## TinyLogic UHS Inverter with Schmitt Trigger Input

## NC7SZ14

## Description

The NC7SZ14 is a single inverter with Schmitt trigger input from ON Semiconductor's Ultra-High Speed (UHS) series of TinyLogic. The device is fabricated w ith advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a very broad $\mathrm{V}_{\mathrm{CC}}$ operating range. The device is specified to operate over the 1.65 V to $5.5 \mathrm{~V} \mathrm{~V}_{\mathrm{CC}}$ range. The inputs and outputs are high-impedance when $\mathrm{V}_{\mathrm{CC}}$ is 0 V . Inputs tolerate voltages up to 5.5 V independent of $\mathrm{V}_{\mathrm{CC}}$ operating voltage.

## Features

- Ultra-High Speed: $\mathrm{t}_{\mathrm{PD}}=3.7 \mathrm{~ns}$ (Typical) into 50 pF at $5 \mathrm{~V} \mathrm{~V}_{\mathrm{CC}}$
- High Output Drive: $\pm 24 \mathrm{~mA}$ at $3 \mathrm{~V} \mathrm{~V}_{\mathrm{CC}}$
- Broad $\mathrm{V}_{\mathrm{CC}}$ Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at $3.3 \mathrm{~V}_{\mathrm{CC}}$
- 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 ${ }^{\text {TM }}$ Packages
- Space-Saving SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant


Figure 1. Logic Symbol

ON Semiconductor ${ }^{\circledR}$
www.onsemi.com


ORDERING INFORMATION
See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

## Pin Configurations



Figure 2. SC-88A and SC-74A (Top View)

PIN DEFINITIONS

| Pin \# SC-88A <br> SC74A | Pin \# MicroPak | Name | Description |
| :---: | :---: | :---: | :--- |
| 1 | 1,5 | NC | No Connect |
| 2 | 2 | A | Input |
| 3 | 3 | GND | Ground |
| 4 | 4 | Y | Output |
| 5 | 6 | $\mathrm{~V}_{\mathrm{CC}}$ | Supply Voltage |



Figure 3. MicroPak (Top Through View)

FUNCTION TABLE

| Inputs | Output |
| :---: | :---: |
| A | $\mathbf{Y}$ |
| L | H |
| H | L |

H = HIGH Logic Level
L = LOW Logic Level

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter |  | Min | Max | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{\mathrm{CC}}$ | Supply Voltage |  | -0.5 | 6.5 | V |
| $\mathrm{V}_{\text {IN }}$ | DC Input Voltage |  | -0.5 | 6.5 | V |
| Vout | DC Output Voltage |  | -0.5 | 6.5 | V |
| IIK | DC Input Diode Current | $\mathrm{V}_{\text {IN }}<0 \mathrm{~V}$ | - | -50 | mA |
| lok | DC Output Diode Current | $\mathrm{V}_{\text {OUT }}<0 \mathrm{~V}$ | - | -50 | mA |
| Iout | DC Output Current |  | - | $\pm 50$ | mA |
| ICC or $\mathrm{I}_{\text {GND }}$ | DC V CC or Ground Current |  | - | $\pm 50$ | mA |
| $\mathrm{T}_{\text {STG }}$ | Storage Temperature Range |  | -65 | +150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{J}$ | Junction Temperature Under Bias |  | - | +150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\mathrm{L}}$ | Junction Lead Temperature (Soldering, 10 Seconds) |  | - | +260 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{P}_{\mathrm{D}}$ | Power Dissipation in Still Air | SC-74A | - | 390 | mW |
|  |  | SC-88A | - | 332 |  |
|  |  | MicroPak-6 | - | 812 |  |
|  |  | MicroPak2 ${ }^{\text {TM }}$-6 | - | 812 |  |
| ESD | Human Body Model, JEDEC: JESD22-A114 |  | - | 2000 | V |
|  | Charge Device Model, JEDEC: JESD22-C101 |  | - | 1000 |  |

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 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{\mathrm{CC}}$ | Supply Voltage Operating |  | 1.65 | 5.5 | V |
|  | Supply Voltage Data Retention |  | 1.5 | 5.5 |  |
| $\mathrm{V}_{\text {IN }}$ | Input Voltage |  | 0 | 5.5 | V |
| $\mathrm{V}_{\text {OUT }}$ | Output Voltage |  | 0 | $\mathrm{V}_{\mathrm{CC}}$ | V |
| $\mathrm{T}_{\mathrm{A}}$ | Operating Temperature |  | -40 | +85 | ${ }^{\circ} \mathrm{C}$ |
| $\theta_{\text {JA }}$ | Thermal Resistance | SC-74A | - | 320 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
|  |  | SC-88A | - | 377 |  |
|  |  | MicroPak-6 | - | 154 |  |
|  |  | MicroPak2-6 | - | 154 |  |

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.

