



**THE DATASHEET OF  
NC7WZ04P6X**



# NC7WZ04

## TinyLogic UHS Dual Inverter

### Description

The NC7WZ04 is a dual inverter from ON Semiconductor's Ultra-High Speed (UHS) series of TinyLogic. The device is fabricated with advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over a very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  range. The inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating voltage.

### Features

- Ultra-High Speed:  $t_{PD}$  2.3 ns (Typical) into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at 3.3 V  $V_{CC}$
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SC70 6-Lead Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

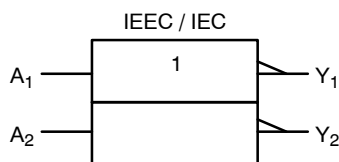


Figure 1. Logic Symbol



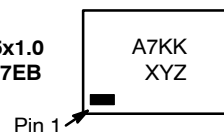
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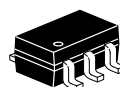
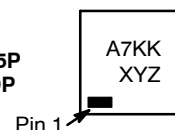
### MARKING DIAGRAMS



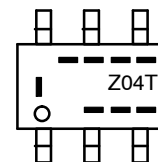
SIP6 1.45x1.0  
CASE 127EB



UDFN6  
1.0x1.0, 0.35P  
CASE 517DP



SC-88  
(SC-70 6 Lead)  
1.25x2  
CASE 419AD-01



- A7, Z04 = Specific Device Code
- KK = 2-Digit Lot Run Traceability Code
- XY = 2-Digit Date Code Format
- Z = Assembly Plant Code
- = Year Coding Scheme
- |- - = Plant Code Identifier
- T = Die Run Code
- = Eight-Week Datacoding Scheme

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

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## Pin Configurations

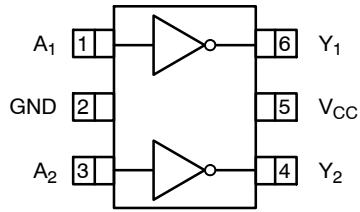


Figure 2. SC70 (Top View)

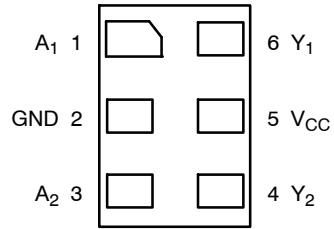
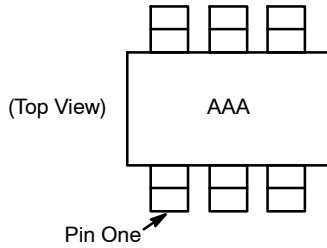


Figure 3. MicroPak (Top Through View)



NOTES:

1. AAA represents product code top mark (see *Ordering Information*).
2. Orientation of top mark determines pin one location.
3. Reading the top mark left to right, pin one is the lower left pin.

Figure 4. SC70 Pin 1 Orientation

### PIN DEFINITIONS

| Pin # SC70 | Pin # MicroPak | Name            | Description    |
|------------|----------------|-----------------|----------------|
| 1          | 1              | A               | Input          |
| 2          | 2              | GND             | Ground         |
| 3          | 3              | A               | Input          |
| 4          | 4              | Y               | Output         |
| 5          | 5              | V <sub>CC</sub> | Supply Voltage |
| 6          | 6              | Y               | Output         |

### FUNCTION TABLE (Y = /A)

| Input | Output |
|-------|--------|
| A     | Y      |
| L     | H      |
| H     | L      |

H = HIGH Logic Level  
L = LOW Logic Level

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## ABSOLUTE MAXIMUM RATINGS

| Symbol                              | Parameter   |                        | Min  | Max  | Unit |
|-------------------------------------|---|------------------------|------|------|------|
| V <sub>CC</sub>                     | Supply Voltage                                    |                        | -0.5 | 6.5  | V    |
| V <sub>IN</sub>                     | DC Input Voltage                                  |                        | -0.5 | 6.5  | V    |
| V <sub>OUT</sub>                    | DC Output Voltage                                 |                        | -0.5 | 6.5  | V    |
| I <sub>IK</sub>                     | DC Input Diode Current                            | V <sub>IN</sub> < 0 V  | -    | -50  | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current                           | V <sub>OUT</sub> < 0 V | -    | -50  | mA   |
| I <sub>OUT</sub>                    | DC Output Source / Sink Current                   |                        | -    | ±50  | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current              |                        | -    | ±100 | mA   |
| T <sub>STG</sub>                    | Storage Temperature Range                         |                        | -65  | +150 | °C   |
| T <sub>J</sub>                      | Junction Temperature Under Bias                   |                        | -    | +150 | °C   |
| T <sub>L</sub>                      | Junction Lead Temperature (Soldering, 10 Seconds) |                        | -    | +260 | °C   |
| P <sub>D</sub>                      | Power Dissipation in Still Air                    | SC70-6                 | -    | 190  | mW   |
|                                     |   | MicroPak-6             | -    | 327  |      |
|                                     |   | MicroPak2™-6           | -    | 327  |      |
| ESD                                 | Human Body Model, JEDEC: JESD22-A114              |                        | -    | 4000 | V    |
|                                     | Charge Device Model, JEDEC: JESD22-C101           |                        | -    | 2000 |      |

