 1.8                     | –              | 5.7             | 7    | –               | 7    |      |
|                 |                   |                        |        | 1.8 – 3.6               | 1.8 – 3.6               | –              | 4.3             | 9.5  | –               | 10   |      |
|                 |                   |                        | B to A | 0.9 – 3.6               | 0.9 – 3.6               | –              | 24              | –    | –               | –    |      |
|                 |                   |                        |        | 1.1 – 3.6               | 1.1 – 3.6               | –              | 8.8             | 30   | –               | 35   |      |
|                 |                   |                        |        | 1.2                     | 1.8                     | –              | 9.9             | 12   | –               | 12   |      |
|                 |                   |                        |        | 1.8                     | 1.2                     | –              | 7.3             | 9    | –               | 9    |      |
|                 |                   |                        |        | 1.8                     | 2.8                     | –              | 5.8             | 7.5  | –               | 7.5  |      |
|                 |                   |                        |        | 2.8                     | 1.8                     | –              | 4.9             | 7    | –               | 7    |      |
|                 |                   |                        |        | 1.8                     | 3.3                     | –              | 5.7             | 7    | –               | 7    |      |
|                 |                   |                        |        | 3.3                     | 1.8                     | –              | 4.6             | 6    | –               | 6    |      |
|                 |                   |                        |        | 1.8 – 3.6               | 1.8 – 3.6               | –              | 4.3             | 9.5  | –               | 10   |      |
|                 |                   | C <sub>L</sub> = 30 pF | A to B | 0.9 – 3.6               | 0.9 – 3.6               | –              | 27              | –    | –               | –    |      |
|                 |                   |                        |        | 1.1 – 3.6               | 1.1 – 3.6               | –              | 9.1             | 32   | –               | 35   |      |
|                 |                   |                        |        | 1.2                     | 1.8                     | –              | 7.8             | 9.3  | –               | 9.3  |      |
|                 |                   |                        |        | 1.8                     | 1.2                     | –              | 10.8            | 12.6 | –               | 12.6 |      |
|                 |                   |                        |        | 1.8                     | 2.8                     | –              | 6.2             | 7.4  | –               | 7.4  |      |
|                 |                   |                        |        | 2.8                     | 1.8                     | –              | 6.0             | 7.9  | –               | 8.0  |      |
|                 |                   |                        |        | 1.8                     | 3.3                     | –              | 6.1             | 7.4  | –               | 7.4  |      |
|                 |                   |                        |        | 3.3                     | 1.8                     | –              | 4.2             | 6.5  | –               | 6.5  |      |
|                 |                   |                        |        | 1.8 – 3.6               | 1.8 – 3.6               | –              | 4.5             | 10   | –               | 10.5 |      |
|                 |                   |                        | B to A | 0.9 – 3.6               | 0.9 – 3.6               | –              | 27              | –    | –               | –    |      |
|                 |                   |                        |        | 1.1 – 3.6               | 1.1 – 3.6               | –              | 9.1             | 32   | –               | 35   |      |
|                 |                   |                        |        | 1.2                     | 1.8                     | –              | 10.8            | 12.6 | –               | 12.6 |      |
|                 |                   |                        |        | 1.8                     | 1.2                     | –              | 7.8             | 9.3  | –               | 9.3  |      |
|                 |                   |                        |        | 1.8                     | 2.8                     | –              | 6.0             | 7.9  | –               | 8.0  |      |
|                 |                   |                        |        | 2.8                     | 1.8                     | –              | 6.2             | 7.4  | –               | 7.4  |      |



# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

| Symbol          | Parameter         | Test Conditions         |        | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |      | –40°C to +125°C |      | Unit |
|-----------------|-------------------|-------------------------|--------|-------------------------|-------------------------|----------------|-----------------|------|-----------------|------|------|
|                 |                   |                         |        |                         |                         | Min            | Typ<br>(Note 4) | Max  | Min             | Max  |      |
| t <sub>PD</sub> | Propagation Delay | C <sub>L</sub> = 30 pF  | B to A | 1.8                     | 3.3                     | –              | 4.2             | 6.5  | –               | 6.5  | ns   |
|                 |                   |                         |        | 3.3                     | 1.8                     | –              | 6.1             | 7.4  | –               | 7.4  |      |
|                 |                   |                         |        | 1.8 –<br>3.6            | 1.8 –<br>3.6            | –              | 4.5             | 10   | –               | 10.5 |      |
|                 |                   | C <sub>L</sub> = 50 pF  | A to B | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 31              | –    | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>3.6            | –              | 9.4             | 35   | –               | 37   |      |
|                 |                   |                         |        | 1.2                     | 1.8                     | –              | 8.1             | 9.5  | –               | 9.5  |      |
|                 |                   |                         |        | 1.8                     | 1.2                     | –              | 11.1            | 13.6 | –               | 13.6 |      |
|                 |                   |                         |        | 1.8                     | 2.8                     | –              | 6.5             | 7.6  | –               | 7.6  |      |
|                 |                   |                         |        | 2.8                     | 1.8                     | –              | 6.2             | 8.2  | –               | 8.3  |      |
|                 |                   |                         |        | 1.8                     | 3.3                     | –              | 6.3             | 7.6  | –               | 7.6  |      |
|                 |                   |                         |        | 3.3                     | 1.8                     | –              | 4.3             | 6.6  | –               | 6.6  |      |
|                 |                   |                         |        | 1.8 –<br>3.6            | 1.8 –<br>3.6            | –              | 4.7             | 10.3 | –               | 10.8 |      |
|                 |                   |                         | B to A | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 31              | –    | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>3.6            | –              | 9.4             | 35   | –               | 37   |      |
|                 |                   |                         |        | 1.2                     | 1.8                     | –              | 11.1            | 13.6 | –               | 13.6 |      |
|                 |                   |                         |        | 1.8                     | 1.2                     | –              | 8.1             | 9.5  | –               | 9.5  |      |
|                 |                   |                         |        | 1.8                     | 2.8                     | –              | 6.2             | 8.2  | –               | 8.3  |      |
|                 |                   |                         |        | 2.8                     | 1.8                     | –              | 6.5             | 7.6  | –               | 7.6  |      |
|                 |                   |                         |        | 1.8                     | 3.3                     | –              | 4.3             | 6.6  | –               | 6.6  |      |
|                 |                   |                         |        | 3.3                     | 1.8                     | –              | 6.3             | 7.6  | –               | 7.6  |      |
|                 |                   |                         |        | 1.8 –<br>3.6            | 1.8 –<br>3.6            | –              | 4.7             | 10.3 | –               | 10.8 |      |
|                 |                   | C <sub>L</sub> = 100 pF | A to B | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 41              | –    | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>3.6            | –              | 12              | 21   | –               | 21   |      |
|                 |                   |                         |        | 1.2                     | 1.8                     | –              | 8.4             | 10   | –               | 10   |      |
|                 |                   |                         |        | 1.8                     | 1.2                     | –              | 11.5            | 15   | –               | 15   |      |
|                 |                   |                         |        | 1.8                     | 2.8                     | –              | 5.5             | 8.3  | –               | 8.3  |      |
|                 |                   |                         |        | 2.8                     | 1.8                     | –              | 6.9             | 8.9  | –               | 9    |      |
|                 |                   |                         |        | 1.8                     | 3.3                     | –              | 5.1             | 6.7  | –               | 6.8  |      |
|                 |                   |                         |        | 3.3                     | 1.8                     | –              | 6.8             | 8.2  | –               | 8.2  |      |
|                 |                   |                         |        | 1.8 –<br>3.6            | 1.8 –<br>3.6            | –              | 5.0             | 11   | –               | 11.5 |      |
|                 |                   |                         | B to A | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 41              | –    | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>3.6            | –              | 12              | 21   | –               | 21   |      |

# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

| Symbol          | Parameter         | Test Conditions         |        | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | -40°C to +85°C |                 |     | -40°C to +125°C |      | Unit |
|-----------------|-------------------|-------------------------|--------|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|------|------|
|                 |                   |                         |        |                         |                         | Min            | Typ<br>(Note 4) | Max | Min             | Max  |      |
| t <sub>PD</sub> | Propagation Delay | C <sub>L</sub> = 100 pF | B to A | 1.2                     | 1.8                     | –              | 11.5            | 15  | –               | 15   | ns   |
|                 |                   |                         |        | 1.8                     | 1.2                     | –              | 8.4             | 10  | –               | 10   |      |
|                 |                   |                         |        | 1.8                     | 2.8                     | –              | 6.9             | 8.9 | –               | 9    |      |
|                 |                   |                         |        | 2.8                     | 1.8                     | –              | 5.5             | 8.3 | –               | 8.3  |      |
|                 |                   |                         |        | 1.8                     | 3.3                     | –              | 6.8             | 8.2 | –               | 8.2  |      |
|                 |                   |                         |        | 3.3                     | 1.8                     | –              | 5.1             | 6.7 | –               | 6.8  |      |
|                 |                   |                         |        | 1.8 –<br>3.6            | 1.8 –<br>3.6            | –              | 5.0             | 11  | –               | 11.5 |      |
| t <sub>R</sub>  | Output Rise Time  | C <sub>L</sub> = 15 pF  | A      | 0.9                     | 0.9 –<br>3.6            | –              | 11.1            | –   | –               | –    | ns   |
|                 |                   |                         |        | 1.1 –<br>1.2            | 1.1 –<br>3.6            | –              | 2.5             | 4.5 | –               | 4.5  |      |
|                 |                   |                         |        | 1.2 –<br>1.8            |                         | –              | 2.0             | 3.5 | –               | 3.5  |      |
|                 |                   |                         |        | 1.8 –<br>2.8            |                         | –              | 0.6             | 2.0 | –               | 2.0  |      |
|                 |                   |                         |        | 2.8 –<br>3.6            |                         | –              | 0.5             | 2.0 | –               | 2.0  |      |
|                 |                   |                         | B      | 0.9 –<br>3.6            | 0.9                     | –              | 11.1            | –   | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>1.2            | –              | 2.5             | 4.5 | –               | 4.5  |      |
|                 |                   |                         |        |                         |                         | –              | 2.0             | 3.5 | –               | 3.5  |      |
|                 |                   |                         |        |                         |                         | –              | 0.6             | 2.0 | –               | 2.0  |      |
|                 |                   |                         |        |                         |                         | –              | 0.5             | 2.0 | –               | 2.0  |      |
| t <sub>F</sub>  | Output Fall Time  | C <sub>L</sub> = 15 pF  | A      | 0.9                     | 0.9 –<br>3.6            | –              | 12.2            | –   | –               | –    | ns   |
|                 |                   |                         |        | 1.1 –<br>1.2            | 1.1 –<br>3.6            | –              | 2.5             | 6.0 | –               | 6.0  |      |
|                 |                   |                         |        | 1.2 –<br>1.8            |                         | –              | 1.8             | 3   | –               | 3    |      |
|                 |                   |                         |        | 1.8 –<br>2.8            |                         | –              | 0.6             | 2.0 | –               | 2.0  |      |
|                 |                   |                         |        | 2.8 –<br>3.6            |                         | –              | 0.5             | 2.0 | –               | 2.0  |      |
|                 |                   |                         | B      | 0.9 –<br>3.6            | 0.9                     | –              | 12.2            | –   | –               | –    |      |
|                 |                   |                         |        | 1.1 –<br>3.6            | 1.1 –<br>1.2            | –              | 2.5             | 6.0 | –               | 6.0  |      |
|                 |                   |                         |        |                         |                         | –              | 1.8             | 3   | –               | 3    |      |
|                 |                   |                         |        |                         |                         | –              | 0.6             | 2.0 | –               | 2.0  |      |
|                 |                   |                         |        |                         |                         | –              | 0.5             | 2.0 | –               | 2.0  |      |

# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

| Symbol          | Parameter               | Test Conditions         | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |     | –40°C to +125°C |     | Unit |
|-----------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|-----|------|
|                 |                         |                         |                         |                         | Min            | Typ<br>(Note 4) | Max | Min             | Max |      |
| t <sub>SK</sub> | Channel-to-Channel Skew |                         | 0.9 – 3.6               | 0.9 – 3.6               | –              | 0.15            | –   | –               | –   | ns   |
| MDR             | Maximum Data Rate       | C <sub>L</sub> = 15 pF  | 0.9 – 3.6               | 0.9 – 3.6               | –              | 50              | –   | –               | –   | Mbps |
|                 |                         |                         | 1.1 – 3.6               | 1.1 – 3.6               | 50             | –               | –   | 50              | –   |      |
|                 |                         |                         | 1.8 – 3.6               | 1.8 – 3.6               | 140            | –               | –   | 140             | –   |      |
|                 |                         | C <sub>L</sub> = 30 pF  | 0.9 – 3.6               | 0.9 – 3.6               | –              | 40              | –   | –               | –   |      |
|                 |                         |                         | 1.1 – 3.6               | 1.1 – 3.6               | 40             | –               | –   | 40              | –   |      |
|                 |                         |                         | 1.8 – 3.6               | 1.8 – 3.6               | 120            | –               | –   | 120             | –   |      |
|                 |                         | C <sub>L</sub> = 50 pF  | 0.9 – 3.6               | 0.9 – 3.6               | –              | 30              | –   | –               | –   |      |
|                 |                         |                         | 1.1 – 3.6               | 1.1 – 3.6               | 30             | –               | –   | 30              | –   |      |
|                 |                         |                         | 1.8 – 3.6               | 1.8 – 3.6               | 100            | –               | –   | 100             | –   |      |
|                 |                         | C <sub>L</sub> = 100 pF | 0.9 – 3.6               | 0.9 – 3.6               | –              | 20              | –   | –               | –   |      |
|                 |                         |                         | 1.1 – 3.6               | 1.1 – 3.6               | 20             | –               | –   | 20              | –   |      |
|                 |                         |                         | 1.8 – 3.6               | 1.8 – 3.6               | 60             | –               | –   | 60              | –   |      |

# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

| Symbol          | Parameter          | Test Conditions                                 |                                    | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |     | –40°C to +125°C |     | Unit |
|-----------------|--------------------|-------------------------------------------------|------------------------------------|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|-----|------|
|                 |                    |                                                 |                                    |                         |                         | Min            | Typ<br>(Note 4) | Max | Min             | Max |      |
| t <sub>EN</sub> | Output Enable Time | C <sub>L</sub> = 15 pF;<br>B = V <sub>CCB</sub> | EN/ $\overline{\text{EN}}$<br>to A | 0.9 – 3.6               | 0.9 – 3.6               | –              | 125             | –   | –               | –   | ns   |
|                 |                    |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 116.3           | 200 | –               | 200 |      |
|                 |                    |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 64.5            | 180 | –               | 180 |      |
|                 |                    |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 49.6            | 150 | –               | 150 |      |
|                 |                    |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 42.5            | 100 | –               | 100 |      |
|                 |                    | C <sub>L</sub> = 15 pF;<br>B = 0 V              | EN/ $\overline{\text{EN}}$<br>to A | 0.9 – 3.6               | 0.9 – 3.6               | –              | 205             | –   | –               | –   |      |
|                 |                    |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 113.4           | 300 | –               | 300 |      |
|                 |                    |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 100             | 250 | –               | 250 |      |
|                 |                    |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 94.3            | 200 | –               | 200 |      |
|                 |                    |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 90.9            | 170 | –               | 170 |      |
|                 |                    | C <sub>L</sub> = 15 pF;<br>A = V <sub>CCA</sub> | EN/ $\overline{\text{EN}}$<br>to B | 0.9 – 3.6               | 0.9 – 3.6               | –              | 125             | –   | –               | –   |      |
|                 |                    |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 116.3           | 200 | –               | 200 |      |
|                 |                    |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 64.5            | 180 | –               | 180 |      |
|                 |                    |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 49.6            | 150 | –               | 150 |      |
|                 |                    |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 42.5            | 100 | –               | 100 |      |
|                 |                    | C <sub>L</sub> = 15 pF;<br>A = 0 V              | EN/ $\overline{\text{EN}}$<br>to B | 0.9 – 3.6               | 0.9 – 3.6               | –              | 205             | –   | –               | –   |      |
|                 |                    |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 113.4           | 300 | –               | 300 |      |
|                 |                    |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 100             | 250 | –               | 250 |      |
|                 |                    |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 94.3            | 200 | –               | 200 |      |
|                 |                    |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 90.9            | 170 | –               | 170 |      |

# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

| Symbol              | Parameter                 | Test Conditions                                 |                                    | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |     | –40°C to +125°C |     | Unit |
|---------------------|---------------------------|-------------------------------------------------|------------------------------------|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|-----|------|
|                     |                           |                                                 |                                    |                         |                         | Min            | Typ<br>(Note 4) | Max | Min             | Max |      |
| t <sub>DIS</sub>    | Output Disable Time       | C <sub>L</sub> = 15 pF;<br>B = V <sub>CCB</sub> | EN/ $\overline{\text{EN}}$<br>to A | 0.9 – 3.6               | 0.9 – 3.6               | –              | 270             | –   | –               | –   | ns   |
|                     |                           |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 255             | 600 | –               | 600 |      |
|                     |                           |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 180             | 350 | –               | 350 |      |
|                     |                           |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 166.7           | 350 | –               | 350 |      |
|                     |                           |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 155.6           | 300 | –               | 300 |      |
|                     |                           | C <sub>L</sub> = 15 pF;<br>B = 0 V              |                                    | 0.9 – 3.6               | 0.9 – 3.6               | –              | 180             | –   | –               | –   |      |
|                     |                           |                                                 |                                    | 1.1 – 3.6               | 1.1 – 3.6               | –              | 156.7           | 400 | –               | 400 |      |
|                     |                           |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 140             | 300 | –               | 300 |      |
|                     |                           |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 130.2           | 300 | –               | 300 |      |
|                     |                           |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 124.6           | 250 | –               | 250 |      |
|                     |                           | C <sub>L</sub> = 15 pF;<br>A = V <sub>CCA</sub> | EN/ $\overline{\text{EN}}$<br>to B | 0.9 – 3.6               | 0.9 – 3.6               | –              | 270             | –   | –               | –   |      |
|                     |                           |                                                 |                                    | 0.9 – 3.6               | 0.9 – 3.6               | –              | 255             | 600 | –               | 600 |      |
|                     |                           |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 180             | 350 | –               | 350 |      |
|                     |                           |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 166.7           | 350 | –               | 350 |      |
|                     |                           |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 155.6           | 300 | –               | 300 |      |
|                     |                           | C <sub>L</sub> = 15 pF;<br>A = 0 V              |                                    | 0.9 – 3.6               | 0.9 – 3.6               | –              | 180             | –   | –               | –   |      |
|                     |                           |                                                 |                                    | 0.9 – 3.6               | 0.9 – 3.6               | –              | 156.7           | 400 | –               | 400 |      |
|                     |                           |                                                 |                                    | 1.2 – 1.8               | 1.2 – 1.8               | –              | 140             | 300 | –               | 300 |      |
|                     |                           |                                                 |                                    | 1.8 – 2.8               | 1.8 – 2.8               | –              | 130.2           | 300 | –               | 300 |      |
|                     |                           |                                                 |                                    | 1.8 – 3.6               | 1.8 – 3.6               | –              | 124.6           | 250 | –               | 250 |      |
| I <sub>I_PEAK</sub> | Input Driver Peak Current | EN = V <sub>CCA</sub> or = 0 V;                 |                                    |                         |                         |                |                 |     |                 |     | mA   |
|                     |                           | A = 1 MHz Sq Wave, Amplitude = V <sub>CCA</sub> | A                                  | 0.9 – 3.6               | 0.9 – 3.6               | –              | –               | 5.0 | –               | 5.0 |      |
|                     |                           | B = 1 MHz Sq Wave, Amplitude = V <sub>CCB</sub> | B                                  | 0.9 – 3.6               | 0.9 – 3.6               | –              | –               | 5.0 | –               | 5.0 |      |

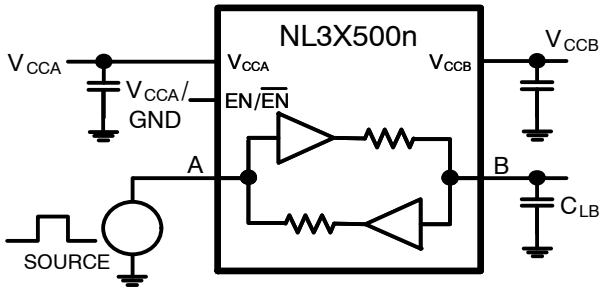
# NL3X5004, NL3XN5004

**Table 4. TIMING CHARACTERISTICS** (continued)

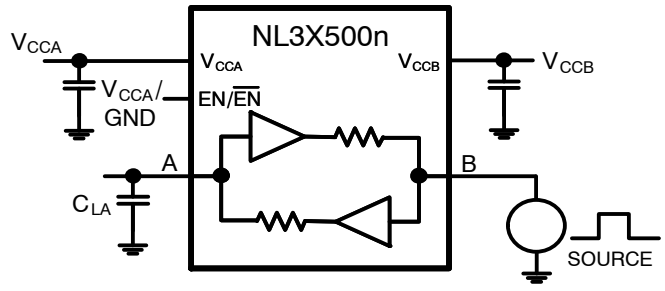
| Symbol                     | Parameter                  | Test Conditions |   | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | –40°C to +85°C |                 |     | –40°C to +125°C |     | Unit |
|----------------------------|----------------------------|-----------------|---|-------------------------|-------------------------|----------------|-----------------|-----|-----------------|-----|------|
|                            |                            |                 |   |                         |                         | Min            | Typ<br>(Note 4) | Max | Min             | Max |      |
| Z <sub>O</sub><br>(Note 4) | 1-Shot Output<br>Impedance |                 | A | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 55              | –   | –               | –   | Ω    |
|                            |                            |                 |   | 1.1                     | 1.1 –<br>3.6            | –              | 37              | –   | –               | –   |      |
|                            |                            |                 |   | 1.8                     |                         | –              | 20              | –   | –               | –   |      |
|                            |                            |                 |   | 3.6                     |                         | –              | 10              | –   | –               | –   |      |
|                            |                            |                 | B | 0.9 –<br>3.6            | 0.9 –<br>3.6            | –              | 55              | –   | –               | –   |      |
|                            |                            |                 |   | 1.1 –<br>3.6            | 1.1                     | –              | 37              | –   | –               | –   |      |
|                            |                            |                 |   |                         | 1.8                     | –              | 20              | –   | –               | –   |      |
|                            |                            |                 |   |                         | 3.6                     | –              | 10              | –   | –               | –   |      |