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

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | $\mathrm{V}_{\mathrm{cc}}(\mathrm{V})$ | Conditions | $\mathrm{T}_{\mathrm{A}}=+25^{\circ} \mathrm{C}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40$ to $+85^{\circ} \mathrm{C}$ |  | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Min | Typ | Max | Min | Max |  |
| $\mathrm{V}_{\mathrm{P}}$ | Positive Threshold Voltage | 1.65 |  | - | 1.00 | 1.40 | - | 1.40 | V |
|  |  | 1.80 |  | - | 1.10 | 1.50 | - | 1.50 |  |
|  |  | 2.30 |  | - | 1.40 | 1.80 | - | 1.80 |  |
|  |  | 3.00 |  | - | 1.75 | 2.20 | - | 2.20 |  |
|  |  | 4.50 |  | - | 2.45 | 3.10 | - | 3.10 |  |
|  |  | 5.50 |  | - | 2.90 | 3.60 | - | 3.60 |  |
| $\mathrm{V}_{\mathrm{N}}$ | Negative Threshold Voltage | 1.65 |  | 0.20 | 0.50 | - | 0.20 | - | V |
|  |  | 1.80 |  | 0.25 | 0.55 | - | 0.25 | - |  |
|  |  | 2.30 |  | 0.40 | 0.75 | - | 0.40 | - |  |
|  |  | 3.00 |  | 0.60 | 1.00 | - | 0.60 | - |  |
|  |  | 4.50 |  | 1.00 | 1.43 | - | 1.00 | - |  |
|  |  | 5.50 |  | 1.20 | 1.70 | - | 1.20 | - |  |
| $\mathrm{V}_{\mathrm{H}}$ | Hysteresis Voltage | 1.65 |  | 0.10 | 0.48 | 0.90 | 0.10 | 0.90 | V |
|  |  | 1.80 |  | 0.15 | 0.54 | 1.00 | 0.15 | 1.00 |  |
|  |  | 2.30 |  | 0.25 | 0.65 | 1.10 | 0.25 | 1.10 |  |
|  |  | 3.00 |  | 0.40 | 0.77 | 1.20 | 0.40 | 1.20 |  |
|  |  | 4.50 |  | 0.60 | 1.01 | 1.50 | 0.60 | 1.50 |  |
|  |  | 5.50 |  | 0.70 | 1.18 | 1.70 | 0.70 | 1.70 |  |

DC ELECTRICAL CHARACTERISTICS (continued)