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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                     | Conditions                             | Min  | Max             | Unit |
|---------------------------------|-------------------------------|--|------|-----------------|------|
| V <sub>CC</sub>                 | Supply Voltage Operating      |  | 1.65 | 5.50            | V    |
|                                 | Supply Voltage Data Retention |  | 1.5  | 5.5             |      |
| V <sub>IN</sub>                 | Input Voltage                 |  | 0    | 5.5             | V    |
| V <sub>OUT</sub>                | Output Voltage                |  | 0    | V <sub>CC</sub> | V    |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Times     | V <sub>CC</sub> at 1.8 V, 2.5 V ±0.2 V | 0    | 20              | ns/V |
|                                 |                               | V <sub>CC</sub> at 3.3 V ±0.3 V        | 0    | 10              |      |
|                                 |                               | V <sub>CC</sub> at 5.0 V ±0.5 V        | 0    | 5               |      |
| T <sub>A</sub>                  | Operating Temperature         |  | -40  | +85             | °C   |
| θ <sub>JA</sub>                 | Thermal Resistance            | SC70-6                                 | -    | 659             | °C/W |
|                                 |                               | MicroPak-6                             | -    | 382             |      |
|                                 |                               | MicroPak2-6                            | -    | 382             | °C/W |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

4. Unused inputs must be held HIGH or LOW. They may not float.

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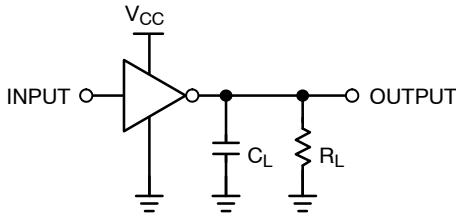
## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                 | V <sub>CC</sub> (V) | Conditions   | T <sub>A</sub> = +25°C   |      |                      | T <sub>A</sub> = -40 to +85°C |                      | Unit |      |
|------------------|---------------------------|---------------------|--|--------------------------|------|----------------------|-------------------------------|----------------------|------|------|
|                  |                           |                     |  | Min                      | Typ  | Max                  | Min                           | Max                  |      |      |
| V <sub>IH</sub>  | HIGH Level Input Voltage  | 1.65 to 1.95        |  | 0.65 V <sub>CC</sub>     | -    | -                    | 0.65 V <sub>CC</sub>          | -                    | V    |      |
|                  |                           | 2.30 to 5.50        |  | 0.70 V <sub>CC</sub>     | -    | -                    | 0.70 V <sub>CC</sub>          | -                    |      |      |
| V <sub>IL</sub>  | LOW Level Input Voltage   | 1.65 to 1.95        |  | -                        | -    | 0.35 V <sub>CC</sub> | -                             | 0.35 V <sub>CC</sub> | V    |      |
|                  |                           | 2.30 to 5.50        |  | -                        | -    | 0.30 V <sub>CC</sub> | -                             | 0.30 V <sub>CC</sub> |      |      |
| V <sub>OH</sub>  | HIGH Level Output Voltage | 1.65                | V <sub>IN</sub> = V <sub>IL</sub> ,<br>I <sub>OH</sub> = -100 μA | 1.55                     | 1.65 | -                    | 1.55                          | -                    | V    |      |
|                  |                           | 1.80                |  | 1.70                     | 1.80 | -                    | 1.70                          | -                    |      |      |
|                  |                           | 2.30                |  | 2.20                     | 2.30 | -                    | 2.20                          | -                    |      |      |
|                  |                           | 3.00                |  | 2.90                     | 3.00 | -                    | 2.90                          | -                    |      |      |
|                  |                           | 4.50                |  | 4.40                     | 4.50 | -                    | 4.40                          | -                    |      |      |
|                  |                           | 1.65                | I <sub>OH</sub> = -4 mA  | 1.29                     | 1.52 | -                    | 1.29                          | -                    |      |      |
|                  |                           | 2.30                |  | I <sub>OH</sub> = -8 mA  | 1.90 | 2.14                 | -                             | 1.90                 |      | -    |
|                  |                           | 3.00                |  | I <sub>OH</sub> = -16 mA | 2.40 | 2.75                 | -                             | 2.40                 |      | -    |
|                  |                           | 3.00                |  | I <sub>OH</sub> = -24 mA | 2.30 | 2.62                 | -                             | 2.30                 |      | -    |