4. Typical values are for T<sub>A</sub> = +25°C.

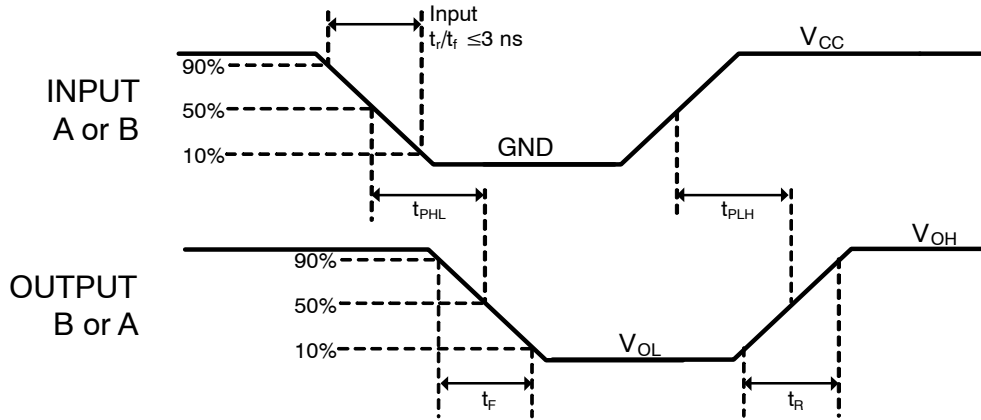
## NL3X5004, NL3XN5004



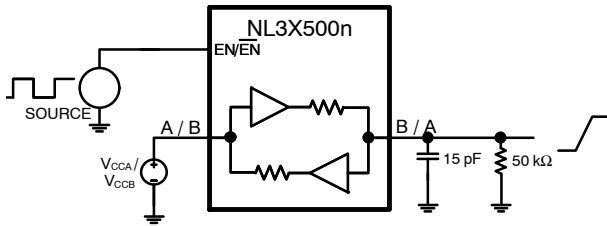
**Figure 8. Driving A-Port Test Circuit ( $t_{PD}$ )**



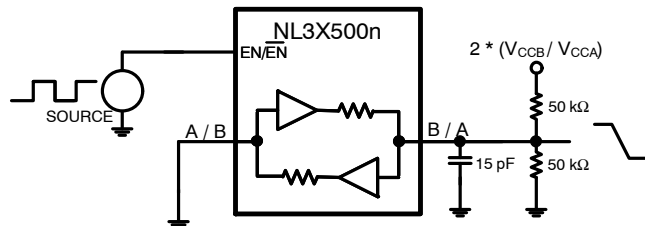
**Figure 9. Driving B-Port Test Circuit ( $t_{PD}$ )**



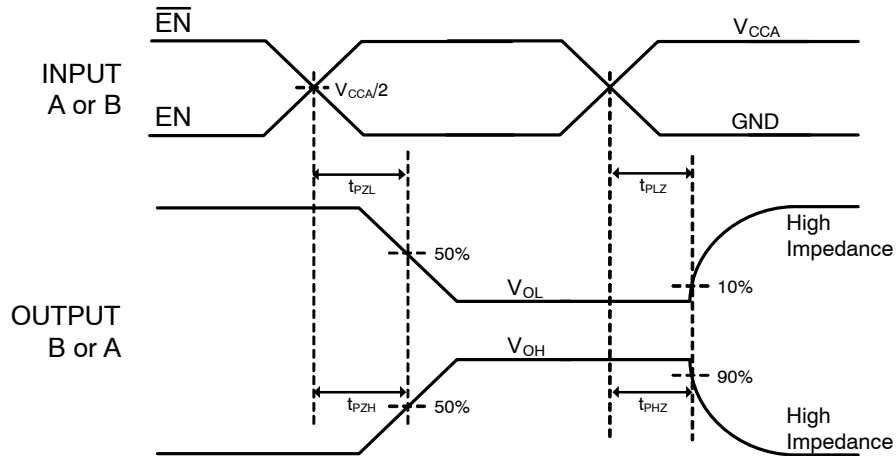
### Figure 10. $t_{PD}$ ( $t_{PLH}/t_{PHL}$ ) Propagation Delay Measurements



**Figure 11. Enable/Disable Test Circuit ( $t_{PZH}/t_{PHZ}$ )**



**Figure 12. Enable/Disable Test Circuit ( $t_{PZL}/t_{PLZ}$ )**



**Figure 13.  $t_{EN}/t_{DIS}$  ( $t_{PZL}/t_{PLZ}/t_{PZH}/t_{PHZ}$ ) Propagation Delay Measurements**

**IMPORTANT APPLICATIONS INFORMATION****Level Translator Architecture**

The NL3X5004 and the NL3XN5004 auto-sense translators provide bi-directional logic voltage level shifting to transfer data in multiple supply voltage systems. These level translators have two supply voltages,  $V_{CCA}$  and  $V_{CCB}$ , which set the logic levels on the input and output sides of the translator. When used to transfer data from the A to the B ports, input signals referenced to the  $V_{CCA}$  supply are translated to output signals with a logic level matched to  $V_{CCB}$ . In a similar manner, the B to A translation shifts input signals with a logic level compatible to  $V_{CCB}$  to an output signal matched to  $V_{CCA}$ .

The NL3X5004 and the NL3XN5004 translators consist of bi-directional channels that independently determine the direction of the data flow without requiring a directional pin. One-shot circuits are used to detect the rising or falling input signals. In addition, the one-shots decrease the rise and fall times of the output signal for high-to-low and low-to-high transitions.

**Input Driver Requirements**

The NL3X5004 and NL3XN5004 support high data rates, but these translators have relatively modest DC output current drive. The high data rate of the bi-directional I/O circuit is used to quickly transform from an input to an output driver and vice versa. Each I/O port has a modest DC current output so that the internal output driver can be over-driven when data is sent in the opposite direction. *For proper operation, the input driver to the auto-sense translator should be capable of driving 5.0 mA of peak output current.* The bi-directional configuration of the translator results in both input stages being active for a very short time period. Although the peak current required from the input signal circuit is relatively large, the average current is small and consistent with a standard CMOS input stage.

**Enable Input (EN/ $\overline{EN}$ )**

The NL3X5004 and NL3XN5004 translators have enable pins that provide tri-state operation at the I/O ports.