| Symbol | Parameter | $\mathrm{V}_{\mathrm{cc}}(\mathrm{V})$ | Conditions | $\mathrm{T}_{\mathrm{A}}=+25^{\circ} \mathrm{C}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40$ to $+85^{\circ} \mathrm{C}$ |  | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Min | Typ | Max | Min | Max |  |
| $\mathrm{V}_{\mathrm{OH}}$ | HIGH Level Output Voltage | 1.65 | $\begin{aligned} & \mathrm{V}_{\mathrm{IN}}=\mathrm{V}_{\mathrm{P}} \text { or } \mathrm{V}_{\mathrm{N}}, \\ & \mathrm{l}_{\mathrm{OH}}=-100 \mu \mathrm{~A} \end{aligned}$ | 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 | $\mathrm{IOH}^{\prime}=-4 \mathrm{~mA}$ | 1.29 | 1.52 | - | 1.29 | - |  |
|  |  | 2.30 | $\mathrm{IOH}=-8 \mathrm{~mA}$ | 1.90 | 2.15 | - | 1.90 | - |  |
|  |  | 3.00 | $\mathrm{IOH}^{\text {a }}$ - 16 mA | 2.40 | 2.80 | - | 2.40 | - |  |
|  |  | 3.00 | $\mathrm{I}_{\mathrm{OH}}=-24 \mathrm{~mA}$ | 2.30 | 2.68 | - | 2.30 | - |  |
|  |  | 4.50 | $\mathrm{I}_{\mathrm{OH}}=-32 \mathrm{~mA}$ | 3.80 | 4.20 | - | 3.80 | - |  |
| V ${ }_{\text {OL }}$ | LOW Level Output Voltage | 1.65 | $\begin{aligned} & \mathrm{V}_{\text {IN }}=\mathrm{V}_{\mathrm{P}} \text { or } \mathrm{V}_{\mathrm{N}}, \\ & \mathrm{l}_{\mathrm{OL}}=100 \mu \mathrm{~A} \end{aligned}$ | - | 0.00 | 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 | $\mathrm{IOL}=4 \mathrm{~mA}$ | - | 0.08 | 0.24 | - | 0.24 |  |
|  |  | 2.30 | $\mathrm{IOL}=8 \mathrm{~mA}$ | - | 0.10 | 0.30 | - | 0.30 |  |
|  |  | 3.00 | $\mathrm{IOL}^{\text {O }}=16 \mathrm{~mA}$ | - | 0.15 | 0.40 | - | 0.40 |  |
|  |  | 3.00 | $\mathrm{IOL}=24 \mathrm{~mA}$ | - | 0.22 | 0.55 | - | 0.55 |  |
|  |  | 4.50 | $\mathrm{IOL}=32 \mathrm{~mA}$ | - | 0.22 | 0.55 | - | 0.55 |  |
| $\mathrm{I}_{\mathrm{N}}$ | Input Leakage Current | 1.65 to 5.5 | $\mathrm{V}_{\mathrm{IN}}=5.5 \mathrm{~V}, \mathrm{GND}$ | - | - | $\pm 0.1$ | - | $\pm 1.0$ | $\mu \mathrm{A}$ |
| IofF | Power Off Leakage Current | 0 | $\mathrm{V}_{\text {IN }}$ or $\mathrm{V}_{\text {OUT }}=5.5 \mathrm{~V}$ | - | - | 1 | - | 10 | $\mu \mathrm{A}$ |
| ICC | Quiescent Supply Current | 1.65 to 5.5 | $\mathrm{V}_{\mathrm{IN}}=5.5 \mathrm{~V}, \mathrm{GND}$ | - | - | 1.0 | - | 10 | $\mu \mathrm{A}$ |

AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | $\mathrm{V}_{\mathrm{cc}}(\mathrm{V})$ | Conditions | $\mathrm{T}_{\mathrm{A}}=+25^{\circ} \mathrm{C}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40$ to $+85^{\circ} \mathrm{C}$ |  | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Min | Typ | Max | Min | Max |  |
| $\mathrm{t}_{\text {PLH }}$, tPHL | Propagation Delay (Figure 4, 5) | 1.65 | $\begin{aligned} & C_{L}=15 \mathrm{pF}, \\ & R_{L}=1 \mathrm{MS} \end{aligned}$ | - | 9.1 | 15.0 | - | 15.6 | ns |
|  |  | 1.80 |  | - | 7.6 | 12.5 | - | 13.0 |  |
|  |  | $2.50 \pm 0.20$ |  | - | 5.0 | 9.0 | - | 9.5 |  |
|  |  | $3.30 \pm 0.30$ |  | - | 3.7 | 6.3 | - | 6.5 |  |
|  |  | $5.00 \pm 0.50$ |  | - | 3.1 | 5.2 | - | 5.5 |  |
|  |  | $3.30 \pm 0.30$ | $\begin{aligned} & C_{L}=50 \mathrm{pF}, \\ & \mathrm{R}_{\mathrm{L}}=500 \Omega \end{aligned}$ | - | 4.4 | 7.2 | - | 7.5 |  |
|  |  | $5.00 \pm 0.50$ |  | - | 3.7 | 5.9 | - | 6.2 |  |
| $\mathrm{C}_{\text {IN }}$ | Input Capacitance | 0.00 |  | - | 4 | - | - | - | pF |
| $\mathrm{C}_{\text {PD }}$ | Power Dissipation Capacitance (Note 2) (Figure 6) | 3.30 |  | - | 24 | - | - | - | pF |
|  |  | 5.00 |  | - | 30 | - | - | - |  |

2. $\mathrm{C}_{\mathrm{PD}}$ is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (ICCD) at no output loading and operating at $50 \%$ duty cycle. $C_{P D}$ is related to $I_{C C D}$ dynamic operating current by the expression:
$I_{C C D}=\left(C_{P D}\right)\left(V_{C C}\right)\left(f_{\mathrm{IN}}\right)+\left(I_{C C}\right.$ static $)$.