|                  |                           | 4.50                |  | I <sub>OH</sub> = -32 mA | 3.80 | 4.13                 | -                             | 3.80                 |      | -    |
| V <sub>OL</sub>  | LOW Level Output Voltage  | 1.65                | V <sub>IN</sub> = V <sub>IH</sub> ,<br>I <sub>OL</sub> = 100 μA  | -                        | 0.10 | 0.10                 | -                             | 0.10                 | V    |      |
|                  |                           | 1.80                |  | -                        | 0.00 | 0.10                 | -                             | 0.10                 |      |      |
|                  |                           | 2.30                |  | -                        | 0.00 | 0.10                 | -                             | 0.10                 |      |      |
|                  |                           | 3.00                |  | -                        | 0.00 | 0.10                 | -                             | 0.10                 |      |      |
|                  |                           | 4.50                |  | -                        | 0.00 | 0.10                 | -                             | 0.10                 |      |      |
|                  |                           | 1.65                | I <sub>OL</sub> = 4 mA   | -                        | 0.80 | 0.24                 | -                             | 0.24                 |      |      |
|                  |                           | 2.30                |  | I <sub>OL</sub> = 8 mA   | -    | 0.10                 | 0.30                          | -                    |      | 0.30 |
|                  |                           | 3.00                |  | I <sub>OL</sub> = 16 mA  | -    | 0.16                 | 0.40                          | -                    |      | 0.40 |
|                  |                           | 3.00                |  | I <sub>OL</sub> = 24 mA  | -    | 0.24                 | 0.55                          | -                    |      | 0.55 |
|                  |                           | 4.50                |  | I <sub>OL</sub> = 32 mA  | -    | 0.25                 | 0.55                          | -                    |      | 0.55 |
| I <sub>IN</sub>  | Input Leakage Current     | 1.65 to 5.5         | 0 ≤ V <sub>IN</sub> ≤ 5.5 V                                      | -                        | -    | ±1                   | -                             | ±1.0                 | μA   |      |
| I <sub>OFF</sub> | Power Off Leakage Current | 0                   | V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V                      | -                        | -    | 1                    | -                             | 10                   | μA   |      |
| I <sub>CC</sub>  | Quiescent Supply Current  | 1.65 to 5.50        | V <sub>IN</sub> = 5.5 V, GND                                     | -                        | -    | 1                    | -                             | 10                   | μA   |      |

AC ELECTRICAL CHARACTERISTICS

| Symbol                              | Parameter  | V <sub>CC</sub> (V) | Conditions                                       | T <sub>A</sub> = +25°C                            |     |     | T <sub>A</sub> = -40 to +85°C |      | Unit |
|-------------------------------------|--|---------------------|--|---|-----|-----|-------------------------------|------|------|
|                                     |  |                     |  | Min   | Typ | Max | Min                           | Max  |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay<br>(Figure 5, 6)                   | 1.65                | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 1 MΩ | -   | 5.3 | 9.2 | -                             | 11.0 | ns   |
|                                     |  | 1.80                |  | -   | 4.4 | 7.6 | -                             | 8.4  |      |
|                                     |  | 2.50 ±0.20          |  | -   | 3.0 | 5.1 | -                             | 5.6  |      |
|                                     |  | 3.30 ±0.30          |  | -   | 2.2 | 3.4 | -                             | 3.8  |      |
|                                     |  | 5.00 ±0.50          |  | -   | 1.8 | 2.8 | -                             | 3.1  |      |
|                                     |  | 3.30 ±0.30          |  | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω | -   | 2.9 | 4.5                           | -    |      |
|                                     |  | 5.00 ±0.50          | -  |   | 2.3 | 3.6 | -                             | 4.0  |      |
| C <sub>IN</sub>                     | Input Capacitance                                    | 0.00                |  | -   | 2.5 | -   | -                             | -    | pF   |
| C <sub>PD</sub>                     | Power Dissipation Capacitance<br>(Note 5) (Figure 7) | 3.30                |  | -   | 9   | -   | -                             | -    | pF   |
|                                     |  | 5.00                |  | -   | 11  | -   | -                             | -    |      |

5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$ .