Driving the NL3X5004 Enable pin (EN) to a low logic level minimizes the power consumption of the device and drives the A- and B-ports to high impedance states. Normal translation operation occurs when the EN pin is equal to a logic high signal.

Driving NL3XN5004 Enable pin ( $\overline{EN}$ ) to a high logic level minimizes the power consumption of the device and drives the A- and B-ports to high impedance states. Normal translation operation occurs when the  $\overline{EN}$  pin is equal to a logic low signal.

Both EN and  $\overline{EN}$  pins are referenced to the  $V_{CCA}$  supply and are Over-Voltage Tolerant (OVT).

**Uni-Directional versus Bi-Directional Translation**

The NL3X5004 and NL3XN5004 translators can function as non-inverting uni-directional translators. One advantage of using these translators as uni-directional devices is that each I/O-port can be configured as either an input or an 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**

The values of the  $V_{CCA}$  and  $V_{CCB}$  supplies can be set to anywhere between 0.9 and 3.6 V. Design flexibility is maximized because  $V_{CCA}$  may be either greater than, equal to or less than the  $V_{CCB}$  supply.

The sequencing of the power supplies will not damage the device during power-up operation. In addition, the A- and B-ports are in high impedance states 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  $V_{CCA}$  and  $V_{CCB}$  power supply pins. Ceramic capacitors are a good design choice to filter and bypass any noise signals on the 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.



# NL3X5004, NL3XN5004

## DEVICE ORDERING INFORMATION

| Device Order Number                             | Device Marking | Package Type            | Tape & Reel Size†  |
|-------------------------------------------------|----------------|-------------------------|--------------------|
| NL3X5004MU2TAG                                  | AA2            | UQFN-12, 1.7 x 2.0      | 3000 / Tape & Reel |
| NL3X5004MU2TAG-Q*                               | AA2            | UQFN-12, 1.7 x 2.0      | 3000 / Tape & Reel |
| NL3X5004MN1TXG                                  | V4             | QFN14, 3.5 x 3.5 x 0.5P | 3000 / Tape & Reel |
| NL3X5004MN1TXG-Q*                               | V4             | QFN14, 3.5 x 3.5 x 0.5P | 3000 / Tape & Reel |
| NL3X5004DR2G<br>(Contact <b>onsemi</b> )        | TBD            | SOIC14                  | 2500 / Tape & Reel |
| NL3X5004DR2G-Q*<br>(Contact <b>onsemi</b> )     | TBD            | SOIC14                  | 2500 / Tape & Reel |
| NL3X5004DTR2G<br>(Contact <b>onsemi</b> )       | TBD            | TSSOP14                 | 2500 / Tape & Reel |
| NL3X5004DTR2G-Q*<br>(Contact <b>onsemi</b> )    | TBD            | TSSOP14                 | 2500 / Tape & Reel |
| NL3X5004MN1ATXG<br>(Contact <b>onsemi</b> )     | TBD            | QFN14, 2.5 x 3.0 x 0.5P | 3000 / Tape & Reel |
| NL3X5004MN1ATXG-Q*<br>(Contact <b>onsemi</b> )  | TBD            | QFN14, 2.5 x 3.0 x 0.5P | 3000 / Tape & Reel |
| NL3XN5004MU2TAG<br>(Contact <b>onsemi</b> )     | TBD            | UQFN-12                 | 3000 / Tape & Reel |
| NL3XN5004MU2TAG-Q*<br>(Contact <b>onsemi</b> )  | TBD            | UQFN-12                 | 3000 / Tape & Reel |
| NL3XN5004DR2G<br>(Contact <b>onsemi</b> )       | TBD            | SOIC14                  | 2500 / Tape & Reel |
| NL3XN5004DR2G-Q*<br>(Contact <b>onsemi</b> )    | TBD            | SOIC14                  | 2500 / Tape & Reel |
| NL3XN5004DTR2G<br>(Contact <b>onsemi</b> )      | TBD            | TSSOP14                 | 2500 / Tape & Reel |
| NL3XN5004DTR2G-Q*<br>(Contact <b>onsemi</b> )   | TBD            | TSSOP14                 | 2500 / Tape & Reel |
| NL3XN5004MN1TXG<br>(Contact <b>onsemi</b> )     | TBD            | QFN14, 3.5 x 3.5 x 0.5P | 3000 / Tape & Reel |
| NL3XN5004MN1TXG-Q*<br>(Contact <b>onsemi</b> )  | TBD            | QFN14, 3.5 x 3.5 x 0.5P | 3000 / Tape & Reel |
| NL3XN5004MN1ATXG<br>(Contact <b>onsemi</b> )    | TBD            | QFN14, 2.5 x 3.0 x 0.5P | 3000 / Tape & Reel |
| NL3XN5004MN1ATXG-Q*<br>(Contact <b>onsemi</b> ) | TBD            | QFN14, 2.5 x 3.0 x 0.5P | 3000 / Tape & Reel |

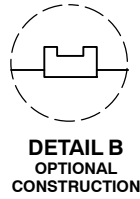
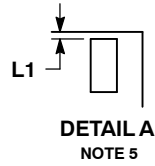
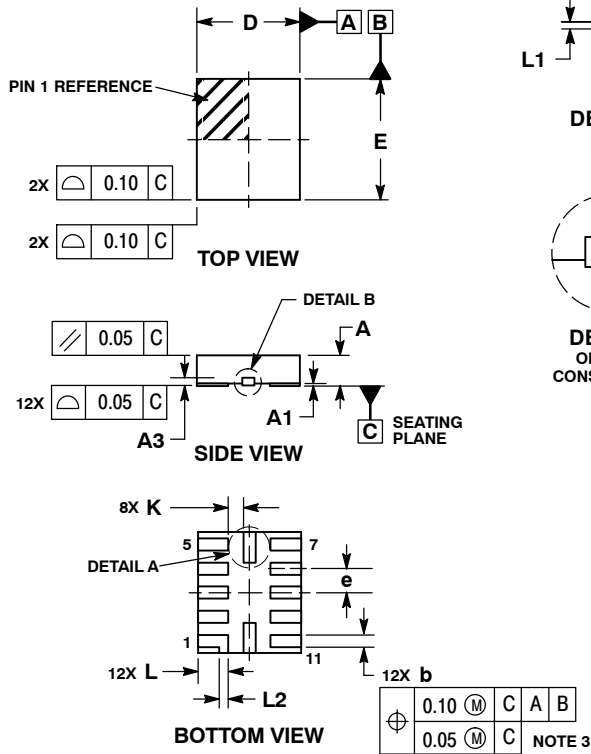
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