NOTE:
4. $\mathrm{C}_{\mathrm{L}}$ includes load and stray capacitance; Input $\mathrm{PRR}=1.0 \mathrm{MHz} ; \mathrm{t}_{\mathrm{W}}=500 \mathrm{~ns}$

Figure 4. AC Test Circuit


Figure 5. AC Waveforms


NOTE:
3. Input $=$ AC Waveform; $\mathrm{t}_{\mathrm{r}}=\mathrm{t}_{\mathrm{f}}=1.8 \mathrm{~ns}$;

PRR $=10 \mathrm{MHz}$; Duty Cycle $=50 \%$.
Figure 6. ICCD Test Circuit

## ORDERING INFORMATION

| Part Number | Top Mark | Operating Temperature | Packages | Shipping ${ }^{\dagger}$ |
| :--- | :---: | :---: | :---: | :---: |
| NC7SZ14M5X | $7 Z 14$ | -40 to $+85^{\circ} \mathrm{C}$ | SC-74A | $3000 /$ Tape \& Reel |
| NC7SZ14P5X | Z14 | -40 to $+85^{\circ} \mathrm{C}$ | SC-88A | $3000 /$ Tape \& Reel |
| NC7SZ14L6X | B6 | -40 to $+85^{\circ} \mathrm{C}$ | SIP6, MicroPak | $5000 /$ Tape \& Reel |
| NC7SZ14FHX | B6 | -40 to $+85^{\circ} \mathrm{C}$ | UDFN6, MicroPak2 | $5000 /$ Tape \& Reel |

$\dagger$ 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. countries.


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| DESCRIPTION: | SIP6 1.45X1.0 | PAGE 1 OF 1 |



SCALE 2:1


1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD
FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE

| DIM | MILLIMETERS |  |
| :---: | :---: | :---: |
|  | MIN | MAX |
| A | 0.90 | 1.10 |
| A1 | 0.01 | 0.10 |
| $\mathbf{b}$ | 0.25 | 0.50 |
| $\mathbf{c}$ | 0.10 | 0.26 |
| $\mathbf{D}$ | 2.85 | 3.15 |
| E | 2.50 | 3.00 |
| E1 | 1.35 | 1.65 |
| $\mathbf{e}$ | 0.95 BSC |  |
| $\mathbf{L}$ | 0.20 | 0.60 |
| $\mathbf{M}$ | $0^{\circ}$ |  |

RECOMMENDED SOLDERING FOOTPRINT*


GENERIC MARKING DIAGRAM*


XXX = Specific Device Code
$M \quad=$ Date Code

- $\quad=$ Pb-Free Package
(Note: Microdot may be in either location)
*This information is generic. Please refer to device data sheet for actual part marking. $\mathrm{Pb}-$ Free indicator, " G " or microdot " - ", may or may not be present. Some products may not follow the Generic Marking.
*For additional information on our $\mathrm{Pb}-$ Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES |  | MILLIMETERS |  |
| :---: | :---: | :---: | :---: | :---: |
|  | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 |  |
| G | 0.026 BSC |  | 0.65 |  |


(Note: Microdot may be in either location)
*This information is generic. Please refer to device data sheet for actual part marking. $\mathrm{Pb}-F r e e$ indicator, " G " or microdot " $\mathrm{=}$ ", may or may not be present. Some products may not follow the Generic Marking.

```
```

STYLE 1:

```
```

STYLE 1:
STYLE 1:
STYLE 1:
2. EMITTER
2. EMITTER
3. BASE
3. BASE
4. COLLECTOR
4. COLLECTOR
5. COLLECTOR

```
```

        5. COLLECTOR
    ```
```

```
STYLE 2:
    PIN 1. ANODE
    2. EMITTER
    STYLE 3
```

STYLE 6:
PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE

STYLE 7:
PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 3
PIN 1. ANODE
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE

## STYLE 8

PIN 1. CATHODE
2. COLLECTOR
3. $\mathrm{N} / \mathrm{C}$
4. BASE
5. EMITTER

SOLDER FOOTPRINT


STYLE 4:
PIN 1. SOURCE 1
2. DRAIN $1 / 2$
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

## STYLE 5:

PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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| ---: | :--- | :--- | :--- |
| DESCRIPTION: | SC-88A (SC-70-5/SOT-353) | PAGE 1 OF 1 |

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SN74LVC1GU04DBVR NL27WZ14DFT2G NLU1G14BMX1TCG NLU2G04AMX1TCG NLU2G14AMX1TCG NLU3G14AMX1TCG
NLVVHC1G04DFT2G NLX2G04CMX1TCG


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