NOTE:  
 6. C<sub>L</sub> includes load and stray capacitance.  
 7. Input PRR = 1.0 MHz, t<sub>W</sub> = 500 ns.

Figure 5. AC Test Circuit

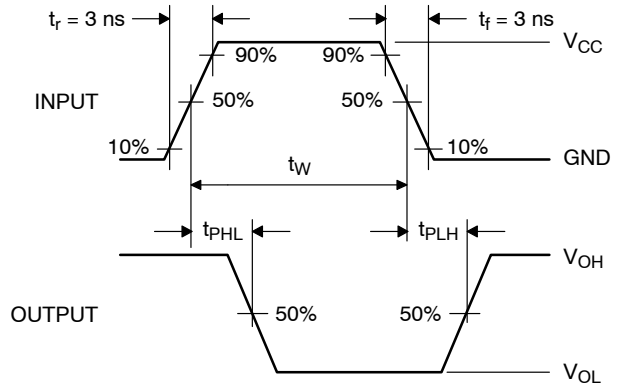
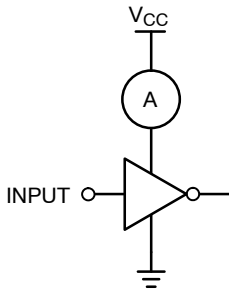


Figure 6. AC Waveforms



NOTE:  
 8. Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns.  
 9. PRR = Variable; Duty Cycle = 50%.

Figure 7. I<sub>CCD</sub> Test Circuit

# NC7WZ04

## DEVICE ORDERING INFORMATION

| Device     | Top Mark | Packages                                     | Shipping†          |
|------------|----------|--|--------------------|
| NC7WZ04P6X | Z04      | 6-Lead SC70, EIAJ SC-88, 1.25 mm Wide        | 3000 / Tape & Reel |
| NC7WZ04L6X | A7       | 6-Lead MicroPak, 1.00 mm Wide                | 5000 / Tape & Reel |
| NC7WZ04FHX | A7       | 6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch | 5000 / 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.

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# MECHANICAL CASE OUTLINE

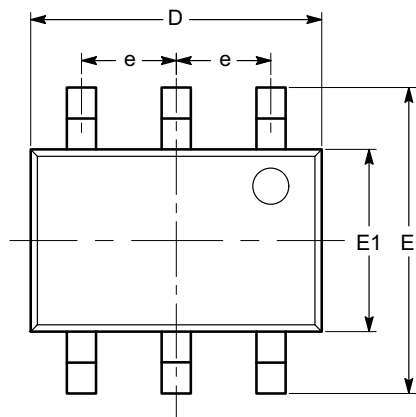
## PACKAGE DIMENSIONS

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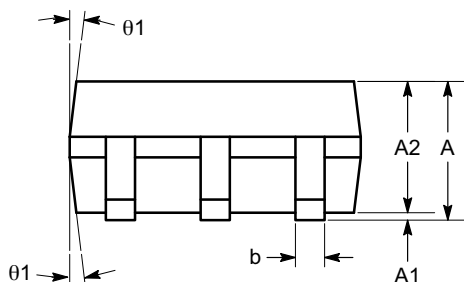
SC-88 (SC-70 6 Lead), 1.25x2  
CASE 419AD-01  
ISSUE A

DATE 07 JUL 2010

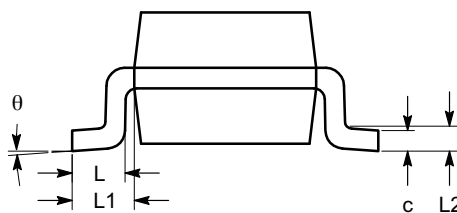


TOP VIEW

| SYMBOL     | MIN      | NOM  | MAX  |
|------------|----------|------|------|
| A          | 0.80     |      | 1.10 |
| A1         | 0.00     |      | 0.10 |
| A2         | 0.80     |      | 1.00 |
| b          | 0.15     |      | 0.30 |
| c          | 0.10     |      | 0.18 |
| D          | 1.80     | 2.00 | 2.20 |
| E          | 1.80     | 2.10 | 2.40 |
| E1         | 1.15     | 1.25 | 1.35 |
| e          | 0.65 BSC |      |      |
| L          | 0.26     | 0.36 | 0.46 |
| L1         | 0.42 REF |      |      |
| L2         | 0.15 BSC |      |      |
| $\theta$   | 0°       |      | 8°   |
| $\theta_1$ | 4°       |      | 10°  |



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

|                         |                              |  |
|-------------------------|------------------------------|--|
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