# NL3X5004, NL3XN5004

## PACKAGE DIMENSIONS

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

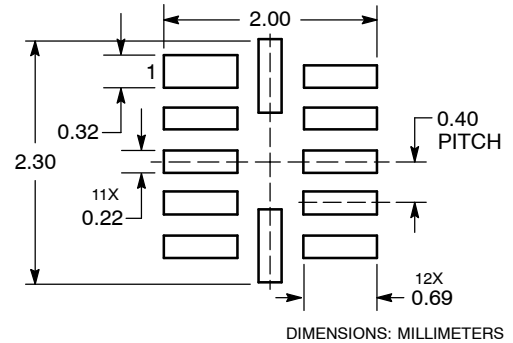


### NOTES:

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.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | 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    |      |

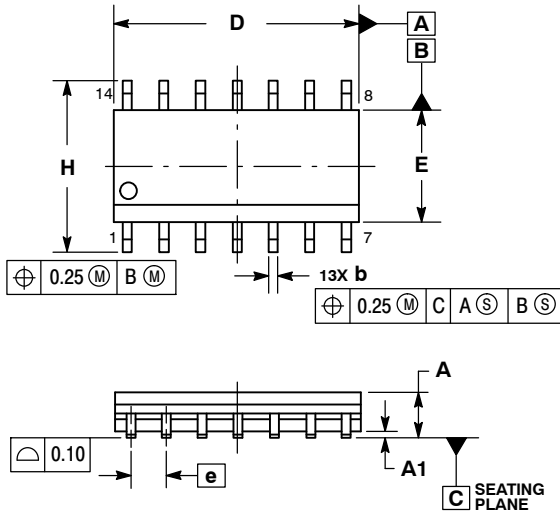
### MOUNTING FOOTPRINT SOLDERMASK DEFINED



# NL3X5004, NL3XN5004

## PACKAGE DIMENSIONS

### SOIC-14 NB CASE 751A-03 ISSUE L

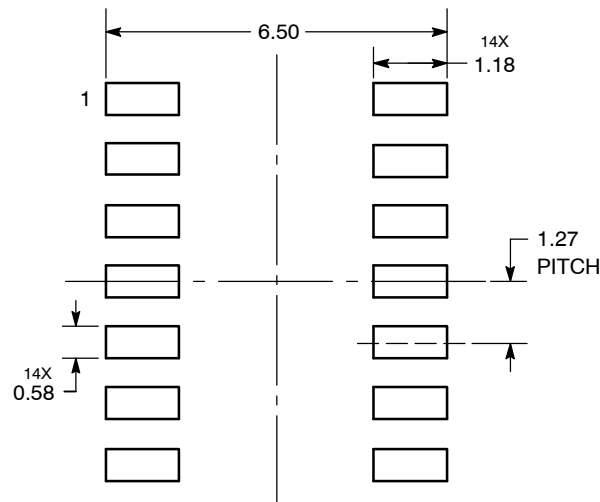


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 0.35        | 0.49 | 0.014     | 0.019 |
| D   | 8.55        | 8.75 | 0.337     | 0.344 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 5.80        | 6.20 | 0.228     | 0.244 |
| h   | 0.25        | 0.50 | 0.010     | 0.019 |
| L   | 0.40        | 1.25 | 0.016     | 0.049 |
| M   | 0°          | 7°   | 0°        | 7°    |

### SOLDERING FOOTPRINT\*



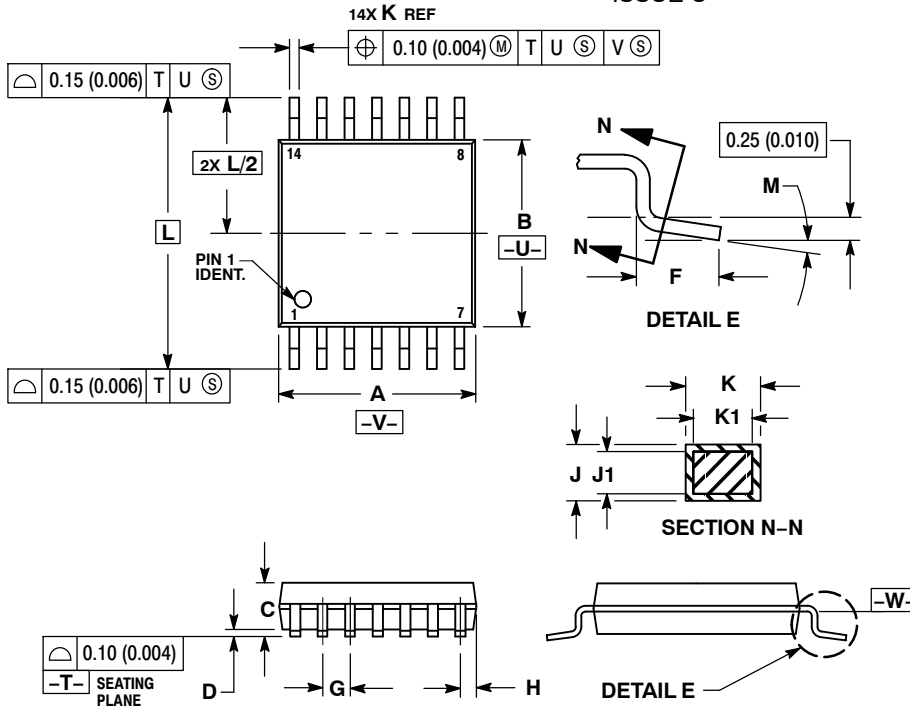
DIMENSIONS: MILLIMETERS

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

# NL3X5004, NL3XN5004

## PACKAGE DIMENSIONS

### TSSOP-14 WB CASE 948G ISSUE C

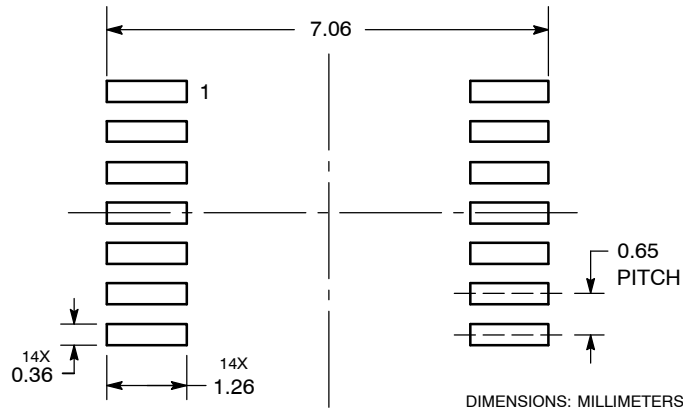


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES |       |
|-----|-------------|------|--------|-------|
|     | MIN         | MAX  | MIN    | MAX   |
| A   | 4.90        | 5.10 | 0.193  | 0.200 |
| B   | 4.30        | 4.50 | 0.169  | 0.177 |
| C   | ---         | 1.20 | ---    | 0.047 |
| D   | 0.05        | 0.15 | 0.002  | 0.006 |
| F   | 0.50        | 0.75 | 0.020  | 0.030 |
| G   | 0.65        | BSC  | 0.026  | BSC   |
| H   | 0.50        | 0.60 | 0.020  | 0.024 |
| J   | 0.09        | 0.20 | 0.004  | 0.008 |
| J1  | 0.09        | 0.16 | 0.004  | 0.006 |
| K   | 0.19        | 0.30 | 0.007  | 0.012 |
| K1  | 0.19        | 0.25 | 0.007  | 0.010 |
| L   | 6.40        | BSC  | 0.252  | BSC   |
| M   | 0°          | 8°   | 0°     | 8°    |

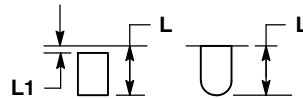
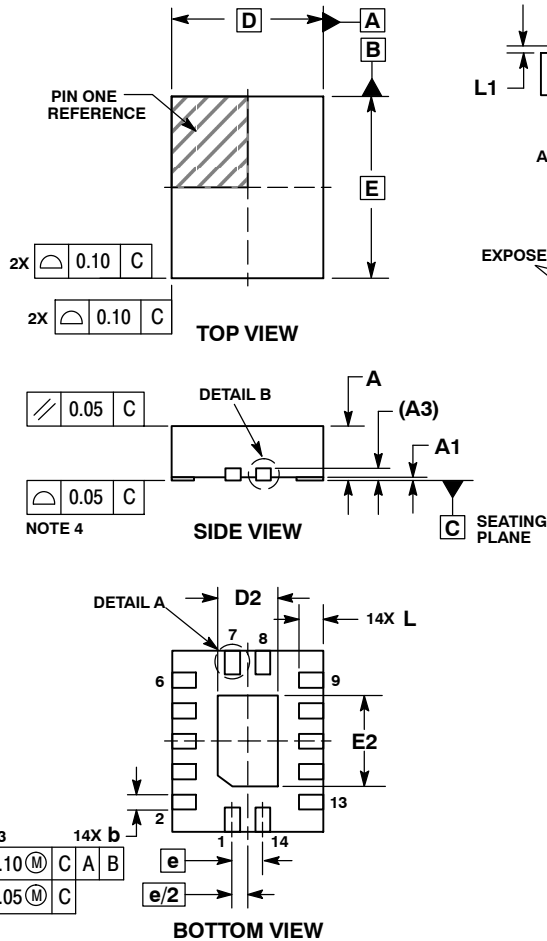
### SOLDERING FOOTPRINT



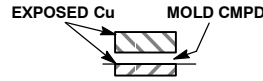
# NL3X5004, NL3XN5004

## PACKAGE DIMENSIONS

QFN14, 2.5x3.0, 0.5P  
CASE 485DE  
ISSUE O



**DETAIL A**  
ALTERNATE TERMINAL  
CONSTRUCTIONS



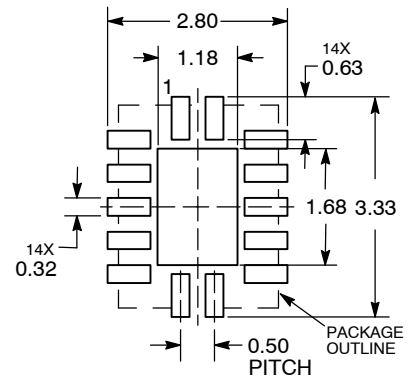
**DETAIL B**  
ALTERNATE  
CONSTRUCTIONS

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS |      |      |
|-------------|------|------|
| DIM         | MIN  | MAX  |
| A           | 0.80 | 1.00 |
| A1          | 0.00 | 0.05 |
| A3          | 0.20 | REF  |
| b           | 0.20 | 0.30 |
| D           | 2.50 | BSC  |
| D2          | 0.90 | 1.10 |
| E           | 3.00 | BSC  |
| E2          | 1.40 | 1.60 |
| e           | 0.50 | BSC  |
| L           | 0.30 | 0.50 |
| L1          | ---  | 0.05 |

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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



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